PROJECT MANUAL

Burbank Dr - Baton Rouge, LA

Baton Rouge, Louisiana

A Development of:
LV Collective

4141 Burbank Drive
Baton Rouge, Louisiana 70808

NILES BOLTON ASSOCIATES

One Buckhead Plaza
3060 Peachtree Rd., N.W.
Suite 600
Atlanta, GA 30305
T 404.365.7600

Design Development - 09/30/2026
PROJECT NO: 126011.00

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SECTION 00 01 02
PROJECT INFORMATION

PART 1 GENERAL

1.01 PROJECT IDENTIFICATION

A. Project Name: Burbank Dr - Baton Rouge, LA.

B. Project Number: 126011.00.

4141 Burbank Drive.

Baton Rouge, Louisiana70808.

C. The Owner, hereinafter referred to as Owner: LV Collective

1.02 PROJECT DESCRIPTION

A. Summary Project Description: See Section 01 10 00 - Summary.

1.03 PROJECT CONSULTANTS

A. The Architect, hereinafter referred to as Architect: NILES BOLTON ASSOCIATES.
   1. Address: 3060 Peachtree Road, NW, Suite 600
   2. City, State, Zip: Atlanta, GA 30305
   3. Phone: 404-365-7600
   4. E-mail: nba@nilesbolton.com
   5. www.nilesbolton.com

B. Structural Engineer: VSMsq Structural Engineers, LLC
   1. Address: 1080 Eldridge Parkway, Suite 350
   2. City, State, Zip: Houston, TX 77077
   3. Phone: (291) 407-5734
   4. vsmsq.com

C. *Landscape Architect: Fable Landscape Collective
   1. Address: 2230 WEBBERVILLE RD
   2. City, State, Zip: AUSTIN, TX 78702
   3. Phone: (512) 865-8565
   4. www.fable-inc.com

D. *Interior Designer:Variant Collaborative
   1. 1550 W. Carroll Avenue, Suite 101
   2. Chicago, Illinois 60607
   3. (773) 340-0557
   4. www.variantco.com

E. *Civil Engineer: DUPLANTIS DESIGN GROUP
   1. Address: 3960 BURBANK DRIVE
   2. City, State, Zip: BATON ROUGE, LA 70810
   3. Phone: (225) 751-4490
   4. duplantisdesigngroup.com

1.04 PROCUREMENT TIMETABLE

A. The Owner reserves the right to change the schedule or terminate the entire procurement process at any time.

1.05 PROCUREMENT DOCUMENTS

A. Availability of Documents: Complete sets of procurement documents may be obtained:
   1. From Owner at the Project Manager's address listed above.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

A. List of Drawings / Index of Drawings.

B. Refer to Drawing Sheet G0.01, "SHEET INDEX" for a list of Drawings.

PART 2 PRODUCTS - (NOT USED)

PART 3 EXECUTION - (NOT USED)

END OF SECTION

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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 Contractor but will not be part of Contract Documents, as follows:

B. Site and Utility Survey:
   1. Copy is available from Owner or Owner's Civil Engineering Consultant.
   2. This survey identifies grade elevations prepared primarily for the use of Architect in establishing new grades and identifying natural water shed.
   3. The Owner does not warrant the correctness of the topographic survey or of any interpretation, deduction, or conclusion given relative to the information contained therein.
   4. This report identifies conditions of existing construction prepared primarily for the use of Architect and it's consultants in addition to other consultants retained directly by Owner in establishing the new versus existing work.
   5. The Owner does not warrant the correctness of underground and other utilities and construction indicated as existing, or any conclusions drawn relative to the information contained therein.
   6. Verify all information shown on surveys.

C. Geotechnical Report:
   1. A copy of the Geotechnical Report is available from the Owner or the Mauricio Visbal.
      a. Prepared by:
         Premier Geotech and Testing, LLC
         9434 Interline Avenue
         Baton Rouge, Louisiana 70809
      b. Report No. 26-0141, Rev.01, dated June 12, 2026.
   2. The Soils Report is made available for the convenience of the Contractor. Data on the indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soils borings. It is expressly understood that Owner will not be responsible for interpretations or conclusions drawn therefore by Contractor. Contractor may make additional test borings and other exploratory operations at his own expense and no additional cost to the Owner.
   3. This report identifies properties of below grade conditions and offers recommendations for the design of foundations, prepared primarily for the use of Architect and it's consultants in addition to other consultants retained directly by Owner.
   4. The recommendations described shall not be construed as requirements of the Contract documents or RFP Documents.
   5. 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.
   6. The Owner does not warrant the correctness of the subsurface investigation report or of any interpretation, deduction, or conclusion given in the report relative to subsoil conditions.

PART 2 PRODUCTS - NOT USED

END OF SECTION

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SECTION 00 50 00
CONTRACTING FORMS AND SUPPLEMENTS

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 CONTRACTOR IS RESPONSIBLE FOR OBTAINING A VALID LICENSE TO USE ALL COPYRIGHTED DOCUMENTS SPECIFIED BUT NOT INCLUDED IN THE PROJECT MANUAL.

1.03 AGREEMENT AND CONDITIONS OF THE CONTRACT

A. See Section 00 72 00 - General Conditions for the General Conditions.

B. See Section 00 73 00 - Supplementary Conditions for the Supplementary Conditions.

C. The Agreement is based on AIA-A101-2017.

D. The General Conditions are based on AIA A201.

1.04 FORMS

A. Use the following forms for the specified purposes unless otherwise indicated elsewhere in Contract Documents.

B. Bond Forms:
   1. Performance and Payment Bond Form: Section 00 61 13 - Performance and Payment Bond.
   2. Performance and Payment Bond Form: AIA A312.
   3. Special Bond Form: Labor and Materials Bond.

C. Post-Award Certificates and Other Forms:
   1. Application for Payment Forms: AIA G702 with AIA G703 (for Contractors).

D. Clarification and Modification Forms:
   1. Substitution Request Form (During Construction): Section 01 25 13.01.
   2. Architect's Supplemental Instructions Form: AIA G710 or alternate form as approved by the Architect.
   3. Construction Change Directive Form: AIA G714.
   4. Change Order Form: AIA G701.

E. Closeout Forms:
   1. Certificate of Substantial Completion Form: AIA G704.
   2. Warranty Form: Section 00 65 00 - Contractor Warranty Form and 00 65 36 - Sub-Contractor Warranty Form.

1.05 REFERENCE STANDARDS

A. AIA A101 - Standard Form of Agreement Between Owner and Contractor where the basis of Payment is a Stipulated Sum.

B. AIA A201 - General Conditions of the Contract for Construction.

C. AIA A312 - Performance Bond and Payment Bond.

D. AIA G701 - Change Order.

E. AIA G702 - Application and Certificate for Payment.

F. AIA G703 - Continuation Sheet.

G. AIA G704 - Certificate of Substantial Completion.

H. AIA G710 - Architect's Supplemental Instructions.

I. AIA G714 - Construction Change Directive.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 00 65 00
CONTRACTOR WARRANTY FORM

PROJECT: BURBANK DR - BATON ROUGE, LA

LOCATION: Baton Rouge, Louisiana

OWNER: LV Collective

We, _____ (Company Name), Contractor for the above referenced Project, do hereby warrant that all labor and materials furnished and work performed are in accord with the Contract Documents and authorized modifications, and will be free from defects due to defective materials or workmanship for one year period from Date of Substantial Completion. This Warranty commences on _____ (Date of Substantial Completion) and expires on _____ (1 yr. from Date of Substantial Completion).

Should any defect develop during Warranty period due to improper materials, workmanship or arrangement, same shall, upon written notice by Owner, be made good by undersigned at no expense to Owner. Nothing in the above shall be deemed to apply to abused or neglected Work by Owner.

FOR: _____

BY: _____

TITLE: _____

DATE: _____

END OF DOCUMENT

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SECTION 00 65 36
SUB-CONTRACTOR WARRANTY FORM

PROJECT: BURBANK DR - BATON ROUGE, LA

LOCATION: BATON ROUGE, LOUISIANA

OWNER: LV COLLECTIVE

We, _____ (Company Name), Subcontractor for _____ (list trade) described in Specification Section(s) _____ (List appropriate spec sections), do hereby warrant that all labor and materials furnished and Work performed in conjunction with the above referenced Project are in accord with the Contract Documents and authorized modifications thereto, and will be free from defects due to defective materials or workmanship for a period of _____ year(s) from Date of Substantial Completion. This Warranty commences on _____ (Date of Substantial Completion) and expires on_____ (expiration date).

Should any defect develop during Warranty period due to improper materials, workmanship or arrangement, same shall, upon written notice by Owner, be made good by undersigned at no expense to Owner. Nothing in the above shall be deemed to apply to abused or neglected Work by Owner.

FOR: _____

BY: _____

TITLE: _____

DATE: _____

END OF DOCUMENT

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SECTION 00 72 00
GENERAL CONDITIONS

FORM OF GENERAL CONDITIONS

1.01 GENERAL CONDITIONS

A. "The General Conditions of the Contract for Construction," AIA Document A201-2017, Articles 1 through 15, of the American Institute of Architects, is hereby made a part of these documents to the same extent as if herein written out in full.

1.02 RELATED REQUIREMENTS

A. Section 00 73 00 - Supplementary Conditions.

B. Section 01 42 16 - Definitions.

END OF DOCUMENT

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SECTION 00 73 00
SUPPLEMENTARY CONDITIONS

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. These Supplementary Conditions amend and supplement the General Conditions defined in Document 00 72 00 - General Conditions and other provisions of Contract Documents as indicated below. Provisions that are not so amended or supplemented remain in full force and effect.

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

1.03 RELATED SECTIONS

A. Section 00 50 00 - Contracting Forms and Supplements.

B. Section 00 72 00 - General Conditions

C. Section 01 42 16 - Definitions.

1.04 REFERENCE STANDARDS

A. AIA A503 - Guide for Supplementary Conditions, including Amendments to AIA Documents A201, the 2017 Owner-Contractor Agreements, and the 2019 Owner-Construction Manager as Constructor Agreements.

1.05 MODIFICATIONS TO GENERAL CONDITIONS

A. Modifications to the General Conditions of the Contract for Construction as defined in Section 00 72 00 will be provided by the Owner.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF DOCUMENT

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SECTION 01 10 00
SUMMARY

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 PROJECT

A. Project Name: Burbank Dr - Baton Rouge, LA.

B. Owner's Name: LV Collective

C. Architect's Name: Niles Bolton Associates, Inc..

D. The Project consists of the construction of the following:
   1. Two Type III Wood framed multi-family apartment buildings, each over one level of Type IA concrete-framed podium, located in Baton Rouge, Louisiana. The project contains approximately 337 units in a multi-height building of 5 or 6 floors, over a cast in place concrete parking deck consisting of 1 floors (5-floor residential) or wrapped around a 7-story parking garage (6-floor residential).

E. Green Building Certification Program:
   1. This project is not designed to be LEED Certified or in accordance with any other Green Building Certification standard.

1.03 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on the Cost of the Work plus a fee as described in Document 00 50 00 - Contracting Forms and Supplements.

1.04 WORK BY OWNER

A. Owner consultants include but are not limited to: Civil Engineer, Geotechnical Engineer, and Low Voltage Consultant

1.05 OWNER OCCUPANCY

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

B. Schedule the Work to accommodate Owner occupancy.

1.06 WORK BY CONTRACTOR

A. Fire Protection Systems are Design-Build by the Contractor.
   1. Delegated Design as indicated in Section 21 00 00 - Fire Protection General.

B. Low Voltage Systems are designed by a consultant retained directly by the Owner.

C. Fire Alarm Systems are Design-Build by the Contractor.

1.07 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas mutually agreed upon between Owner and Contractor.
   1. Contractor shall have full use of premises for construction operations, including use of Project site, during construction period.
   2. Contractor's use of premises is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

B. Arrange use of site and premises to allow:
   1. Owner occupancy.
   2. Work by Others.
   3. Work by Owner.
   4. Owner's Design Professionals and other Consultants.
   5. Other entities at the discretion of the Owner.

C. 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.

D. Driveways and Entrances: Keep driveways parking garage, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
1. Schedule deliveries to minimize use of driveways and entrances.
2. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 23 00
ALTERNATES

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 SECTION INCLUDES

A. Description of Alternates.

1.03 RELATED REQUIREMENTS

A. Document 00 21 13 - Instructions to Bidders: Instructions for preparation of pricing for Alternates.

B. Document 00 50 00 - Contracting Forms and Supplements: Incorporating monetary value of accepted Alternates.

C. Document 01 23 00 - Alternates: List of Alternates as supplement to Bid Form.

D. Section 01 25 13 - Product Substitution Procedures

E. Section 01 30 00 - Administrative Requirements

1.04 DEFINITIONS

A. Alternates: Alternate products, materials, equipment or systems for Work, which may, at Owner's option be accepted and become a part of the Owner/Contractor Agreement to either add, eliminate or substitute comparable items in the Contract Documents.

1.05 ACCEPTANCE OF ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.
   1. Numbering: Each Alternate is identified by number, and describes the changes to be incorporated into the Work, only when that Alternate is made a part of the Work by specific provisions in the Agreement.
   2. Language: Each Alternate contained herein is defined by abbreviated language, recognizing that Drawings and Specifications document the requirements. Information contained herein is intended to summarize Alternates, but does not necessarily include references to every trade or item of Work.

B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.
   1. Ensure that Work affected by each accepted Alternate is complete and interfaced with Work of Alternates.
      a. Referenced Sections of Specifications stipulate pertinent requirements to achieve the work stipulated under each Alternate.
      b. Coordinate pertinent related Work and modify surrounding Work to integrate work under each Alternate, and to provide complete construction required by Contract Documents, as changed by Alternates, which are accepted and made a part of the Agreement.

1.06 SCHEDULE OF ALTERNATES

A. Alternate No. 01 - Payment and Performance Bond: If required, add $200,000.00.

B. Alternate No. 02 - Water Repellant Admixture in Colored Mortar:
   1. Base Bid Item: Section 04 20 01 - Masonry Veneer: Mortar with water repellant admixture.
   2. Alternate Item: Section 04 20 01 - Masonry Veneer: Deduct for mortar without water repellant admixture.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 25 13.01
REQUEST FOR SUBSTITUTION FORM

TO: **Niles Bolton Associates, Inc.**
ONE BUCKHEAD PLAZA, SUITE 600
3060 PEACHTREE ROAD, N.W.
ATLANTA, GEORGIA 30305
(404) 365-7600

FROM: _____

(NAME AND COMPANY)

_____

(STREET ADDRESS)

_____

(CITY AND STATE)

_____

(PHONE NUMBER & CONTACT)

PROJECT: Burbank Dr - Baton Rouge, LA, 4141 Burbank Drive, Baton Rouge, Louisiana 70808

1. Specification Section and Paragraph numbers of product specified:
2. Proposed Substitute
   a. Name and Model No.: _____
   b. Brief Description: _____
      _____
      _____
      _____
   c. Reason for Substitution (Circle one: cause / convenience): _____
   _____
   d. Brief summary of impact to schedule: _____
   _____
   e. Brief summary of cost change: _____
   _____
   f. Attach applicable Submittal information as enumerated in Article 1.04. Where summary descriptions are included above, more detailed descriptions and documentation may be required in order to comply with 1.04 requirements.
   g. Insert numbers of applicable Reference Standards. _____
   h. Attach a color chart, if applicable.
   i. Attach installation instructions.
   j. Manufacturer's Reputation: Attach the following:
      i. Evidence of reputation for prompt delivery.
      ii. Evidence of reputation for efficiency in servicing products.
   k. Comparison: Attach an itemized comparison of the proposed substitution with product specified.
   l. Changes in Work: Attach data relating to changes required in other work to permit use of proposed substitution and changes required in construction schedule.
   m. Cost Data: Attach accurate cost data on proposed substitution in comparison with product specified.

(CONTINUED NEXT PAGE)

n. Previous Installations: Provide the following information on similar projects on which proposed substitution was used, list projects in the locale of the project primarily and then in other areas that best represent its application on this project.

Name and Address of Project	Date of Installation	Name, Address, Phone of Architect
_____	_____	_____
_____	_____	_____
_____	_____	_____

In making a request for substitution, the manufacturer, installer, and Contractor each represent:

He has examined the Drawings and Specifications and has determined that, to the best of this knowledge, the proposed substitution is appropriate for the use intended in the Drawings and Specifications.

He will provide the same or better warranty for substitution as for product or method specified.

The product is equal or better in quality and serviceability to the specified item.

In making a request for substitution the installer and Contractor each represents that:

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

He waives all claims for additional costs related to substitution which consequently become apparent.

Cost data is complete and includes all related costs under his Contract, but excludes costs under separate contracts and the Architect's redesign costs.

The substitution meets the requirements of the Contract Documents, regardless of the evidence submitted or any review or independent investigation by the Owner or Architect.

Reason(s) for Substitution Request: (attach additional pages as necessary):

_____

_____

NAME OF MANUFACTURER & SIGNATURE OF MANUFACTURER'S REP DATE

_____

NAME OF MANUFACTURER & SIGNATURE OF INSTALLER'S REP DATE

_____

NAME OF MANUFACTURER & SIGNATURE OF CONTRACTOR'S REP DATE

END OF REQUEST FOR SUBSTITUTION FORM

SECTION 01 25 13
PRODUCT SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

A. Section includes administrative and procedural requirements for substitutions.
   1. Section includes, to the extent applicable, materials or assemblies where a “Basis-of-Design” product is named and a product or assembly by a named acceptable manufacturer or an unnamed manufacturer is proposed.

1.03 RELATED REQUIREMENTS

A. Section 01 25 13.01 - Request for Substitution Form: Substitution Request Form.

B. Section 01 30 00 - Administrative Requirements.

C. Section 01 40 00 - Quality Requirements: Product quality monitoring.

D. Section 01 60 00 - Product Requirements.

E. Divisions 02 through 33 Sections for specific requirements and limitations for substitutions.

1.04 APPLICABILITY

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
   1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
   2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

B. Alternate Manufacturers Listed as Acceptable: Where a “Basis-of-Design” product or assembly is named in the specifications and the Contractor proposes a comparable product or assembly by a listed acceptable manufacturer, the responsibility is with the Contractor to provide evidence that the proposed product or assembly is in full compliance with the specified requirements.
   1. Submittals: Initial Submittal for above may be in any format consistent with Division 01 Section “Submittal Procedures.”
      a. If the determines that there is some question as to whether or not the product or assembly fully complies with the specification requirements, a new Submittal in full compliance with the requirements of this Section as “Substitutions for Cause” will be required.

C. Alternate Manufacturers Unlisted: Where a “Basis-of-Design” product or assembly is named in the specifications and the Contractor proposes a comparable product or assembly by a manufacturer not on the list of acceptable manufacturers, all requirements of this Section as “Substitutions for Cause” shall be followed.

1.05 REQUIRED DOCUMENTATION

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Substitution Request Form: A “REQUEST FOR SUBSTITUTION” form is attached at the end of this Section.
      a. Contractor may use a different format than above provided the same type of information is included in making the request for substitution.
   2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable specification section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. Evidence of proposed manufacturer's reputation and years in business.
h. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
i. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
j. Research reports evidencing compliance with building code in effect for Project, from ICC-ES, or similar documentation.
k. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
l. Cost information, including a proposal of change, if any, in the Contract Sum.
m. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
n. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of Owner's acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
a. Forms of Acceptance: Owner's written approval of substitution.
b. Formal Actions after Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
c. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.06 QUALITY ASSURANCE

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

1.07 PROCEDURES

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

PART 2 PRODUCTS

2.01 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately upon discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
   1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
      a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
      b. Substitution request is fully documented and properly submitted using attached form “REQUEST FOR SUBSTITUTION FORM.”
      c. Requested substitution will not adversely affect Contractor's construction schedule.
      d. Requested substitution has received necessary approvals of authorities having jurisdiction.
      e. Requested substitution is compatible with other portions of the Work.
      f. Requested substitution has been coordinated with other portions of the Work.
      g. Requested substitution provides specified warranty.
      h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience:
   1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
      a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
      b. Requested substitution does not require extensive revisions to the Contract Documents.
      c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
      d. Substitution request is fully documented and properly submitted.
      e. Requested substitution will not adversely affect Contractor's construction schedule.
      f. Requested substitution has received necessary approvals of authorities having jurisdiction.
      g. Requested substitution is compatible with other portions of the Work.
      h. Requested substitution has been coordinated with other portions of the Work.
      i. Requested substitution provides specified warranty.
      j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 EXECUTION

3.01 EXAMINATION

A. Contractor identifies reason for substitution: Cause or Convenience.

B. Contractor completely fills out form 01 25 13.01 - Request for Substitution Form.

C. Contractor submits form and all relevant support data and support documentation to AHJ for written approval.

D. Contractor submits all relevant data and support documentation with AHJ written approval to Architect
   1. Architect Reviews and makes recommendation for approval or rejection to Owner in writing.

2. Owner conveys answer to Architect in writing
3. Architect conveys answer to Contractor in writing

E. If approved, Contractor may submit the product under the normal Submittal procedures and include the form with Owner and AHJ approval.

END OF SECTION – "REQUEST FOR SUBSTITUTION FORM" FOLLOWS

SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

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 SECTION INCLUDES

A. General administrative requirements.

B. Electronic document submittal service.

C. Preconstruction meeting.

D. Site mobilization meeting.

E. Progress meetings.

F. Contractor's daily reports.

G. Progress photographs.

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

I. Number of copies of submittals.

J. Requests for Interpretation (RFI) procedures.

K. Submittal procedures.

1.03 RELATED REQUIREMENTS

A. Section 00 72 00 - General Conditions: Dates for applications for payment.

B. Section 01 25 13 - Product Substitution Procedures

C. Section 01 25 13.01 - Request for Substitution Form

D. Section 01 32 16 - Construction Progress Schedule: Form, content, and administration of schedules.

E. Section 01 33 10 - Schedule of Submittals

F. Section 01 60 00 - Product Requirements: General product requirements.

G. Section 01 70 00 - Execution and Closeout Requirements: Additional coordination requirements.

H. Section 01 74 19 - Construction Waste Management and Disposal.

I. Section 01 78 00 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

J. Section 01 93 15 - Schedule of Periodic Maintenance.

1.04 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.05 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 01 70 00 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

B. Make the following types of submittals to Architect:
   1. Requests for Interpretation (RFI).
   2. Requests for substitution.

3. Shop drawings, product data, and samples.
4. Test and inspection reports.
5. Design data.
6. Manufacturer's instructions and field reports.
7. Applications for payment and change order requests.
8. Progress schedules.
9. Coordination drawings.
10. Correction Punch List and Final Correction Punch List for Substantial Completion.
11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTALS

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF) format and transmitted via the Internet. The Contractor shall track, log, and store documents, provide for electronic stamping and signatures, and notifications 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. It is Contractor's responsibility to submit documents in allowable format.
   3. Internet access, an email address, 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) is required.
   4. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.
      a. Transmit all color related submittals and samples to the Architect.

B. Cost: The costs associated with submitting and tracking documents electronically are the responsibility of the Contractor.

3.02 PRECONSTRUCTION MEETING

A. Owner and Contractor will schedule a meeting after Notice of Award at a mutually agreed upon location and date.

B. Attendance Required:
   1. Owner.
   2. Architect.
   3. Contractor.

C. 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, Owner Consultants and Architect.
   6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   7. Scheduling.
   8. Scheduling activities of a Geotechnical Engineer.

D. 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 SITE MOBILIZATION MEETING

A. Schedule meeting at the Project site prior to Contractor occupancy.

B. Invite the following for Attendance at a minimum:
   1. Contractor.
   2. Owner.
   3. Architect.
   4. Special consultants.
   5. Contractor's superintendent.
   6. Major subcontractors.
   7. Owner Consultants.

C. Agenda:
   1. Use of premises by Owner and Contractor.
   2. Owner's requirements.
   3. Construction facilities and controls provided by Owner.
   4. Temporary utilities provided by Owner.
   5. Survey and building layout.
   6. Security and housekeeping procedures.
   7. Schedules.
   8. Application for payment procedures.
   9. Procedures for testing.
   10. Procedures for maintaining record documents.
   11. Requirements for start-up of equipment.
   12. Inspection and acceptance of equipment put into service during construction period.

D. Record minutes and distribute copies within two days after meeting to participants, with digital copies to Architect, Owner, participants, and those affected by decisions made.

3.04 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the work at maximum of twice per month in accordance with Owner-Contractor Agreement.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required:
   1. Contractor.
   2. Owner.
   3. Contractor's superintendent.
   4. Major subcontractors.

D. Additional invitations for each meeting to:
   1. Architect (as stipulated in Owner-Architect Agreement).
   2. Architect's Consultants (as stipulated in Owner-Architect Agreement).
   3. Owner's Consultants.
   4. Major subcontractors.

E. 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 RFIs log and status of responses.
   7. Review of off-site fabrication and delivery schedules.
   8. Maintenance of progress schedule.
   9. Corrective measures to regain projected schedules.
   10. Planned progress during succeeding work period.
   11. Maintenance of quality and work standards.
   12. Effect of proposed changes on progress schedule and coordination.
   13. Other business relating to work.

F. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.05 CONSTRUCTION PROGRESS SCHEDULE - SEE SECTION 01 32 16

3.06 DAILY CONSTRUCTION REPORTS

A. Include only factual information. Do not include personal remarks or opinions regarding operations and/or personnel.

B. Prepare a daily construction report recording the following information concerning events at Project site and project progress:
   1. Date.
   2. High and low temperatures, and general weather conditions.
   3. List of subcontractors at Project site.
   4. List of separate contractors at Project site.
   5. Major equipment at Project site.
   6. Material deliveries.
   7. Safety, environmental, or industrial relations incidents.
   8. Meetings and significant decisions.
   9. Unusual events (submit a separate special report).
   10. Stoppages, delays, shortages, and losses. Include comparison between scheduled work activities (in Contractor's most recently updated and published schedule) and actual activities. Explain differences, if any. Note days or periods when no work was in progress and explain the reasons why.
   11. Meter readings and similar recordings.
   12. Emergency procedures.
   13. Directives and requests of Authority(s) Having Jurisdiction (AHJ).
   14. Change Orders received and implemented.
   15. Testing and/or inspections performed.
   16. List of verbal instruction given by Owner and/or Architect.
   17. Signature of Contractor's authorized representative.

3.07 PROGRESS PHOTOGRAPHS

A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.

B. Maintain one set of all photographs at project site for reference; same copies as submitted, identified as such.

C. Photography Type: Digital; electronic files.

D. Provide photographs of site and construction throughout progress of work produced by an experienced photographer, acceptable to Architect.

E. In addition to periodic, recurring views, take photographs of each of the following events:
   1. Completion of site clearing.
   2. Foundations in progress and upon completion.
   3. Structural framing in progress and upon completion.
   4. Enclosure of building, upon completion.

F. Views:
   1. Provide aerial photographs from four cardinal views at each specified time, until structure is enclosed.
   2. Provide non-aerial photographs from four cardinal views at each specified time, until date of Substantial Completion.
   3. Consult with Architect for instructions on views required.
   4. Provide factual presentation.
   5. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.

G. 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.

3.08 REQUESTS FOR INTERPRETATION (RFI)

A. Definition: A request seeking one of the following:
   1. 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.
   2. A resolution to an issue which has arisen due to field conditions and affects design intent.

B. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
   1. Prepare a separate RFI for each specific item.
      a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
      b. Do not forward requests which solely require internal coordination between subcontractors.
   2. Prepare in a format and with content acceptable to Owner.
   3. Prepare using an electronic form.
   4. Combine RFI and its attachments into a single electronic file. PDF format is preferred.

C. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is 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).
   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.

D. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
   1. Official Project name and number, and any additional required identifiers established in Contract Documents.
   2. Owner's, Architect's, and Contractor's names.
   3. Discrete and consecutive RFI number, and descriptive subject/title.
   4. Issue date, and requested reply date.
   5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
   6. Annotations: Field dimensions and/or description of conditions which have engendered the request.

7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.

E. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

F. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
   1. Indicate current status of every RFI. Update log promptly and on a regular basis.
   2. Note dates of when each request is made, and when a response is received.
   3. Highlight items requiring priority or expedited response.
   4. Highlight items for which a timely response has not been received to date.
   5. Identify and include improper or frivolous RFIs.

G. Review Time: Architect will respond and return RFIs to Contractor within a reasonable number of calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 3:00 PM will be considered as having been received on the following regular working day.

H. 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.

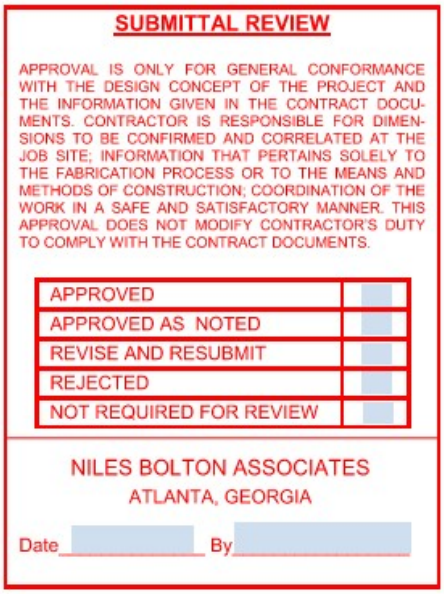
3.09 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.
   1. Coordinate with Contractor's construction schedule and schedule of values.
   2. Format schedule to allow tracking of status of submittals throughout duration of construction.
   3. 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.
   4. 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.

3.10 SUBMITTALS FOR REVIEW

A. Submit the following items for review where specified in individual sections, including but not limited to the following:
   1. Product data. Safety Data Sheets are not acceptable representations of Product Data.
   2. Shop drawings.
   3. Samples.
   4. Certificates.
   5. Qualification Statements.
   6. Evidence that reports, engineering evaluations, or other components required by the Authority Having Jurisdiction have been submitted and approved.

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.
   1. Architect shop drawing stamp contains the following information:



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.

3.11 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
   1. Design data.
   2. Certificates.
   3. Test reports.
   4. Inspection reports.
   5. Manufacturer's instructions.
   6. Manufacturer's field reports.
   7. Permits, Licenses, Certificates:
      a. For Owner's record, submit copies of permits, licenses, certificates and certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.
   8. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner. Submittal will be retained on file for record and information only. No action is required by the Architect or Engineer.

3.12 SUBMITTALS NOT REQUIRED FOR REVIEW

A. Material Safety Data Sheets (MSDS) and Safety Data Sheets (SDS) are not required for Design Team review. Do not submit MSDS information to Architect or Owner.

3.13 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. Bonds.
5. Other types as indicated.

D. Final Property Survey.

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

3.14 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; one 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.

3.15 SUBMITTAL PROCEDURES

A. General Requirements:
1. Incomplete submittals may not be reviewed. Provide submittals for each Section listed in the SUBMITTALS heading as a single package.
   a. Partial submittals for distinct portion(s) of the work may be reviewed only with prior approval by the Architect, or as identified in each individual Section.
   b. Submittals shall be reflected in a schedule and coordinated with the construction schedule.
2. Use a separate transmittal for each item.
3. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
4. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
5. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
   a. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
   b. Submittals from sources other than the Contractor or without Contractor's stamp will not be acknowledged, reviewed, or returned.
   c. Submittals from sources other than the Contractor or without Contractor's stamp will not be reviewed. Architect is not obligated to advise Contractor of missing review stamps.
6. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties and is of the benefit to the project.
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.
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.
    a. Note date and content of previous submittal.
    b. Provide written response to previous comments.
    c. Previous review comments remain applicable to subsequent versions of the submittal, whether or not included in subsequent submittal reviews.

d. Note date and content of revision in label or title block and clearly indicate extent of revision.
e. Resubmit submittals until they are marked with approval notation from action stamp.

11. Submittals not requested will be recognized, and will be returned "Not Reviewed",

B. Product Data Procedures:
1. Submit only information required by individual specification sections.
2. Collect required information into a single submittal.
3. Submit concurrently with related shop drawing submittal.
4. Do not submit (Material) Safety Data Sheets for materials or products.

C. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
2. Do not reproduce Contract Documents to create shop drawings.
3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

D. Samples Procedures:
1. Transmit related items together as single package.
2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.

E. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.

3.16 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.
1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.

D. Architect's and consultants' actions on items submitted for review:
1. Authorizing purchasing, fabrication, delivery, and installation:
a. "Approved", or language with same legal meaning.
b. "Approved as Noted", or language with same legal meaning.
1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.
1) Resubmit corrected item, with review notations acknowledged and incorporated. Resubmit separately, or as part of project record documents.
2. Not Authorizing fabrication, delivery, and installation:
a. "Revise and Resubmit".
1) Resubmit revised item, with review notations acknowledged and incorporated.
b. "Rejected".
1) Submit item complying with requirements of Contract Documents.

E. Architect's and consultants' actions on items submitted for information:
1. Items for which no action was taken:
a. "Not Required for Review" - to notify the Contractor that the submittal has been received for record only.
2. Items for which action was taken:
a. "Reviewed" - no further action is required from Contractor.

END OF SECTION

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SECTION 01 31 14
FACILITY SERVICES COORDINATION

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 SECTION INCLUDES

A. Services of a coordinator for facility services construction.

B. Coordination documents.

1.03 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Responsibilities of separate contractors.

B. Section 01 30 00 - Administrative Requirements: Additional requirements for coordination.

C. Section 01 60 00 - Product Requirements: Spare parts and maintenance materials.

D. Section 01 70 00 - Execution and Closeout Requirements: Starting of Systems. Systems Demonstration.

E. Section 01 78 00 - Closeout Submittals: Project record documents.

1.04 MECHANICAL AND ELECTRICAL COORDINATOR

A. Employ and pay for services of a person, technically qualified and administratively experienced in field coordination of the type of work required to be coordinated, for the duration of the Work.

1.05 SUBMITTALS

A. Submit name, address, and telephone number of coordinator and name of principal officer for review.

B. Submit coordination drawings and schedules prior to submitting shop drawings, product data, and samples.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 COORDINATION REQUIRED

A. Coordinate the work listed below:
   1. Fire Suppression: Division 21.
   2. Plumbing: Division 22.
   3. Heating, Ventilating, and Air Conditioning: Division 23.
   4. Electrical: Division 26.
   5. Communications: Division 27.
   6. Electronic Safety and Security: Division 28.
   7. Site Utilities: Division 33.

B. Coordinate progress schedules, including dates for submittals and for delivery of products.

C. Conduct meetings among subcontractors and others concerned, to establish and maintain coordination and schedules, and to resolve coordination matters in dispute.

D. Participate in progress meetings. Report on progress of work to be adjusted under coordination requirements, and any required changes in schedules. Transmit minutes of meetings and reports to concerned parties.

3.02 COORDINATION DOCUMENTS

A. Prepare coordination drawings to organize installation of products for efficient use of available space, for proper sequence of installation, and to identify potential conflicts.

B. Prepare a master schedule identifying responsibilities for activities that directly relate to this work, including submittals and temporary utilities; organize by specification section.

C. Identify electrical power characteristics and control wiring required for each item of equipment.

D. Maintain documents for the duration of the work, recording changes due to site instructions, modifications or adjustments.

3.03 COORDINATION OF SUBMITTALS

A. Review shop drawings, product data, and samples for compliance with Contract Documents and for coordination with related work. Transmit copies of reviewed documents to Architect.

B. Check field dimensions and clearances and relationship to available space and anchors.

C. Check compatibility with equipment and work of other sections, electrical characteristics, and operational control requirements.

D. Check motor voltages and control characteristics.

E. Coordinate controls, interlocks, wiring of switches, and relays.

F. Coordinate wiring and control diagrams.

G. When changes in the work are made, review their effect on other work.

H. Verify information and coordinate maintenance of record documents.

3.04 OBSERVATION OF WORK

A. Observe work for compliance with Contract Documents.

B. Maintain a list of observed deficiencies and defects; promptly submit.

3.05 DOCUMENTATION

A. Observe and maintain a record of tests. Record:
   1. Specification section number and product name.
   2. Name of Contractor, subcontractor and Utility (where applicable).
   3. Name of testing agency and name of inspector.
   4. Name of manufacturer's representative present.
   5. Date, time, and duration of tests.
   6. Type of test, and results.
   7. Retesting required.

3.06 EQUIPMENT START-UP

A. Verify utilities, connections, and controls are complete and equipment is in operable condition as required by Section 01 70 00.

B. Observe start-up and adjustments, test run, record time and date of start-up, and results.

C. Observe equipment demonstrations made to Owner; record times and additional information required for operation and maintenance manuals.

3.07 INSPECTION AND ACCEPTANCE OF EQUIPMENT

A. Prior to inspection, verify that equipment is tested, operational, clean, and ready for operation.

END OF SECTION

SECTION 01 32 16
CONSTRUCTION PROGRESS SCHEDULE

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 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, bar chart type.

1.03 RELATED SECTIONS

A. Section 01 10 00 - Summary: Work sequence.

1.04 SUBMITTALS

A. Submit schedules in accordance with Proposal Form.
   1. Submit preliminary schedule defining general operations for the Work at time of bid.

B. Within 20 days after date established in Notice to Proceed, submit updated schedule defining planned operations for the first 45 days of Work, with a general outline for remainder of Work.

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

D. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major Subcontractors have reviewed and accepted proposed schedule.

E. Within 10 days after joint review, submit complete schedule.
   1. Include written certification that major Subcontractors have reviewed and accepted proposed schedule.

F. Submit updated schedule in accordance with Part 3 below this Section.

1.05 QUALITY ASSURANCE

A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with two years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 24 hours of request.

1.06 SCHEDULE FORMAT

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

B. Diagram Sheet Size: Maximum 22 x 17 inches.

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a Gannt Chart.

3.02 CONTENT

A. Time Frame: Schedule shall include the time period from Notice to Proceed through Date of Substantial Completion and Final Completion, with each of these benchmarks clearly identified as milestones.
   1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

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

1. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule
2. Startup and Testing Time: Include not less than 15 days for startup and testing.
3. Substantial Completion: Indicate completion in advance of date established for
4. Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
5. Punch List and Final Completion: Include not more than 30 days for punch list and Final Completion.

C. Identify each item by specification section number.

D. Include conferences and meetings in schedule.

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

F. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, products identified under Allowances, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.

G. Indicate delivery dates for owner-furnished products.

H. Provide legend for symbols and abbreviations used.

3.03 BAR CHARTS

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

B. Identify the first work day of each week.

3.04 NETWORK ANALYSIS

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

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

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

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

E. Required Reports: List activities in sorts or groups:
1. By preceding work item or event number from lowest to highest.
2. By amount of float, then in order of early start.
3. Listing of activities on the critical path.

3.05 REVIEW AND EVALUATION OF SCHEDULE

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

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

3.06 UPDATING SCHEDULE

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

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

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

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

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

F. Submit reports required to support recommended changes.

G. Provide narrative report to define problem areas, anticipated delays, and impact on the schedule. Report corrective action taken or proposed and its effect including the effects of changes on schedules of separate contractors.

H. Submit weekly updates of 6-week look ahead.

I. Submit monthly update of full CPM Schedule.

3.07 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.
   1. Digital PDF is preferred for Owner and Architect.

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

END OF SECTION

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SECTION 01 32 36
VIDEO MONITORING AND DOCUMENTATION

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 SECTION INCLUDES

A. Webcam for remote viewing of the project on a secure connection via a network connection.

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. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.04 SUBMITTALS

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

B. Product Data: Provide all physical and digital characteristics for each type of equipment component specified.

C. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

D. Software: Copy of software required in this section, associated licensing documentation, and support contact information. Indicate that licensing is in the Owner's name.

1.05 QUALITY ASSURANCE

A. Vendor Qualifications: Company specializing in manufacturing products specified in this section, with at least five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

C. Documents at Project Site: Maintain at project site one copy of manufacturer's instructions.

D. Source Limitations: Furnish products obtained from single supplier.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver all materials in their original sealed packaging and labeled with manufacturer’s name and identification of product.

B. Protect and store accessory and auxiliary products in accordance with manufacturer’s written instructions.

1.07 FIELD CONDITIONS

A. See site and utility survey, geotechnical report, hazardous material survey, existing conditions survey, and site drawing; refer to Section 00 31 00.

1.08 WARRANTY

A. Replace defective or non-operational cameras within a 24-hour period from the time the camera is reported as non-functional at no additional cost to the Owner.

PART 2 PRODUCTS

2.01 SYSTEM REQUIRMENTS

A. The outdoor camera system shall consist of a tamper and impact resistant enclosure with integrated camera and heavy-duty robotic pedestal to be on a mobile solar powered trailer platform.

B. The camera shall take high-resolution 8 Megapixel digital images every 15 minutes and provide live video.

C. The camera shall upload both images and video over a wireless cellular modem.

D. The content shall be sent to a secure, password protected website with an interface and online software features provided by the Vendor as a managed service.

2.02 INTERFACE AND ONLINE SOFTWARE

A. Remote Access: Contractor's System Vendor shall provide an internet based interface and online software as a managed service to allow the viewing of all high-definition digital still images captured and stored and live video from any location with internet access via a secure password protected website.
   1. Maintain images on the System Vendor's website for reference available at all times during the life of the project and for not less than 60 days after completion.

B. Online Interface Features:
   1. Software delivered by Vendor as a managed service.
   2. Displays company logo and project name.
   3. Capable of viewing live video.
   4. Picture in Picture to control and view live video while viewing high definition images.
   5. Robotic pan, tilt, and zoom control of robotic camera system.
   6. Featuring high-definition panoramic images with a panoramic image comparison tool.
   7. Calendar based navigation system for selecting specific images and panoramas.
   8. Multifunction image browsing.
   9. Pan, tilt and zoom control capability within a high-definition image.
   10. Onscreen button for wiper control to allow remote cleaning of the viewing window.
   11. A multiview screen to view all of the cameras on a project at the same time.
   12. Graphical mark-up tools for detailing and creating overlays on images.
   13. Graphical weather applet displaying not less than ten points of local weather data and 48-hour forecast.
   14. Remote solar monitoring screen displaying the DC amperage output of solar panels.
   15. Remote battery monitoring screen displaying battery voltage, temperature, and status.
   16. Remote cellular monitoring screen displaying connectivity, network traffic, and modem temperature.
   17. Remote wireless radio monitoring screen displaying connectivity, network traffic, and Map features including wireless radio locations.
   18. hare image tools: save, print, email, and post to message board or mobile devices.
   19. Automated progress reports in Power Point, Open Office, and PDF formats.
   20. Map, aerial and satellite view by Google.
   21. Time lapse features include – Instant time lapse play back by day, week, month, or year.
   22. Machine to machine self-healing technology that automates maintenance of camera up to 288 times daily.
   23. Account security features include – Four levels of password protection, IP address block / permission, and SSL protection of the user login password.
   24. All Images are the copyright of the client and protected on secure servers owned and operated by the system vendor.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that site conditions are ready to accept video monitoring systems.

B. Verify that internet service and power sources are in place and ready to operate.

C. Preinstallation Testing: Test internet for speed capabilities to serve contratually required functions.

3.02 PREPARATION

A. Unpack camera system components and save packing materials (box and foam) for future shipment of camera system, including associated appurtenances and mounting equipment to Owner or Vendor as required.

3.03 INSTALLATION

A. General:

1. Install in accordance with manufacturer's written instructions, State and Municipality codes and requirements, and approved submittals.
2. Install units plumb, level, and at proper angle to provide maximum field of view of on-site operations.
3. Securely and rigidly anchor products in place at locations selected by and acceptable to the Owner.
4. Connect cameras to power.

3.04 FIELD QUALITY CONTROL

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

B. Preinstallation Testing: Test camera on-site at ground level prior to mounting unit in its intended elevated position.
1. Contact System Vendor not less than 24 hours in advance of installation for testing.
2. Connect unit.
3. After 30 minutes, contact System Vendor and require System Vendor to remotely confirm camera is operating properly.
4. Install cameras in approved locations.

3.05 SYSTEM STARTUP

A. Manufacturer Services: Provide services of camera field representative to perform systems startup.

B. Prepare and start equipment and systems in accordance with manufacturers' written instructions and recommendations.

3.06 ADJUSTING

A. Adjust for proper operation within manufacturer's published tolerances.

3.07 CLEANING

A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.

B. Clean installed items using methods and materials recommended in writing by manufacturer.

C. Clean camera system components, including camera-housing windows, lenses, and monitor screens.

3.08 COMMISSIONING

A. See Section 01 91 13 - General Commissioning Requirements for additional requirements.

B. Engage a factory-authorized service representative by phone to instruct Contractor's personnel in procedures to adjust and maintain camera equipment.
1. Instruct Contractor's personnel on procedures and schedules for troubleshooting and maintaining equipment.
2. Explain methods of determining optimum alignment and adjustment of components.

3.09 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals for additional submittals.

B. Transfer of data to Owner.

3.10 OPERATION, TERMINATION, AND REMOVAL

A. Maintenance: Maintain camera equipment in good operating condition on a 24-hour basis until removal.

B. Termination and Removal: Removal of camera system only when instructed by the Owner.
1. Camera system including associated appurtenances and mounting equipment are property of Contractor.

3.11 PROTECTION

A. Protect installed Video Monitoring Equipment, power supply, and internet service during construction operations.

END OF SECTION

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SECTION 01 33 10
SCHEDULE OF SUBMITTALS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

A. SUBMITTAL LOG - See insert beginning next page.
   1. The attached log is being provided as a courtesy to the Contractor, who shall bear the responsibility for all shop drawings listed in the Project Manual, whether or not included in the attached log.

1.03 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Contract descriptions, description of alterations work, work by others, future work, occupancy conditions, use of site and premises, work sequence.

B. Section 01 30 00 - Administrative Requirements: Submittal procedures, project meetings, progress schedules and documentation, reports, coordination.

C. Section 01 40 00 - Quality Requirements: Procedures for testing, inspection, mock-ups, reports, certificates; use of reference standards.

D. Section 01 60 00 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.

E. Section 01 70 00 - Execution Requirements: Examination, preparation, and general installation procedures; preinstallation meetings; cutting and patching; cleaning and protection; starting of systems; demonstration and instruction; closeout procedures except payment procedures; requirements for alterations work.

F. Section 01 78 00 - Closeout Submittals: Project record documents, operation and maintenance (O&M) data, warranties and bonds.

1.04 QUALITY ASSURANCE

A. Designer Qualifications: Perform delegated design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in Louisiana.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PREPARATION

A. Contractor shall review the attached Shop Drawing Log and coordinate with the entire Project Manual. The Shop Drawing Log is provided as a convenience and benefit to the Contractor, and in no way shall relieve the Contractor of the responsibility for providing submittal not listed in the Shop Drawing Log.

3.02 ATTACHMENTS

A. SHOP DRAWING LOG, dated MM/dd/yyyy.

END OF SECTION

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SECTION 01 40 00
QUALITY REQUIREMENTS

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 SECTION INCLUDES

A. Submittals.

B. Quality assurance.

C. References and standards.

D. Testing and inspection agencies and services.

E. Control of installation.

F. Mock-ups.

G. Tolerances.

H. Manufacturers' field services.

I. Defect Assessment.

1.03 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittal procedures.

B. Section 01 42 16 - Definitions.

C. Section 01 43 39 - Mock-Ups

D. Section 01 45 33 - Code-Required Special Inspections and Procedures: Code required inspections and testing.

E. Section 01 45 35 - Quality Assurance Program for Penetrations & Joints: Joint Inspections.

F. Section 01 60 00 - Product Requirements: Requirements for material and product quality.

1.04 SUBMITTALS

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

B. 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.

C. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.

1. Test report submittals are 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. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.

1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

E. 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.

F. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.

1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in Louisiana.

1.06 REFERENCES AND STANDARDS

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

B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

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

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

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

1.07 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Owner will employ and pay for services of an independent testing agency to perform code required threshold 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 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

A. Refer to Section 01 43 39 - Mock-Ups.

B. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

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

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

E. 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 and inspection 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. 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. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
   6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

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.

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, and training as applicable, and to initiate instructions when necessary.

B. 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 42 16
DEFINITIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This section supplements the definitions contained in the General Conditions.

B. Other definitions are included in individual specification sections.

1.03 DEFINITIONS

A. "Approved": The term "approved," when used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the Architect's duties and responsibilities as stated in the Conditions of the Contract.

B. "Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by the Architect, requested by the Architect, and similar phrases.

C. Furnish: To supply, deliver, unload, and inspect for damage.

D. Furnish: To supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

E. General: Basic contract definitions are included in the Conditions of the Contract.

F. Indicated: Graphic representations, notes, or schedules on the Drawings; or to other paragraphs or schedules in the Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference. Location is not limited.

G. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.

H. Install: Operations at the Project site including the actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

I. Installer: The Contractor or another entity engaged by the Contractor either as an employee, subcontractor, or contractor of lower tier, who performs a particular construction activity including installation, erection, application, or similar operations. Installers are required to be experienced in the operations they are engaged to perform.
   1. The term "experienced," when used with the term "installer," means having successfully completed a minimum of 5 previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.
   2. Trades: Using terms such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.
   3. Assigning Specialists: Certain Sections of the Specifications require that specific construction activities shall be performed by specialists who are recognized experts in those operations. The specialists must be engaged for those activities, and their assignments are requirements over which the Contractor has no option. However, the ultimate responsibility for fulfilling contract requirements remains with the Contractor.
      a. This requirement shall not be interpreted to conflict with enforcing building codes and similar regulations governing the Work. It is also not intended to interfere with local trade-union jurisdictional settlements and similar conventions.

J. Product: 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. Products may be new, never before used, or re-used materials or equipment.

K. Project Manual: The book-sized volume that includes the procurement requirements (if any), the contracting requirements, and the specifications.

L. Project site: The space available to the Contractor for performing construction activities, either exclusively or in conjunction with others performing work as part of the Project. The extent of the Project site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.

M. Provide: To furnish and install.

N. Provide: To furnish and install, complete and ready for the intended use.

O. Regulations: Includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

P. Supply: Same as Furnish.

Q. Testing Agencies: An independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 43 39
MOCK-UPS

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 MOCK-UPS

A. General mock-up requirements
   1. Intent of mock-up is to permit review of appearance, quality of workmanship, coordination, compatibility, and relationships with adjacent materials, to test air and water infiltration performance, and to provide Contractor with opportunity to coordinate Subcontractor Work.
   2. Maintain quality control over Work of various Sections of Specifications, manufacturers, products, services, workmanship, and site conditions to produce mock-ups in accordance with the Contract Documents.
   3. Mock-ups include, but are not necessarily limited to, the following:
      a. Exterior claddings, and finishes.
      b. Special Exterior Materials.
      c. Special Interior Finishes.

B. Location of the mock-up assembly at Project site must be approved by the Owner.

1.03 SECTION INCLUDES

A. Exterior Mock-up Panels: Provide a freestanding exterior building mock-up to permit review of appearance, quality of workmanship, coordination, compatibility, and relationships with adjacent materials. The mock-up will stand through the completion of the building exterior and serve as the standard for workmanship once it has been accepted in writing by the Owner's Representative. Provide the following exterior building mock-ups:
   1. Exterior wall assembly systems and finishes, including all transitions and interfaces between different materials and walls to openings/curtain wall and storefronts. This is a single comprehensive mock-up.

B. Interior Mock-up Panels.

1.04 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Contract descriptions, description of alterations work, work by others, future work, occupancy conditions, use of site and premises, work sequence.

B. Section 01 23 00 - Alternates: Descriptions of items, administrative requirements.

C. Section 01 30 00 - Administrative Requirements: Submittal procedures, project meetings, progress schedules and documentation, reports, coordination.

D. Section 01 40 00 - Quality Requirements: Procedures for testing, inspection, mock-ups, reports, certificates; use of reference standards.

E. Section 01 42 16 - Definitions.

F. Section 01 60 00 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.

G. Section 01 74 19 - Construction Waste Management and Disposal; disposal of mock-ups.

H. Section 01 78 00 - Closeout Submittals: Project record documents, operation & maintenance (O&M) data, warranties, and bonds.

I. Divisions 02 through 33 Sections for specific material mockups unique to individual work results.

1.05 DEFINITIONS

A. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing,

or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.

1.06 SUBMITTALS

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

B. Samples: Prior to construction of mock-ups, provide material samples required to build mock-ups in addition to those specified in the respective Specification Sections included as part of the mock-ups.

C. Mock-ups shall not be fabricated until after acceptance of required submittals for all finish materials to be incorporated into the mock-ups. Project schedule shall consider early submittal of these components to the Owner.

1.07 QUALITY ASSURANCE

A. Coordinate with trades affected in completion of required mockups at location designated by .Owner

B. Complete each item or system of the mockup by the tradesmen who will provide the actual work.

C. Upon the approval of submittals of products and colors to be included in the sample panel, and Prior to installation of exterior finishes, windows, doors, and related work, a sample panel shall be constructed and shall receive an inspection and approval from the Architect and an Owner representative.

D. Performance: Mock-ups shall be constructed for the Architect and Owner's Representative’s review for compliance with the Contract Documents.

E. Make necessary additions and modifications to mock-ups as required by the Architect and Owner's Representative.

F. Modify mock-ups, or construct or install new components if requested by the Architect and 'Owners Representative, until final acceptance is obtained.

G. Provide as many modifications as required to achieve mock-ups that are acceptable to the Architect and Owner's Representative, meeting testing requirements, and of sufficient quality to serve as the standard for the complete Project.

H. Following acceptance, mock-ups shall serve as a performance standard of quality and appearance of the Work it represents, including the interface with adjacent materials and components as applicable.

I. Coordinate fabrication, delivery, assembly, and installation with related materials to be included in the mock-ups. Construction of the mock-up assemblies shall be under the supervision of the same personnel who will be employed for the subsequent work.

J. Scheduling:
   1. Construct mock-ups in a timely manner to permit review and modifications such that the work is not delayed.
   2. Do not proceed with ordering of components or start construction until after mock-up acceptances have been obtained and Architect and Owner's Representative has approved.
   3. Include line item in the construction schedule for the exterior building mock-up, showing submittals, construction, review, and approval periods.
   4. Allow sufficient time in the schedule to accommodate failures of tests and necessity to modify and retest. The mock-up shall be erected in sufficient time to allow final approval of window frame color, glass selection, and sealant colors.

1.08 FIELD CONDITIONS

A. Coordinate with trades affected in completion of required mockups at location designated by Owner.

B. Complete each item or system of the mockup by the respective trades and subcontractors who will be performing the actual Work.

C. Before installing portions of the work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed work:
   1. Build mockups in location and of size indicated or, if not indicated, as directed by the Owner and Architect.
   2. Mock-ups may not remain as part of the completed Work.
   3. Notify Owner and Architect five days in advance of dates and times when mockups will be constructed.
   4. Demonstrate the proposed range of aesthetic effects and workmanship.
   5. Obtain Owner's and Architect's approval of mockups before starting fabrication, or construction of remaining work represented by the mockup.
      a. Allow five days for initial review and each re-review of each mockup.
   6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   7. Demolish and remove mockups when directed, unless otherwise indicated.

D. Use the same installation methods and materials as required for the Work. Schedule construction so that it may be reviewed, and any necessary adjustments made, prior to commencing fabrication of the Work. When accepted, mock-up shall serve as the standard for materials, workmanship, and appearance throughout the Project.

PART 2 PRODUCTS (NOT USED)

2.01 COMPONENTS

A. One Exterior Outside Corner:
   1. All Exterior trim and detailing materials appearing in the field of the wall and where exterior finishes interface with the window and door.
   2. One full-sized fully operating window unit including all surrounding interior and exterior details, trims, and sills.
   3. Storefront window system.
   4. Masonry Veneer.
   5. Cap flashing and roof membrane termination at parapet. Provide cut-away view to show concealed assemblies and lapping of materials.
   6. Application of all sealants and applicable flashing related to the window and rooms.
   7. Threshold installation.
   8. Door Hardware.
   9. Termination of exterior finishes at grade.
   10. 6" minimum sample area for color(s) approval.
   11. Include complete typical exterior wall assembly including exterior and interior finishes and insulation.
   12. Create “cut away” along the face of the exterior wall showing the sequence of materials placed on the sample wall.

PART 3 EXECUTION

3.01 INSTALLERS

A. Employ same installers as they would be employed during the actual performance of the Work at the job site. Employ same supervisory personnel who will perform site erection.

B. Substitution Limitations: Same as specified for products; see Section 01 60 00 - Product Requirements.

3.02 INSTALLATION

A. Mockup components shall be full size, using the same materials as those to be used in the actual Work, including details and methods of construction.

B. Fabricate exterior wall mockup in accordance with approved shop drawings.

C. Install in accordance with manufacturer's instructions and Contract Documents.

D. Provide full size mockup of portion of exterior wall system as indicated on Drawings, to include the following:

1. Structural backup wall, including sheathing.
2. WRB and flashing at all project conditions, including at-grade termination and flashings at all opening types.
3. Masonry veneer, including veneer ties and reinforcing.
4. Exterior Skin Materials.
5. Exterior window assembly.
6. Exterior Storefront Framing Assembly.
7. Parapet cap flashing.
8. Roof Membrane termination.

3.03 TOLERANCES

A. Maximum Variation From plumb, trueness, square, or level: As specified in Section related to each individual component.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

3.05 DISPOSAL

A. When authorized by Architect and Owner's Representative, demolish and remove all components of composite mockups from project site in accordance with Section 01 74 19 - Construction Waste Management and Disposal in a legal manner.

END OF SECTION

SECTION 01 45 33
CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

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 SECTION INCLUDES

A. Code-required Special Inspections.

B. Other Special Inspections.

C. Submittals.

D. Manufacturers' field services.

E. Fabricators' field services.

1.03 RELATED REQUIREMENTS

A. Special Inspection requirements as indicated in Contract Documents and as required by Applicable Codes.

B. Section 01 30 00 - Administrative Requirements: Submittal procedures.

C. Section 01 40 00 - Quality Requirements.

D. Section 01 45 35 - Quality Assurance Program for Penetrations & Joints

E. Section 01 60 00 - Product Requirements: Requirements for material and product quality.

1.04 DEFINITIONS

A. Code or Building Code: Applicable Building Codes as indicated on Drawings.

B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.

C. Special Inspections and Tests: Inspections and testing of materials, installation, fabrication, erection, or placement of components and connections mandated by Building Code to safeguard public welfare.

1. Special inspections and tests are separate from and independent of tests and inspections conducted by Owner or Contractor for purposes of quality assurance and contract administration.

1.05 REFERENCE STANDARDS

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

B. IAS AC89 - Accreditation Criteria for Testing Laboratories.

C. IAS AC291 - Accreditation Criteria for Special Inspection Agencies AC291.

D. ICC (IBC) - International Building Code.

1.06 SUBMITTALS

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

B. Special Inspection Reports: After each special inspection, Special Inspector is required to promptly submit at least three copies of report; one to Owner, one to Architect, and one to the AHJ.

C. Fabricator's Inspection Reports: When required by AHJ, submit reports to Architect and AHJ.

1.07 SPECIAL INSPECTION AND TESTING AGENCY

A. Owner will employ services of a Special Inspection Agency to perform inspections and associated testing and sampling in accordance with ASTM E329 and required by the Applicable Building Codes.

B. The Special Inspection Agency may employ and pay for services of an independent testing agency to perform testing and sampling associated with special inspections and required by the Applicable Building Codes.

C. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of contract documents.

1.08 TESTING AND INSPECTION AGENCIES

A. Owner may employ services of an independent testing agency to perform additional testing and sampling associated with special inspections but not required by the Applicable Building Codes.

B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of contract documents.

1.09 QUALITY ASSURANCE

A. Contractor shall be responsible to coordinate all Owner Consultants.

B. Special Inspection Agency Qualifications:
   1. Independent firm specializing in performing testing and inspections of the type specified in this section.
   2. Accredited by IAS according to IAS AC291.

C. Testing Agency Qualifications:
   1. Independent firm specializing in performing testing and inspections of the type specified in this section.
   2. Accredited by IAS according to IAS AC89.

D. Copies of Documents at Project Site: Maintain at the project site a copy of each report and test result document.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SPECIAL INSPECTIONS AND TESTING

A. The Code requires special inspections and testing of certain materials, components, assemblies, and connections used in constructing the project. Special inspections and testing will be performed in accordance with the Code.

B. Special inspections and testing will be performed in accordance with the Code for the following materials and project components:
   1. Sprayed fire-resistant materials.
   2. Mastic and intumescent fire-resistant coatings.
   3. Fire-resistant penetrations and joints.

3.02 OWNER REQUESTED NON-CODE REQUIRED SPECIAL INSPECTIONS

A. Waterproofing/Building Envelope Inspections.
   1. Coordinate with Owner's Waterproofing/Building Envelope consultant. The scope of these inspections will be made available to the Contractor after award of Contract.

B. Roofing Inspections.
   1. Coordinate with Owner's Waterproofing/Building Envelope consultant. The scope of these inspections will be made available to the Contractor after award of Contract.

3.03 CONTRACTOR DUTIES AND RESPONSIBILITIES

A. Contractor Responsibilities, General:
   1. Deliver to agency at designated location, adequate samples of materials for special inspections that require material verification.
   2. Cooperate with agency and laboratory personnel; provide access to approved documents at project site, to the work, to manufacturers' facilities, and to fabricators' facilities.
   3. Provide incidental labor and facilities:
      a. To provide access to work to be tested or inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested or inspected.
      c. To facilitate tests or 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 or inspection services.
5. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

3.04 FABRICATORS' FIELD SERVICES

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

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

END OF SECTION

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SECTION 01 45 35
QUALITY ASSURANCE PROGRAM FOR PENETRATIONS & JOINTS

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 SECTION INCLUDES

A. In compliance with Project requirements, the Owner will employ a Special Inspector to observe construction of the Fire-Resistive Joint Systems and Fire Stop Systems components for the project.

1.03 RELATED REQUIREMENTS

A. Special Inspection requirements as indicated in Contract Documents and as required by Applicable Codes.

B. Section 01 45 33 - Code-Required Special Inspections and Procedures: Other Inspection Procedures.

1.04 ABBREVIATIONS AND ACRONYMS

A. AHJ: Authority Having Jurisdiction.

B. RDP: Registered Design Professional.

C. QAP: Quality Assurance Program.

1.05 DEFINITIONS

A. Code or Building Code: Applicable Building Codes as indicated on Drawings.

B. Special Inspector: Person or Entity approved in writing by the AHJ to perform inspections outlined in this Section.

1.06 REFERENCE STANDARDS

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

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.

C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

D. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.

E. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems.

F. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.

G. UL 1479 - Standard for Fire Tests of Penetration Firestops.

H. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems.

1.07 RESPONSIBILITIES OF THE SPECIAL INSPECTOR

A. The Special Inspector will be responsible to the Authority Having Jurisdiction (AHJ) and will report their inspection results in accordance with the Owner-Contractor Agreement.

B. A Special Inspector must be one of the following:
   1. A certified Code Official/Inspector.
   2. A licensed Architect or Engineer.
   3. A licensed Professional in the Construction Industry.
   4. A certified representative of a quality assurance agency or accredited testing laboratory.
   5. A Special Inspector must have a minimum of two (2) years in construction field experience.

C. The Special Inspector shall present credentials to and be accepted by the AHJ. The Special Inspector shall submit the proposed report format documents to AHJ.

D. The Special Inspector shall be completely independent of, and divested from, the installer, Contractor and any sub-contractor, manufacturer, or supplier of any material being inspected. The Special Inspector shall not be a competitor of the installer, Contractor and any sub-contractor, manufacturer, or supplier of any materials being inspected.

E. The Special Inspector is responsible for observing and verifying that the construction of the Fire Stop and Fire-Resistive Joint Systems complies with the Contract Documents. Contract Documents are defined as the permitted Drawings, Addenda, and the Specifications with all amendments thereto, and this Quality Assurance Program.

F. The Special Inspector may use a representative to perform inspection work. The Special Inspector utilizing Authorized Representatives shall ensure the Authorized Representative is qualified by education to perform the duties assigned by the Special Inspector and shall maintain responsible supervisory control over the representative pursuant to the AHJ. The Special Inspector shall be in responsible charge of the work of the Authorized Representative, including reviewing reports and spot checks. The Special Inspector shall visit the site at points during construction which he deems key to the Inspection program.

G. The Special Inspector or their Authorized Representative shall visit the project site as required by the construction activity to inspect the elements during the progress of the work. Further, it is required that the Special Inspector visit the project on a regular periodic basis during construction of elements.

H. The Special Inspector will report observations of materials, workmanship, or other features of construction deviating from the requirements of the Contract Documents. Guidelines for observations covering specific areas of construction are listed herein. The Special Inspector shall complete inspection reports after each inspection, sign each report and forward them to the AHJ with copies going to the Architect of Record, Engineer of Record, Owner, and Contractor. Reports are to be submitted on a monthly basis.

I. Quality control inspections and testing by an independent testing laboratory are required by the project Specifications. Other inspection and testing standards referenced for some elements shall be made available to the Special Inspector to supplement their own inspections when requested by the Special Inspector.

J. The acceptance of any firestop or fire resistive component by the Special Inspector in no way relieves the Contractor of responsibility for complying with the requirements of the Contract Documents.

K. Neither the Special Inspector nor their Authorized Representative shall make any design decisions or direct the Contractor to deviate from the approved Contract Documents. Any deviation from the approved Contract Documents shall be brought to the attention of the Contractor in a timely manner, so as to avert any undue expenses. If the Contractor corrects any deviation to the satisfaction of the Special Inspector, no further action is necessary. If the deviations are not corrected to the satisfaction of the Special Inspector, they shall be brought to the attention of the RDP of Record and the AHJ.

L. The Special Inspector shall institute quality assurance procedures to include, but not be limited to, requiring unscheduled visits, utilization of relevant check lists, use of an Inspection Report and ensuring that the Inspector or the Authorized Representative is at the project whenever so required by the Quality Assurance Program.

M. The Special Inspector will maintain a written record of Quality Assurance Program building inspection activities and will render signed reports promptly to the Building Official with copies to the Owner, Architect of Record, Structural Engineer of Record and the Contractor. Individual reports may include any or all of the following:
   1. General report on construction progress.
   2. Weather conditions.
   3. Other personnel present during the inspections.
   4. Detailed check-off reports on specific areas.
   5. Reports of the corrections of deficiencies previously noted.
   6. Special test reports, sketches or other supplemental data.

N. The Special Inspector shall provide inspection services and testing which is in accordance to the following:

1. Inspect firestop and fire-resistive joint systems in all buildings three stories or greater in height.
2. Inspect firestop joint systems of types as listed in ASTM E814 or UL 1479 in accordance with ASTM E2174.
3. Inspect fire-resistive joint systems of types as listed in ASTM E1966 or UL 2079 in accordance with ASTM E2393.
4. Where subsequent construction operations damage previously inspected firestop and fire-resistive joint systems, repair and reinspect. Follow reporting procedures referenced or noted elsewhere in this Section.

O. The Special Inspector shall provide inspection services and testing in accordance with the following standards:
1. ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops, or ANSI/UL 1479, Standard for Fire Tests of Through-Penetration Firestops.
2. ASTM E2174, Standard Practice for On-Site Inspection of Installed Fire Stops.
3. ASTM E1996, Standard Test Method for Fire-Resistive Joint Systems, or ANSI/UL 2079, Standard for Tests for Fire Resistance of Buildings Joint Systems.
4. ASTM E2393, Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.

P. The Quality Assurance Program allows for general and specific items of concern. It does not limit the Special Inspector to only items listed. The Special Inspector's judgment must prevail on items not specifically covered.

Q. The Special Inspector shall provide a final closing document containing all previous reports, correspondence and information for the RDP to review for compliance of the original quality assurance program intent. Closing document shall be signed and sealed by the RDP then submitted to the AHJ.

1.08 RESPONSIBILITIES OF THE CONTRACTOR

A. The Contractor shall furnish the Special Inspector with a schedule of construction, and provide the Special Inspector with all updates and revisions. The Contractor shall notify the Special Inspector not less than 24 hours prior to the need for an inspection. The Contractor shall not cover any work needing inspection prior to inspection by the Special Inspector. The Contractor shall make all areas available and safe for inspection.

B. The Contractor shall provide to the Special Inspector a copy of each approved submittal related to Firestop and Fire Resistive Joint Systems, materials and components for use in verifying proper construction. Such submittals shall include, but are not limited to, the following:
1. Contract Documents, including all revisions.
2. Firestop and joint shop drawings and product data.

C. All submittals provided to the Special Inspector shall bear the stamp and initials of the Contractor and the Architect or Engineer of Record.

1.09 SPECIAL INSPECTOR’S OBSERVATIONS

A. The contract requirements for this project are contained in the Contract Documents. The following guidelines shall be used in conjunction with a careful study of the Contract Documents.

B. GENERAL
1. Review the Contract Documents to be sure that they are approved and available before the start of any phase of inspections.
2. Review with the Contractor the construction procedure before the start of any phase of the inspections to make sure that it accommodates the design.
3. Review with the independent testing laboratory and Contractor the requirements as to the type of inspection and testing that is necessary before the start of the next phase of work that may cover up items that require inspections. Establish a clear method for marking all tested and inspected items. Confirm that the testing agency uses qualified personnel and completing all tests and inspections in a timely and professional manner.

4. After delivery to the job, inspect firestopping materials for compliance with the Contract Documents, in addition to checking for damage and flaws. Confirm that the firestopping materials are being protected and stored properly.
5. Inspect areas to receive firestopping materials and verify substrates are ready to properly receive the firestopping materials and systems.
6. Verify that all tests, sampling, or reports have been completed before finished work is covered and no longer capable of being inspected or tested.
7. Confirm the repair and treatment of areas containing defective work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provision of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

A. Temporary utilities.

B. Temporary telecommunications services.

C. Temporary sanitary facilities.

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

E. Security requirements.

F. Vehicular access and parking.

G. Waste removal facilities and services.

H. Project identification sign.

I. Field offices.

1.03 TEMPORARY UTILITIES

A. Provide and pay for all electrical power, lighting, sewer & drainage, water, sanitary facilities, heating & cooling, ventilation & humidity control, electronic communications, and telephone required for construction purposes.

B. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.04 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.

B. Telecommunications services shall include:
   1. Telephone Land Lines: One line, minimum; one handset per line.
   2. Internet Connections: Minimum of one; DSL modem or faster.

1.05 TEMPORARY SANITARY FACILITIES

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

B. Maintain daily in clean and sanitary condition.

1.06 BARRIERS

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

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

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

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

1.07 FENCING

A. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

B. Coordinate with Civil Engineering requirements as noted under separate Contract Documents.

1.08 SECURITY

A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

1.09 VEHICULAR ACCESS AND PARKING

A. Coordinate access and haul routes with governing authorities and Owner.

B. Provide and maintain access to fire hydrants, free of obstructions.

C. Provide means of removing mud from vehicle wheels before entering streets.

D. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.10 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.

1.11 PROJECT IDENTIFICATION

A. Provide project identification sign of design and construction indicated on drawings.

B. Erect on site at location indicated.

C. No other signs are allowed without Owner permission except those required by law.

1.12 FIELD OFFICES

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.

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

C. Provide separate private office similarly equipped and furnished, for use of Owner.

D. Locate offices a minimum distance of 30 feet from existing and new structures.

1.13 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.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

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 SECTION INCLUDES

A. General product requirements.

B. Transportation, handling, storage and protection.

C. Product option requirements.

D. Substitution limitations.

E. Procedures for Owner-supplied products.

F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.03 RELATED REQUIREMENTS

A. Document 00 21 13 - Instructions to Bidders: Product options and substitution procedures prior to bid date

B. Section 01 10 00 - Summary: Identification of Owner-supplied products.

C. Section 01 25 13 - Product Substitution Procedures: Substitutions made during and after the Bidding/Negotiation Phase.

D. Section 01 25 13.01 - Request for Substitution Form: Substitution Request Form.

E. Section 01 30 00 - Administrative Requirements

F. Section 01 40 00 - Quality Requirements: Product quality monitoring.

G. Section 01 74 19 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.04 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code.

1.05 SUBMITTALS

A. 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.

B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. 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.

1.06 QUALITY ASSURANCE

A. Source Limitations: For each type of material required to complete the work of any section, provide products from a single manufacturer. Obtain secondary materials including, but not limited to, fasteners and accessories from a source recommend by primary material manufacturer.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

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

B. Use of products having any of the following characteristics is not permitted:
   1. Made using or containing CFC's or HCFC's.

2. Containing lead, cadmium, asbestos, or other prohibited materials.

C. Where other criteria are met, Contractor shall give preference to products that:
   1. Are extracted, harvested, and/or manufactured closer to the location of the project.
   2. Have longer documented life span under normal use.
   3. Result in less construction waste.
   4. Are made of recycled materials.

2.02 PRODUCT OPTIONS

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

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

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

D. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

E. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

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 SUBSTITUTION LIMITATIONS

A. Refer to Section 01 25 13 - Product Substitution Procedures.

3.02 OWNER-SUPPLIED PRODUCTS

A. See Section 01 10 00 - Summary for identification of Owner-supplied products.

B. Owner's Responsibilities:
   1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
   2. Arrange and pay for product delivery to site.
   3. On delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
   5. Arrange for manufacturers' warranties, inspections, and service.

C. Contractor's Responsibilities:
   1. Review Owner reviewed shop drawings, product data, and samples.
   2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
   3. Handle, store, install and finish products.
   4. Repair or replace items damaged after receipt.

3.03 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.

3.04 STORAGE AND PROTECTION

A. 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.

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

C. Store with seals and labels intact and legible.

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

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

F. Provide bonded off-site storage and protection when site does not permit on-site storage or protection. Consult with Owner for insurance and documentation procedures.

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.

J. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

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

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

M. 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

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SECTION 01 70 00
EXECUTION AND CLOSEOUT REQUIREMENTS

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 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Pre-installation meetings.

C. Cutting and patching.

D. Cleaning and protection.

E. Starting of systems and equipment.

F. Demonstration and instruction of Owner personnel.

G. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

H. General requirements for maintenance service.

1.03 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 01 30 00 - Administrative Requirements: Submittals procedures, Electronic document submittal service.

C. Section 01 45 33 - Code Required Special Inspections.

D. Section 01 71 23 - Field Engineering: Additional requirements for field engineering and surveying work.

E. Section 01 74 19 - Construction Waste Management and Disposal: Additional procedures for trash/waste removal, recycling, salvage, and reuse.

F. Section 01 78 00 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.

G. Section 01 79 00 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

H. Section 07 84 00 - Firestopping.

I. Individual Product Specification Sections:
   1. Advance notification to other sections of openings required in work of those sections.

1.04 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.

1.05 QUALIFICATIONS

A. For surveying work, employ a land surveyor registered in Louisiana 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 Louisiana. 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 Louisiana.

1.06 PROJECT CONDITIONS

A. Use of explosives is not permitted.

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

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

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

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

F. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.

G. 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.

1.07 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

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 fabrication error.

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 two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 GENERAL INSTALLATION REQUIREMENTS

A. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.

B. 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.

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

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

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

F. Make neat transitions between different surfaces, maintaining texture and appearance.

3.05 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match work that has been cut to adjacent work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new work damaged by subsequent work.
   7. Remove samples of installed work for testing when requested.
   8. Remove and replace defective and non-complying work.

C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

D. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

F. Restore work with new products in accordance with requirements of Contract Documents.

G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.

I. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.
   3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.06 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

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

3.07 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction
   1. Except as otherwise specified, do not allow waste materials that are to be disposed of to accumulate on-site
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

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. 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.

3.11 ADJUSTING

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

3.12 FINAL CLEANING

A. Execute final cleaning prior to Substantial Completion.
   1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.

B. Use cleaning materials that are nonhazardous.

C. 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.

D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

F. Clean filters of operating equipment.

G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, drainage systems, and landscape areas.

H. Clean site; sweep paved areas, rake clean landscaped surfaces.

I. 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.

B. Accompany Project Coordinator on preliminary inspection 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 inspection.

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 inspection.

E. Owner will occupy all of the building as specified in Section 01 10 00.

F. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

G. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

H. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

I. 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. Refer to and coordinate with requirements set forth in Section 01 93 15 - Schedule of Periodic Maintenance.

C. 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.

D. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

E. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

F. Within the Maintenance Period, Contractor shall repair and level flooring as necessary to maintain smooth surfaces and transitions. Repair finish materials as necessary.

G. Within the Maintenance Period, Contractor shall repair and adjust doors as necessary to maintain smooth operation.

H. 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 71 23
FIELD ENGINEERING

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 SECTION INCLUDES

A. Field engineering services by Contractor.

B. Land surveying services by Contractor.

C. Construction surveying by Contractor.

D. Support and bracing.

E. Submittal requirements and procedures for field engineering record drawings.

1.03 RELATED REQUIREMENTS

A. Section 01 70 00 - Execution and Closeout Requirements: Contract closeout procedures.

1.04 DESCRIPTION OF SERVICES

A. Specific services listed in this section are in addition to, and do not supersede, general Execution and Closeout Requirements.

B. Sole responsibility for establishing all locations, dimensions and levels of items of work.

C. Sole responsibility for provision of all materials required to establish and maintain benchmarks and control points, including batter boards, grade stakes, structure elevation stakes, and other items.

D. Keeping a transit, theodolite, or TST (total station theodolite with electronic distance measurement device); leveling instrument; and related implements such as survey rods and other measurement devices, at the project site at all times.

E. Provision of facilities and assistance necessary for Architect to check lines and grade points placed by Contractor.
   1. Performance of excavation or embankment work until after all cross-sectioning necessary for determining payment quantities for Unit Price work have been completed and accepted by Architect.

F. Preparation and maintenance of daily reports of activity on the work. Submission of reports containing key progress indicators and job conditions to Architect.
   1. Major equipment and materials installed as part of the work.
   2. Location of areas in which construction was performed.
   3. Work performed, including field quality control measures and testing.
   4. Weather conditions.
   5. Instructions received from Architect or Owner, if any.

G. Preparation and maintenance of professional-quality, accurate, well organized, legible notes of all measurements and calculations made while surveying and laying out the work.

1.05 REFERENCE STANDARDS

A. FGDC-STD-007.1 - Geospatial Positioning Accuracy Standards - Part 1: Reporting Methodology.

B. FGDC-STD-007.2 - Geospatial Positioning Accuracy Standards - Part 2: Standards for Geodetic Networks.

C. FGDC-STD-007.4 - Geospatial Positioning Accuracy Standards - Part 4: Architecture, Engineering, Construction, and Facilities Measurement.

D. State Plane Coordinate System for Louisiana.

1.06 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.

1.07 SUBMITTALS

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

B. Submit in addition to items required in Section 01 70 00 - Execution and Closeout Requirements.

C. Informational Submittals: Submit the following:
   1. Field Engineering: Submit daily reports, with content as indicated in this section.
      a. When requested by Architect, submit for Record documentation verifying accuracy of field engineering including, but not limited to, Contractor's survey notes and field notes.
   2. Final property survey.

1.08 QUALITY ASSURANCE

A. Use adequate number of skilled and thoroughly-trained workers to perform the work of this section in a timely and comprehensive manner.

B. Minimum accuracy for required work is as follows:
   1. Grade: Horizontal Tolerance: Plus or minus 0.5 feet, Vertical Tolerance: Plus or minus 0.05 feet.
   2. Culverts and ditches: Horizontal Tolerance: Plus or minus 0.5 feet, Vertical Tolerance: Plus or minus 0.05 feet.
   3. Structures: Horizontal Tolerance: Plus or minus 0.5 feet (location), Vertical Tolerance: Plus or minus 0.05 feet.

PART 2 PRODUCTS - NOT USED

2.01 EQUIPMENT

A. Furnish all surveying equipment, stakes and any other material necessary to perform the Work.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify layout information shown on drawings in relation to property survey and existing benchmarks.

B. Notify Owner’s representative and Architect of discrepancies immediately in writing before proceeding to lay out work.

C. Existing Utilities and Equipment: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify existing conditions.

3.02 FIELD ENGINEERING

A. Maintain field office files, drawings, specifications, and record documents.

B. Coordinate field engineering services with Contractor's subcontractors, installers, and suppliers as appropriate.

C. Prepare layout and coordination drawings for construction operations.

D. Check and coordinate the work for conflicts and interferences, and immediately advise Architect and Owner of all discrepancies of which Contractor is aware.

E. Cooperate as required with Architect and Owner in observing the work and performing field inspections.

F. Review and coordinate work on a regular basis with shop drawings and Contractor's other submittals.

G. Check the location, line and grade of every major element as the work progresses. Notify the Architect when deviations from required lines or grades exceed allowable tolerances. Include in such notifications a thorough explanation of the problem, and a proposed plan and schedule

for remedying the deviation. Do not proceed with remedial work without Owner's concurrence of the remediation plan.

H. Check all formwork, reinforcing, inserts, structural steel, bolts, sleeves, piping, other materials and equipment for compliance with shop drawings and Contract Documents requirements.

I. Check all bracing and shoring for structural integrity and compliance with designs prepared by the Contractor.

3.03 CONTROL

A. Benchmarks and reference control points shall be established outside of the construction limits by the Owner and are to be preserved by the Contractor. Any desired supplemental control will be established and maintained by the Contractor.

B. The original construction layout staking necessary for construction operations shall be provided by the Owner. Any additional re-staking will be at the Contractor's expense.

C. The Contractor shall furnish personnel fully qualified and capable of establishing or re-establishing all line and grade points necessary to complete the Work.

3.04 LAND SURVEYING

A. General: Follow standards for geospatial positioning accuracy.
   1. FGDC-STD-007.1 as amended by Authority Having Jurisdiction.
   2. FGDC-STD-007.2 as amended by Authority Having Jurisdiction.
   3. FGDC-STD-007.4 as amended by Authority Having Jurisdiction.

B. Coordinate survey data with the State Plane Coordinate System of Louisiana.

C. Contractor is responsible for the restoration of all property corners and control monuments damaged or destroyed by construction-related activities. Any disturbed monuments must be replaced at Contractor's expense by a surveyor licensed in Louisiana, and approved by the Architect.
   1. Temporarily suspend work at such points and for such reasonable times as the Owner may require for resetting monuments. The Contractor will not be entitled to any additional compensation or extension of time.

3.05 CONSTRUCTION SURVEYING

A. General: Perform surveying as applicable to specific items necessary for proper execution of work.
   1. Alignment Staking: Provide alignment stakes at 50 foot intervals on tangent, and at 25 foot intervals on curves.
   2. Slope Staking: Provide slope staking at 50 foot intervals on tangent, and at 25 foot intervals on curves. Re-stake at every ten-foot difference in elevation.
   3. Site Utilities: Stake out utility lines including elevations, and check prior to and during construction.
   4. Structural Frame: Upon completion, certify location and plumbness.

B. Record Log: Maintain a log of layout control work. Record any deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used.

C. Accuracy:
   1. Establish Contractor's temporary survey references points for Contractor's use to at least second-order accuracy (e.g., 1:10000). Set construction staking used as a guide for the work to at least third-order accuracy (e.g., 1:5000). Provide the absolute margin for error specified below on the basis established by such orders.
      a. Accuracy of Other Staking: Plus/minus 0.04 foot horizontally and plus/minus 0.02 foot vertically.
      b. Include an error analysis sufficient to demonstrate required accuracy in survey calculations.
   2. Owner reserves the right to check the Contractor's survey, measurements, and calculations. The requirement for accuracy will not be waived, whether this right is exercised or not.

3.06 SUPPORT AND BRACING

A. General requirements: Design all support and bracing systems, if required. Provide for attachment to portions of the building structure capable of bearing the loads imposed. Design systems to not overstress the building structure.

3.07 REPORTS

A. Submit two copies of Contractor's daily reports at Architect's field office (or electronically) by 9:00 AM the next working day after the day covered in the associated report. Daily report shall be signed by responsible member of Contractor's staff, such as project manager or superintendent, or foreman designated by Contractor as having authority to sign daily reports.

3.08 RECORDS

A. Maintain at the Site a complete and accurate log of control and survey work as it progresses.
   1. Organize and record survey data in accordance with recognized professional surveying standards, Laws and Regulations, and prevailing standards of practice in Louisiana. Record Contractor's surveyor's original field notes, computations, and other surveying data in Contractor-furnished hard-bound field books. Contractor is solely responsible for completeness and accuracy of survey work, and completeness and accuracy of survey records, including field books. Survey records,(including field books) may be rejected by Owner due to failure to organize and maintain survey records in a manner that allows reasonable and independent verification of calculations, and/or allows identification of elevations, dimensions, and grades of the work.
   2. Illegible notes or data, and erasures on any page of field books, are unacceptable. Do not submit copied notes or data. Corrections by ruling or lining out errors will be unacceptable unless initialed by the surveyor. Violation of these requirements may require re-surveying the data questioned by Architect.

B. Submit three copies of final property survey to Owner. Include on the survey a certification, signed by the surveyor, that principal metes, bounds, lines, and levels of the Project are accurately positioned as shown on the survey. Include the following information:
   1. Structure locations from property lines, and distances to adjacent buildings.
   2. Dimensions and locations of drives, walks, walls, underground utilities, appurtenances, major site features, and signs.
   3. Location of easements.
   4. Final grading topographic survey.

3.09 ACCEPTANCE

A. Acceptance of all or any part of the Contractor's Lay out by the Owner shall not relieve the Contractor of his responsibility to secure proper dimensions in the Completed Work.

3.10 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

END OF SECTION

SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

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 WASTE MANAGEMENT REQUIREMENTS

A. 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.

B. 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.

1.03 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation or repair operations. Construction waste includes packaging.

C. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition.

D. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

E. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

F. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

G. 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.

H. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

I. 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.

J. Return: To give back reusable items or unused products to vendors for credit.

K. Reuse: To reuse a construction waste material in some manner on the project site.

L. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

M. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

N. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

O. Toxic: Poisonous to humans either immediately or after a long period of exposure.

P. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

Q. 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.

1.04 SUBMITTALS

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

PART 2 PRODUCTS

2.01 PRODUCT SUBSTITUTIONS

A. See Section 01 60 00 and Section 01 25 00.

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

A. See Section 01 30 00 for additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. See Section 01 50 00 for additional requirements related to trash/waste collection and removal facilities and services.

C. See Section 01 60 00 for waste prevention requirements related to delivery, storage, and handling.

D. See Section 01 70 00 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

E. See Section 01 84 14 for additional requirements for related to credit MR 3.1 and 3.2 Waste Management.

3.02 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
   1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not bum waste materials.

C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION

SECTION 01 78 00
CLOSEOUT SUBMITTALS

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 SECTION INCLUDES

A. Project record documents.

B. Operation and maintenance data.

C. Warranties and bonds.

1.03 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Section 01 70 00 - Execution and Closeout Requirements: Contract closeout procedures.

C. Section 01 93 15 - Schedule of Periodic Maintenance

D. Individual Product Sections: Specific requirements for operation and maintenance data.

E. Individual Product Sections: Warranties required for specific products or Work.

1.04 SUBMITTALS

A. Project Record Documents: Submit documents to Owner with claim for final Application for Payment.

B. Operation and Maintenance Data:
   1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Owner will review draft and return one copy with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Owner comments. Revise content of all document sets as required prior to final submission.
   4. Submit two sets of revised final documents in hard copy final form within 10 days after final inspection.
   5. Submit in electronic format on media suitable to the size of the files at quality level equal to a first generation color scan and submit four copies to Owner. File type shall be as directed by Owner or Architect.

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 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.

6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish first floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   4. Field changes of dimension and detail.
   5. Details not on original Contract Drawings.

G. Supplemental Information: Provide documentation as required or requested by Owner.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 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. Additional information as specified in individual product specification sections.

E. 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.

3.04 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. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

D. Include color coded wiring diagrams as installed.

E. 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.

F. 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.

G. Provide servicing and lubrication schedule, and list of lubricants required.

H. Include manufacturer's printed operation and maintenance instructions.

I. Include sequence of operation by controls manufacturer.

J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

K. Provide control diagrams by controls manufacturer as installed.

L. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.

M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

N. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

O. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Coordinate with Owner requirements and preferences for digital and/or hard bound copies of Operation and Maintenance Manuals.

B. 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.

C. Where systems involve more than one specification section, provide separate tabbed divider for each system.

D. 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.

E. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

F. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

G. 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.

H. 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.

I. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.

J. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

K. Arrangement of Contents: Organize each volume in parts as follows:
   1. Project Directory.

2. Table of Contents, of all volumes, and of this volume.
3. Operation and Maintenance Data: Arranged by system, then by product category.
    a. Source data.
    b. Product data, shop drawings, and other submittals.
    c. Operation and maintenance data.
    d. Field quality control data.
    e. Photocopies of warranties and bonds.

3.06 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. Include written instructions for all preventative maintenance and service requirements necessary to maintain warranty.

C. Verify that documents are in proper form, contain full information, and are notarized.

D. Co-execute submittals when required.

E. Retain warranties and bonds until time specified for submittal.

F. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.

G. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.

H. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

I. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION

SECTION 01 79 00
DEMONSTRATION AND TRAINING

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 SECTION INCLUDES

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. Fire Protection and Plumbing equipment.
   4. Electrical systems and equipment.
   5. Landscape irrigation.
   6. Access Control and AV Equipment if and where accepted as alternate.
   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.

1.03 RELATED REQUIREMENTS

A. Section 01 78 00 - Closeout Submittals: Operation and maintenance manuals.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures; except:
   1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.
   2. Submit one copy to the Commissioning Authority, not to be returned.
   3. Make commissioning submittals on time schedule specified by Commissioning Authority.
   4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 preferred.

B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit to Commissioning Authority for review and inclusion in overall training plan.
   2. Submit not less than four weeks prior to start of training.
   3. Revise and resubmit until acceptable.
   4. Provide an overall schedule showing all training sessions.
   5. 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. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such a slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. 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.

D. Training Reports:
1. Identification of each training session, date, time, and duration.
2. Sign-in sheet showing names and job titles of attendees.
3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.
4. Include Commissioning Authority's formal acceptance of training session.

E. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
1. Format: Digital Files.
a. The Owner will provide an ftp link for the Contractor to upload all training videos.
2. Label each disc and container with session identification and date.

1.05 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. Provide training in minimum two hour segments.

F. The Commissioning Authority is responsible for determining that the training was satisfactorily completed and will provide approval forms.

G. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

H. 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.

I. 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.

J. 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

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SECTION 01 93 15
SCHEDULE OF PERIODIC MAINTENANCE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provision of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

A. Schedule of periodic maintenance as performed by the Owner, or companies performing work in behalf of the Owner.
   1. Maintenance work as described in this section is not required of the Contractor except as may be specifically indicated in subsequent Sections for particular systems.

1.03 RELATED SECTIONS

A. Division 01 Section 01 70 00 - Execution and Closeout Requirements for closeout procedures and Division 01 Section 01 78 00 - Closeout Submittals for closeout documents including but not limited to Record Drawings, maintenance instructions, and maintenance manuals.

B. Division 03 thru 33 for requirements for maintenance information required for specific products and systems. Contractor shall prepare closeout documents consistent with requirements of this section.

1.04 RELATED DOCUMENTS

A. ACI PRC-362.2 - Guide for Structural Maintenance of Parking Structures (Reapproved 2013).

B. Comply with applicable sections of International Property Maintenance Code.

C. Comply with local zoning and other municipality requirements for property maintenance.

D. Comply with Precast/Prestressed Concrete Institute Maintenance Manual for Precast Parking Structures.

1.05 GENERAL

A. The requirements indicated in this section are not intended as an exhaustive, all inclusive list, and shall in no way limit the maintenance requirements to be performed. Routine inspections by the Owner's personnel or subcontractors shall determine where additional maintenance is warranted.

PART 2 PRODUCTS

2.01 CLEANERS

A. Use cleaning products as listed in the product manufacturer's maintenance instructions or as otherwise consistent with the manufacturer's recommendations.

PART 3 EXECUTION

3.01 EMERGENCY AND AFTER HOURS

A. Water Leaks:
   1. Plumbing Leaks: When plumbing leaks occur, property management should shut off water supply, call the plumber and start drying and cleaning process immediately. Standing water must be removed at once.
   2. Rainwater Intrusion: When roof or wall leaks occur, property management should cover/patch roof or wall immediately to stop water infiltration. Standing water in units must be removed immediately and drying and cleaning started at once to minimize damage.
   3. Wetting from Unknown Source: When water intrusion occurs from an unknown source, remove water and immediately execute drying and cleaning process to minimize damage. Investigate source of water and implement repairs immediately.

B. On-Site Utility Disruption:
   1. Electrical Outage: Once outage is detected, utility company should be notified. Where outage is due to damaged equipment, power should be turned off when possible.
   2. Telephone and TV outage: Notify utility company.
   3. Sewage back-up or overflows: control flow and repair immediately.

C. Fire: Evacuate building involved, call fire department then evacuate adjacent buildings.

D. Building or Pavement Failure: Rope off area and notify emergency services if there are injuries.

3.02 DAILY WORK ITEMS

A. Office and entry should be cleaned with trash removed.

3.03 WEEKLY WORK ITEMS

A. Lawns: Mow, trim and collect limbs, trash, etc.

B. Buildings:
   1. Clean public entry areas.
   2. Check for burned out light bulb and broken light fixtures.
   3. Check for damaged areas in public areas.
   4. Inspect sites for drainage and soil erosion problems, evidence of sewer clean-out overflows or other immediate problems.

3.04 MONTHLY

A. Site drainage, paving, sidewalks, and curbs should be inspected and repaired as necessary.

B. Main electrical breakers, exterior lights and outlets, meters and service equipment should be inspected for damage. Make repairs.

C. Buildings:
   1. Visually inspect exteriors for signs of settlement or standing water settlement repair.
   2. Visually inspect doors and windows (from exterior) for missing caulk, broken glass or disrepair.
   3. Visually inspect painted surfaces for peeling and damage.
   4. Treat building for general insect control; inside units and outside buildings.
   5. Visually inspect and clean all drains, including but not limited to site drains, roof drains, and parking structure drains.

3.05 QUARTERLY

A. Clean gutters, downspouts and generally inspect roof condition. Make repairs as necessary.

B. Mechanical Equipment:
   1. Change all filters and clean return air grilles in all units and perform the following items by the quarter listed:
      a. Winter:
         1) Check plumbing fixtures and equipment for leaks, scaling and proper operation.
      b. Spring:
         1) Check refrigerant charge on all units.
         2) Clean condenser coils and comb fins if necessary.
      c. Fall:
         1) Vacuum debris from heat exchanger and flywheel of mechanical unit.
         2) Inspect operation of heating elements.
      d. Summer:
         1) Test pressure relief value on water heater.
         2) Operate main shut-off values in domestic water system.
   2. Visually inspect mechanical rooms/closets and equipment for any signs of damage or malfunction.
      a. Inspection shall include but not be limited to verification that condensate drains and drain pans are functioning properly.

C. Inspect all doors and windows from inside the units. Make repairs and adjustments as necessary.

D. Inspect storm drainage outfalls for collected debris.

E. Rod sewer clean-outs to protect against back-ups.

3.06 ANNUALLY

A. Annual mechanical service listed and scheduled under Section 3.05 Quarterly.

B. Have warranty roof inspection and repair work done, annually and at other intervals as recommended by roof manufacturer.

C. Inspect, repair and touch-up paint all painted surfaces.

D. Site:
   1. Clean, caulk and seal cracks in pavement.
   2. Storm drains and storm lines. Flush structures out.
   3. Clean and inspect all drainage structures and downspouts/gutters connections.
   4. Check lawns for proper drainage and erosion areas.
   5. Fertilize plant material.

E. Inspect interior light fixtures, outlets, equipment and drywall ceilings.

F. Visually inspect building interior wall and floor surfaces for settlement, consolidation, and differential movement. Repair gypsum board and level flooring as necessary to maintain smooth surfaces and transitions. Repair finish materials as necessary.

G. Conduct building inspection, including exterior cladding, railings and guards, fenestrations, foundations and exterior sealants. Repair all items exhibiting damage or deterioration.

H. Fire door assemblies shall be inspected and tested in accordance with NFPA 80. Not less than annually.

I. Draftstop assemblies, access doors, and access panels.

3.07 EVERY FOUR TO FIVE YEARS

A. Exteriors: Repair all trim, siding, cladding and similar components, whether wood material or synthetic. Inspect and repair exposed metal surfaces and touch-up paint if applicable. In general, repair all exterior surfaces and clean as required.

B. Conduct thorough investigation of all sealants and caulk joints. Inspect intersections of dissimilar materials. Completely remove existing damaged or deteriorating sealant and backer rod. Clean and repair joint. Install new properly sized backer rod and sealant. Sealants must be replaced at intervals recommended by manufacturer and first sign of joint deterioration.

C. Breezeways, building corridors, and entry areas should be repainted.

D. Balconies, Railings and Guards, and Exterior Stairs: Inspect by engineer licensed in Louisiana.

3.08 UNOCCUPIED SPACE

A. Inspection: Inspect vacant space quarterly for general damage or deterioration.

B. Freeze Prevention: Run central heat system or take other measures to ensure that temperature remains above freezing to ensure that water pipes are not allowed to freeze.

C. Temperature Control: Run central air conditioning and/or heating equipment as appropriate, or take other measures to control interior climate, interior surfaces, and/or inside wall/partition/ceiling cavities.

3.09 PARKING STRUCTURES

A. Comply with maintenance guidelines outlined in ACI PRC-362.2 for weekly, monthly, semi-annual, and annual maintenance tasks.

3.10 MAKE READY ITEMS PRIOR TO NEW TENANT OCCUPYING UNIT

A. Inspect and repair all finish items in the unit (vinyl flooring, ceramic tile, etc.).

B. Repair gypsum board cracks and then repaint interior wall surfaces.

C. Clean or replace carpet.

D. Inspect, test and service all appliances, fixtures and equipment

E. Check all doors and windows for operation and condition. Repair as necessary.

F. Inspect and repair all cabinet work in the unit.

END OF SECTION

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SECTION 03 05 16
UNDERSLAB VAPOR BARRIER

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 SECTION INCLUDES

A. Sheet vapor barrier under all conditioned and unconditioned concrete slabs on grade.

1.03 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Preparation of subgrade, granular fill, placement of concrete.

B. Section 31 31 16 - Termite Control: Below-grade soil treatment prior to installation of the Work in this Section.

1.04 REFERENCE STANDARDS

A. ASTM D1709 - Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.

B. ASTM E154/E154M - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

C. 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.

D. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

E. ASTM F1249 - Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.

1.05 SUBMITTALS

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

B. Product Data: Submit manufacturers' data on manufactured products.

C. Samples: Submit samples of underslab vapor barrier to be used.

D. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction.

1.06 QUALITY ASSURANCE

A. Coordinate the requirements of this Section with the actual products proposed in Section 31 31 16 - Termite Control to ensure compatibility with soil treatment products.

PART 2 PRODUCTS

2.01 MATERIALS

A. Underslab Vapor Barrier:
   1. Water Vapor Permeance: ASTM E154/E154M Section 7 or ASTM F1249: Not more than 0.030 perms, maximum.
   2. Complying with ASTM E1745 Class A.
      a. Puncture Resistance, ASTM D1709 : minimum 2200g.
      b. Tensile Strength, ASTM E154/E154M; minimum 45.0 lbf/in.
   3. Thickness: minimum 10 mils.
   4. Manufactured with only virgin, non-recycled resins.
   5. Resistant to degradation by soil treatment products.

B. Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers shall include but are not limited to the following:
   1. Barrier-Bac, Inc.; VB-250: www.barrierbac.com.
   2. Fortifiber Building Systems Group; Moistop Ultra 10: www.fortifiber.com.

3. ISI Building Products; Viper II 10-mil "Class A" Vapor Barrier: isibp.com.
4. Reef Industries, Inc.; Griffolyn® 10 Mil Green: www.reefindustries.com
5. Stego Industries, Inc.; STEGO WRAP 10-MIL: www.stegoindustries.com.
6. Tex-Trude; X-Treme Vapor Barrier 10-mil Class A: xtremevaporbarrier.com.
7. W.R. Meadows; PERMINATOR 10-mil: www.wrmeadows.com.
8. Substitutions: Not permitted.

C. Accessory Products: Vapor barrier manufacturer's recommended tape, adhesive, mastic, etc., for sealing seams and penetrations in vapor barrier and complying with the water vapor permeance requirements of the listed ASTM requirements for the installed membrane.

D. Pipe Boots
1. Construct pipe boots from vapor barrier material, pressure sensitive tape and/or mastic per manufacturer’s requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surface over which vapor barrier is to be installed is complete and ready before proceeding with installation of vapor barrier.
1. Level and compact base material.

3.02 INSTALLATION

A. Install vapor barrier in accordance with manufacturer's written instructions and ASTM E1643.
1. If capillary fill is required by the documents, vapor barrier shall be installed above the capillary fill, immediately under the concrete.
2. Unroll vapor retarder with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible. Install vapor retarders in largest practical widths.
3. Lap vapor retarder over footings and seal to foundation walls where applicable.
4. At turned-down slabs, extend vapor retarder under and beyond bottom of turn-down, to be turned-up at perimeter vertical face before backfilling. Trim flush with grade.
5. No penetration of the vapor retarder is allowed except for reinforcing steel and permanent utilities.
6. Seal all penetrations (including pipes and conduit) per manufacturer’s written instructions.
7. Repair damaged areas by cutting patches of vapor retarder, overlapping damaged area in the same manner required by the manufacturer for typical seams.
8. The intent of above installation procedures is that as a minimum there is no view of ground after the vapor retarder is installed.

B. Install vapor barrier under interior slabs on grade and as shown on the Drawings; lap sheet over footings and seal to foundation walls.

C. Lap joints minimum 12 inches typical, but not less than the minimum overlap required in writing by the manufacturer.

D. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions.

E. No penetration of vapor barrier is allowed except for reinforcing steel and permanent utilities.

F. Repair damaged vapor retarder before covering with other materials.

END OF SECTION

SECTION 03 15 05
CONCRETE ACCESSORIES

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 SECTION INCLUDES

A. Joint devices associated with concrete work.

1.03 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 07 92 00 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

1.04 REFERENCE STANDARDS

A. ACI 301 - Specifications for Concrete Construction.

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

C. ASTM E11 - Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves.

D. ICC-ES AC380 - Acceptance Criteria for Termite Physical Barrier Systems.

E. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.

1.05 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.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the jobsite in undamaged and clearly marked containers and/or wrapping indicating the name of the Waterproofing Manufacturer and product.

B. Store materials as recommended in writing by the Waterproofing Manufacturer in addition to the following:
   1. Keep solvents away from open flame or excessive heat.
   2. Store rolled materials on end.

C. Product handling requirements may vary. Refer to Waterproofing Manufacturer’s published literature for each product specified.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Waterstops: Provide five year manufacturer's limited warranty.

PART 2 PRODUCTS

2.01 FORMWORK

A. Comply with requirements of Section 03 10 00.

2.02 ACCESSORY MATERIALS

A. Termite-Resistant Barrier Sealant: Solvent-based; single component, non-sag, non-skinning, non-hardening, non-bleeding; vapor-impermeable; intended for fully concealed applications.
   1. Termite Resistance: 100 percent when tested in accordance with ICC-ES AC380.

2.03 BONDING AND JOINTING PRODUCTS

A. Hydrophilic Waterstops: Bentonite or bentonite/butyl rubber.
   1. Configuration: As indicated on Drawings.
   2. Size: As indicated on Drawings.

3. Manufacturers:
    a. Carlisle Coatings & Waterproofing; MiraSTOP BW: www.carlisleccw.com.
    b. CETCO, a division of Minerals Technologies Inc.; WATERSTOP RX: www.mineralstech.com.
    c. TegraSeal Products, LLC; TegraStop™ : www.tegraseal.com.
    d. Tremco, Inc.; Superstop: www.tremcosealants.com
    e. W.R. Meadows; Waterstop EC or Waterstop EC Plus: www.wrmeadows.com.
    f. Substitutions: See Section 01 60 00 - Product Requirements.

B. Waterstop Accessories: UV stable sealants, adhesives, and primers; same manufacturer as waterstop products, or approvded in writing by manufacturer of waterstop product.

C. Reglets: Formed steel sheet, with temporary filler to prevent concrete intrusion during placement.
    1. Stainless steel; ASTM B209
    2. Size: As indicated on Drawings.

D. Termite-Excluding Slab Isolation Joint Filler: 1/2 inch thick, composite sheet of elastomeric membrane, embedded stainless steel termite-exclusion screen, adhesive on both sides, and a disposable, treated release sheet.
    1. Termite Resistance: 100 percent when tested in accordance with ICC-ES AC380.
    2. Stainless Steel Mesh: ASTM E11; opening size 0.018 inch, maximum.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrate, clean and repair as required to eliminate conditions that would be detrimental to proper installation. Verify substrate conditions are within alignment tolerances for proper installation.

B. Examine reinforcing layout and coordinate waterstop locations and minimum coverage requirements.

3.02 PREPARATION

A. Formwork: Comply with requirements of ACI 301.

B. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

C. Prepare existing concrete surfaces to be repaired according to ICRI 310.2R.

D. Ensure inserts, waterstops, and formed construction joint devices will not be disturbed during concrete placement.

E. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

3.03 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION

SECTION 03 35 00
CONCRETE FINISHING

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 SECTION INCLUDES

A. Surface treatments for concrete floors and slabs.

B. Surface treatments for exposed concrete columns and walls.

1.03 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing compounds that also function as sealers.

B. Section 03 30 00 - Cast-in-Place Concrete: Curing compounds that also function as sealers.

C. Section 03 35 60 - Integrally Colored Concrete.

D. Section 07 19 00 - Water Repellents.

E. Section 09 65 66 - Resilient Athletic Flooring: Fluid-applied athletic flooring.

1.04 DEFINITIONS

A. Light or Fine-broomed finish—less than 1/32 in. in depth and created with a soft or horsehair bristle concrete finishing broom.

B. Medium-broomed finish—1/32 to 3/64 in. in depth and created with a horsehair or synthetic bristle concrete finishing broom.

C. Heavy-broomed finish—3/64 and 1/8 in. in depth and created with a stiff-bristled concrete broom.

1.05 REFERENCE STANDARDS

A. ACI 117 - Specification for Tolerances for Concrete Construction and Materials.

B. ACI 301 - Specifications for Concrete Construction.

C. ACI 318 - Building Code Requirements for Structural Concrete.

D. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.

E. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.

F. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

G. ASTM E1155/E1155M - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers.

1.06 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with concrete floor placement and concrete floor curing.

1.07 SUBMITTALS

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

B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.

C. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

1.08 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.

1.09 MOCK-UP

A. For coatings and polished concrete systems, construct mock-up area under conditions similar to those that will exist during application, with coatings applied.

B. Mock-Up Size: 8 feet square.

C. Locate where directed by Owner and/or Architect.

D. Mock-up may not remain as part of the work, unless otherwise approved in writing by Owner.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's sealed packaging, including application instructions.

1.11 FIELD CONDITIONS

A. Maintain light level equivalent to a minimum 200 W light source at 8 feet above the floor surface over each 20 foot square area of floor being finished.

B. Do not finish floors until interior heating system is operational.

C. Maintain ambient temperature of 50 degrees F minimum for seven days after placing. Protect work against frost, rapid drying and heavy rain.

1.12 COORDINATION

A. Coordinate the Work with other Specification Sections for compatibility of materials, including but not limited to, sealers, curing compounds, densifiers and hardeners.

PART 2 PRODUCTS

2.01 CURING AND SEALING COMPOUND - CAST-IN-PLACE CONCRETE

A. Acceptable products:
   1. Euclid Chemical Co., Super Diamond Clear.
   2. Gifford-Hill & Co., Sealco.
   3. MAPEI Corp., Mapecure AP.
   4. Sonneborn Div. of Contech, Inc., Kure-N-Seal 0800.

B. Type: Clear acrylic based, non-yellowing, meeting ASTM C309, Type I.

C. Moist cure surfaces to receive waterproofing.

2.02 CURING AND HARDENING COMPOUND

A. Acceptable Products:
   1. Euclid Chemical Co., Eucosil.
   2. MAPEI Corp., Mapecrete Hard SI.
   3. Sonneborn Div. of Contech, Inc., Sonosil.
   4. W. R. Meadows Co., Durehard.

B. Type: Clear sodium silicate based, meeting ASTM C309, Type I.

2.03 WET AND CURING MATERIALS

A. Sand: Clean, natural sand meeting ASTM C144.

B. Moisture-retaining Cover: Waterproof paper, polyethylene film or burlap-polyethylene sheet meeting ASTM C171.

C. Water: Clean, potable free of alkali, acid, oil or organic matter.

2.04 ABRASIVE AGGREGATE

A. Aluminum oxide or emery graded from particles retained on a #50 mesh screen to particles passed by a 1/8 in. screen.

2.05 CONCRETE BONDING AGENT

A. Acceptable Products:
   1. Burke Concrete Accessories, Inc., Bondcrete-S.
   2. Euclid Chemical Co., Flexcon.
   3. Larsen Products Corp., Weld-Crete.
   4. MAPEI Corp., Planicrete AC.
   5. Sika Chemical Corp., Sika Latex.
   6. Sonneborn Div. of Contech, Inc., Sonocrete.
   7. The Upco. Co., 705 Bonding Adhesive.

B. Characteristics: Acrylic latex emulsion, non-reversible.

2.06 EXPOSED CONCRETE COLUMNS AND WALLS

A. Provide Class A Cast in Place Architectural Concrete with sealed form joints at locations indicated on Drawings.

B. Form-facing materials: Form-facing material in contact with concrete shall be lumber, plywood, tempered concrete-form-grade hardboard, metal, plastic, or paper that creates specified appearance and texture of concrete surface. Coordinate with the requirements of Section 03 30 00 - Cast-in-Place Concrete.

C. Spray on water-based surface repellent: As specified in Section 07 19 00 - Water Repellents.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that vertical and horizontal concrete surfaces are acceptable to receive the work of this Section.

B. Verify that floor surfaces are acceptable to receive the work of this Section.

C. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

3.02 GENERAL

A. Apply materials in accordance with manufacturer's instructions.

3.03 COATING APPLICATION

A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.

B. Verify that water vapor emission from concrete and relative humidity in concrete are within limits established by coating manufacturer.

C. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.

D. Apply coatings in accordance with manufacturer's written instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

3.04 CONCRETE SLAB FINISHING

A. Screed floor slabs to even surface by use of straightedge and screeding strips, within tolerances prescribed by ACI 301 for specified slab finish.

B. Float surfaces on concrete with wood float in manner which will compact concrete and produce surface free of depressions or ridges. Test for grade or level and correct as necessary by removing excess or adding and compacting additional concrete. Surfaces to receive float finish include slabs to receive setting beds.

C. Trowel Finish: Apply trowel finish to designated monolithic slab surfaces. After floating, begin first trowel finish operation using power-driven trowel. Begin final troweling when surface produces ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand troweling operation, free of trowel marks, uniform in texture and appearance. The following surfaces shall receive a trowel finish:
   1. Slabs to be exposed in the finished work, except where designated to receive a non-slip broom finish as scheduled below.
   2. Slabs designated to receive elastomeric surfacing seamless flooring.
   3. Slabs to receive resilient flooring, carpet and similar finish materials.

D. Non-slip Broom Finish: Immediately after trowel finishing, roughen concrete surface by brooming in direction perpendicular to main traffic routed. Coordinate required final finish with Architect before application. Apply non-slip broom finish to exterior concrete platforms, steps and ramps.

E. Non-slip Aggregate Finish: After completion of float finishing, and before beginning trowel finish, distribute 25 lbs. of dampened abrasive aggregate per 100 sq. ft. of surface. Tamp aggregate flush with surface using steel trowel, but do not force non-slip aggregate particles below the surface. After broadcasting and tamping, apply trowel finishing as specified. After

curing, work surface with steel wire brush, or an abrasive stone, and water to expose non-slip aggregate. Apply non-slip aggregate finish to interior concrete stair treads, platforms, and ramps.

F. Nonmetallic hardened finish: Apply hardener as dust coat, in two shakes. Apply at a minimum rate in accord with manufacturer's product data. Apply approximately 2/3 of aggregate in first shake, floating into surface. Apply remainder of aggregate after achieving uniform color and when surface water disappears. Trowel finish as specified.

G. Concrete Slab Finish Schedule:
   1. Elevated balconies and patios: Medium broom finish.
   2. Ground levels in parking decks: Heavy broom finish:
   3. Elevated levels in parking decks, covered: Heavy broom finish, or as required by traffic coating manufacturer.
   4. Elevated levels in parking decks, exposed to sun: Heavy broom finish, or as required by traffic coating manufacturer.
   5. Stair Treads and Landings: Light broom finish

H. Tool all edges, joints, and transitions not scheduled for saw-cut, unless otherwise detailed on Drawings.

3.05 FLOOR FINISH TOLERANCE

A. Interior slabs:
   1. Test Layout: In accordance with ASTM E1155/E1155M.
      a. Test area: Area of concrete placed in a continuous pour.
      b. Test sections: Area bounded by grid lines, slab edge or construction joints.
      c. Sample measurement lines: As defined in ASTM E1155/E1155M.
   2. Flatness and Levelness Tolerance:
      a. Specified overall value:
         1) Floor Flatness: FF (SOV) = 35
         2) Floor Levelness: FL (SOV) = 25
      b. Minimum Local Value:
         1) Floor Flatness: FF (MLV) = 17
         2) Floor Levelness: FL (MLV) = 15

B. Time of Tests:
   1. Obtain floor tolerance measurements within 24 hours after slab installation.
   2. Obtain measurements prior to removal of shores and forms supporting floor being measured.
   3. Test Reports for Flood Finish Tolerance:
      a. Provide report of test results to Subcontractor, Owner and Architect within 72 hours after slab installation.
      b. Include in the report a running tabulation of all overall FF and overall FL values of slabs installed to date.
   4. Acceptance Criteria: Remedial work may be required if either of the following is not met:
      a. The composite value of the entire test area must be equal or greater than either the entire specified overall F-numbers.
      b. The values for any test section must be equal or greater than either of the minimum local F-numbers.
   5. Remedial Work:
      a. Remedial work may include grinding, planing, skimming, re-topping, or removal and replacement.
      b. Contractor submit method and materials proposed for remedial work at each location to the Architect for review.
      c. Retest is required for all repaired work within two weeks to confirm conformance with floor finish criteria.
      d. The Contractor is responsible for correction of floors finished out of tolerance.

C. Exterior Slabs:
   1. Finish exterior slabs to drain freely.

2. Cut out and replace depressions that hold water.

3.06 PATCHING OF EXPOSED CONCRETE SURFACES

A. Exposed vertical concrete surfaces (walls and columns) in areas available to public view shall comply with Surface Finish category 3.0 (SF-3.0) in accordance with ACI 301 and ACI 117.
   1. SF-3.0:
      a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
      b. Remove projections larger than 1/8 inch.
      c. Patch tie holes.
      d. Surface tolerance Class A as specified in ACI 117.
      e. Provide mockup of concrete surface appearance and texture confirmation.

B. Areas requiring patching shall not exceed two sq. ft. per 1000 sq. ft. of surface area and shall be widely dispersed. Areas having excessive defects as determined by the Architect shall be removed and replaced.

C. Following finishing operation, patch voids, honeycomb, form tie holes and defects using a mixture of similar proportions to original concrete, deleting coarse aggregate.

D. In preparing areas to receive patch, remove loose particles and chip out adjacent sound concrete to avoid featheredge patches. Patches shall match approved patches on mock-up.

E. Apply a coating of bonding agent to areas being patched. Take care to prevent staining of exposed surfaces. Apply bonding agent in accord with manufacturer's product data.

F. Fill in area with selected mix, bringing to same level as original concrete. Brush out area to match surrounding work. Allow to cure.

3.07 CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperature, and maintain without drying at relatively constant temperature for the period of time necessary for hydration of cement and hardening of concrete.

B. Begin initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Keep concrete continuously moist for not less than 72 hours.

C. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 168 cumulative hours; (not necessarily consecutive), during which concrete has been exposed to air temperatures above 50 degrees F. Avoid rapid drying at end of final curing period.

D. Curing Methods: Cure concrete by moist curing, by moisture-retaining cover curing, by liquid curing compound, or by combinations thereof, except where manufactured products in accord with manufacturer's product data forbid mixing certain methods.

E. Cure surfaces to receive elastomeric roofing or coatings using sodium silicate or chlorinated rubber-based curing and sealing compound.

F. Cure interior floor surfaces which are not designated to receive further finish with sodium silicate or chlorinated rubber-based curing and sealing compound finishing.

G. Provide moisture curing by any of the following methods:
   1. Keep surface of concrete continuously wet by covering with water.
   2. Continuous water-fog spray.
   3. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water, and keeping absorptive continuously wet.

H. Provide moisture retaining cover curing as follows: Cover concrete surfaces with specified moisture-retaining cover for curing concrete; place in widest practicable width with sides and ends lapped at least 3 in. and sealed with waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

I. Provide liquid curing-sealing compound as follows: Apply specified membrane-forming, curing-sealing compound to damp concrete surfaces as soon as concrete has set sufficiently so as not to be marred by the application. Areas which are subjected to heavy rainfall within three hours after initial application shall be recoated. Maintain continuity of coating and repair damage to coat during entire period.

J. Do not use membrane curing-sealing compounds on surfaces which are covered with coating material applied directly to concrete or with waterproofing, damp-proofing, flooring, paint, and coatings and finish materials.

K. Cure formed concrete surfaces including supported slabs undersides and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

L. Curing Unformed Surfaces:
   1. Initially cure unformed surfaces, such as slabs and other flat surfaces, by moist curing.
   2. Final cure unformed surfaces by any of methods specified above, as applicable, unless otherwise specified.

3.08 PROTECTION

A. Protect freshly placed concrete from damage due to water, falling objects, or marring finish surface of concrete. Surfaces damaged due to lack of protective measures shall be removed and replaced with fresh concrete.

B. Protect finished surfaces from damage by work of other trades due to subsequent work.

C. Protect floor surfaces to be left exposed from damage during subsequent construction operations and make necessary repairs to damaged areas, returning to original condition.

END OF SECTION

SECTION 03 35 11
CONCRETE FLOOR FINISHES

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 SECTION INCLUDES

A. Surface treatments.

B. High-gloss sealer.

C. Low-gloss sealer.

D. Clear coatings.

E. Clear, penetrating, moisture-vapor-resistant sealers.

F. Slip-resistant coatings.

1.03 RELATED REQUIREMENTS

A. Section 03 05 16 - Underslab Vapor Barrier: Underslab vapor barrier.

B. Section 03 30 00 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing compounds that also function as sealers.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

B. Coordinate the work with concrete floor placement and concrete floor curing, including other specification sections for compatibility of materials, including but not limited to, sealers, curing compounds, densifiers and hardeners..

1.05 SUBMITTALS

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

B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.

C. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

1.06 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.

1.07 MOCK-UPS

A. For coatings and polished concrete systems, construct mock-up area under conditions similar to those that will exist during application, with coatings applied.

B. Locate where directed.

C. Mock-up may not remain as part of the work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's sealed packaging, including application instructions.

1.09 FIELD CONDITIONS

A. Maintain light level equivalent to a minimum 200 W light source at 8 feet above the floor surface over each 20 foot square area of floor being finished.

B. Do not finish floors until interior heating system is operational.

C. Maintain ambient temperature of 50 degrees F minimum.

1.10 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Unless otherwise indicated on drawings, finish concrete floors using troweling aid, densifier, and curing agent.

B. Clear Coating:
   1. Use at following locations: All "Back of House" spaces.

C. Slip-Resistant Coating: Finely-ground aggregates added to coatings.
   1. Use at following locations: Stair treads, stair landings, and breezeways exposed to the exterior.

2.02 SURFACE TREATMENTS

A. Troweling Aid, Densifier and Curing Agent: Liquid reactive colloidal silica-based topical treatment, spray-applied to wet concrete and floated or troweled into the surface.

2.03 COATINGS

A. High-Gloss Clear Coating: Transparent, nonyellowing, acrylic-polymer-based coating.
   1. Composition: Water-based.
      a. Nonvolatile Content: 25 percent, minimum, when measured by volume.

B. Low-Gloss Clear Coating: Transparent, nonyellowing, acrylic-polymer-based coating.
   1. Composition: Water-based.
      a. Nonvolatile Content: 20 percent, minimum, when measured by volume.

C. Clear Coatings: Clear coating recommended by manufacturer for finishing concrete floors and slabs.
   1. Gloss: High gloss.

D. Penetrating Sealer: Transparent, nonyellowing, water-based coating.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that floor surfaces are acceptable to receive the work of this section.

B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

3.02 GENERAL

A. Apply materials in accordance with manufacturer's instructions.

3.03 COATING APPLICATION

A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.

B. Verify that water vapor emission from concrete and relative humidity in concrete are within limits established by coating manufacturer.

C. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.

D. Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

END OF SECTION

SECTION 03 54 00
CAST UNDERLAYMENT

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 SECTION INCLUDES

A. Self-leveling floor underlayment for interior use only.
   1. Use gypsum-based type at locations indicated on Drawings.
   2. Sound Deadening Pad (SDP) for installation under the cast-in-place gypsum cement topping.

B. Remediation materials and procedures.

1.03 RELATED REQUIREMENTS

A. Section 03 53 15 - Lightweight Concrete Floor Topping Accessories: Cast-in-place flooring at corridors, balconies, breezeways, and other locations identified on the Drawings.

B. Section 06 10 00 - Rough Carpentry; Wood floor framing requirements.

C. Section 07 21 00 - Thermal Insulation: Cavity insulation.

D. Section 07 84 00 - Firestopping: Rated ceiling penetrations.

E. Section 09 21 16 - Gypsum Board Assemblies; Cavity insulation.

F. Section 09 21 16 - Gypsum Board Assemblies; Gypsum panels for ceilings and resilient channels.

G. Division 21; Fire Protection Sprinkler systems.

H. Division 23; Mechanical dampers and exhaust fans as part of the fire-rated floor/ceiling assembly.

1.04 REFERENCE STANDARDS

A. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters, and Gypsum Concrete.

B. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.

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

D. ASTM F2419 - Standard Practice for Installation of Thick Poured Gypsum Concrete Underlayments and Preparation of the Surface to Receive Resilient Flooring.

E. ASTM F2678 - Standard Practice for Preparing Panel Underlayments, Thick Poured Gypsum Concrete Underlayments, Thick Poured Lightweight Cellular Concrete Underlayments, and Concrete Subfloors with Underlayment Patching Compounds to Receive Resilient Flooring.

1.05 SUBMITTALS

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

B. Product Data: Provide manufacturer's data sheets documenting physical characteristics and product limitations of underlayment materials. Include information on surface preparation, mixing instructions, environmental limitations, storage and handling requirements, and installation instructions.
   1. Clearly mark submittals with each component for proprietary systems, including but not limited to: underlayment, SDP, insulation type and thickness, gypsum board, dampers, and resilient channels.

C. Certificate: Certify that products meet or exceed fire rating and acoustical performance requirements as indicated on drawings.

D. Manufacturer's Instructions.

E. Sample of Sound Deadening Pad, 6 inches by 6 inches.

1.06 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the work of this section, and approved by manufacturer.

B. Gypsum Underlayment is part of a fire-rated Floor/Ceiling System. Coordination with products and procedures installed by other trades is the responsibility of the Contractor, including but not limited to: underlayment, SDP, insulation type and thickness, gypsum board, lighting, sprinklers, dampers and fans, resilient channels, and insulation.

C. Gypsum Underlayment is part of an acoustically-rated Floor/Ceiling System. Products specified in other Sections for sound test compliance may exceed the minimum performance requirements outlined in the Basis of Design fire-rated Floor/Ceiling System, including but not limited to the thickness of the underlayment and the specified resilient channels.

1.07 COORDINATION

A. Coordinate gypsum underlayment with UL assemblies indicated on Drawings. Confirm selected manufacturer's proprietary products conform to UL assembly requirements.

B. Basis of Design UL Assemblies may list a lower compressive strength than the values specified herein and in other locations on Drawings. Provide and install the compressive strength specified herein, as UL Assemblies identify only a minimum required compressive strength.

C. Basis of Design UL Assemblies and or Sound Tests may list an optional or thinner Sound Deadening Pad than the values specified herein and in other locations on Drawings. Provide and install the Sound Deadening Pad thickness specified herein, as UL Assemblies identify only a minimum required pad thickness.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Keep dry and protect from direct sun exposure, freezing, and ambient temperature greater than 105 degrees F.

1.09 REGULATORY REQUIREMENTS

A. Comply with applicable code for combustibility or flame spread requirements.

1.10 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.

1.11 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Contractor shall repair and level flooring as necessary to maintain smooth surfaces and transitions for a minimum period of one year after Date of Substantial Completion. Repair finish materials as necessary.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Gypsum Underlayment. Subject to compliance with requirements, provide one of the following:
   1. Hacker Industries, Inc: www.hackerindustries.com.
      a. Product; FIRM-FILL® 2010+; Mix Design strength not less than 3000 pounds per square inch.
   2. Maxxon Corporation: www.maxxon.com.
      a. Product; Gypcrete 2000 Multifamily; Mix Design strength not less than 3000 pounds per square inch.
   3. USG Corporation: www.usg.com.
      a. Product; Levelrock; Mix Design strength not less than 3000 pounds per square inch.
   4. As indicated in Basis of Design fire test assembly indicated on Drawings.

B. Sound Deadening Pad. Gypsum Underlayment Sound Attenuation Mat: Subject to compliance with requirements, provide one of the following:
   1. Hacker Industries; Firm-Fill SCM-250.
   2. Maxxon Corporation; Acousti-Mat 1/4.
   3. USG Corporation; SAM-N25 (1/4 inches thick).
   4. As indicated in basis of design fire test assembly indicated on Drawings.

2.02 MATERIALS

A. Cast Underlayments, General:
   1. Comply with applicable code for combustibility or flame spread requirements.
   2. Provide certificate of compliance from authority having jurisdiction indicating approval of underlayment materials in the required fire rated assembly.

B. Gypsum-Based Underlayment: Gypsum based mix, that when mixed with water in accordance with manufacturer's written directions will produce self-leveling underlayment with the following properties:
   1. Compressive Strength: Tested per ASTM C472.
      a. Typical: Minimum allowable 3,000 pounds per square inch .
      b. Corridors and Common Spaces: Minimum allowable 4000 pounds per square inch.
   2. Mix Design Ratio: 1.6.
   3. Density: Maximum 115 pounds per cubic foot.
   4. Final Set Time: 1 to 2 hours, maximum.
   5. Thickness: 3/4 inch to maximum 3-1/2 inch, as indicated on Drawings.
      a. 1 inch minimum at areas to receive sound deadening pad.
   6. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0 in accordance with ASTM E84.

C. Sound Deadening Pad.
   1. Basis-of-Design: Entangled mat with non-woven filter fabric, matching UL Assembly specified on Drawings.
   2. Additional Acceptable Manufacturer’s:
      a. Obtain the sound deadening pad and perimeter isolation strip through the same manufacturer as the gypsum cement material.

D. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to underlayment mix materials.

E. Primer: Manufacturer's recommended type.

F. Joint and Crack Filler: Latex-based filler, as recommended in writing by manufacturer.

G. Perimeter isolation strip; full depth of poured gypsum fill, compatible with cast underlayment manufacturer's materials.

H. Remediation Materials:
   1. For use with Hacker Industries cast underlayment system; .
      a. SCHÖNOX® FP.
      b. SCHÖNOX® RF.
   2. Maxxon Corporation; GYP-FIX EZ.
   3. USG Corporation; USG Tuf-Skim.
   4. Any floor patch materials approved in writing by underlayment manufacturer.

2.03 MIXING

A. Site mix materials in accordance with manufacturer's written 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.

B. Verify that Sound Deadening Pad is securely placed prior to application of Gypsum Underlayment.

C. Verify that perimeter isolation strip is securely placed prior to application of Gypsum Underlayment.

3.02 PREPARATION

A. Concrete: Mechanically prepare steel troweled concrete to create a textured surface necessary to achieve the best bond; acceptable methods include bead blasting and scarifying. Do not use acid etching.

B. Remove substrate surface irregularities. Fill voids and deck joints with filler. Finish smooth.

C. Vacuum clean surfaces.

D. Prime substrate in accordance with manufacturer's written instructions. Allow to dry.

E. Close floor openings.

F. Install sound control mat in accordance with manufacturer's written instructions.

G. Transition Areas: Install bulk heads in all areas where the sound deadening pad stops and meets the carpet areas.

H. Install perimeter isolation strip.

3.03 APPLICATION OF SOUND DEADENING PAD

A. Sound Deadening Pad Installation: Install sound deadening pad following manufacturer’s written instructions.

3.04 APPLICATION OF GYPSUM UNDERLAYMENT

A. Install underlayment in accordance with manufacturer's written instructions.

B. Pump or pour material onto substrate. Do not retemper or add water.
   1. Pump, move, and screed while the material is still highly flowable.
   2. Be careful not to create cold joints.
   3. Wear spiked shoes while working in the wet material to avoid leaving marks.

C. Place to indicated thickness, with top surface level to 1/8 inch in 10 ft.

D. Place poured gypsum underlayment a minimum 1 inch thick over sound deadening pad and 1-1/4 inch over thick areas without pad, achieving one level floor surface throughout.

E. For final thickness over 1-1/2 inches, place underlayment in layers. Allow initial layer to harden to the point where the material has lost its evaporative moisture. Immediately prime and begin application of the subsequent layer within 24 hours.

F. Place after partition installation.

G. Where additional aggregate has been used in the mix, add a top layer of neat mix (without aggregate), if needed to level and smooth the surface.

H. If a fine, feathered edge is desired, steel trowel the edge after initial set, but before it is completely hard.

3.05 CURING

A. Once underlayment starts to set, prohibit foot traffic until final set has been reached.

B. Air cure in accordance with manufacturer's written instructions.

C. Provide mechanical ventilation and/or dehumidification where project conditions or natural ventilation does not meet manufacturer's written requirements.

3.06 FIELD QUALITY CONTROL

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

B. Placed Material: Agency will test for compliance with specification requirements.

C. Strength Test: Gypsum underlayment shall be tested for compressive strength in accordance with manufacturer’s written instructions.

D. Field Samples: At least one set of 3 molded cube samples shall be taken from each day's pour during the application. Cubes shall be tested as recommended in writing by the gypsum underlayment manufacturer in accordance with modified ASTM C472. Test results shall be provided to Architect and Contractor.
   1. Test daily during Work; random samples, minimum one sample set per 5,000 sq. ft. area daily or one set per day if less than 5,000 sq. ft. area.

E. Defective Topping: Repair and patch damaged or defective gypsum underlayment areas.

3.07 REMEDIATION

A. Preparation:
   1. Gypsum underlayment shall be dry; as determined by field test in accordance with ASTM F2419 and manufacturer's written requirements.
   2. Gypsum underlayment shall be sealed with manufacturer's approved underlayment in accordance with manufacturer's written instructions.

B. Patches may slope up to 1/2 inch where indicated in writing by floor patch material manufacturer.
   1. Maintain all cross slope requirements in accordance with accessibility provisions and Safe Harbors indicated on Drawings.

3.08 PROTECTION

A. Protect against direct sunlight, heat, and wind; prevent rapid drying to avoid shrinkage and cracking.

B. Do not permit traffic over unprotected floor underlayment surfaces.

END OF SECTION

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SECTION 04 05 11
MASONRY MORTARING AND GROUTING

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 SECTION INCLUDES

A. Mortar for masonry.

1.03 RELATED REQUIREMENTS

A. Section 04 20 00 - Unit Masonry: Installation of mortar and grout.

B. ASTM C91/C91M - Standard Specification for Masonry Cement.

C. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.

D. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.

E. ASTM C270 - Standard Specification for Mortar for Unit Masonry.

F. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.

G. ASTM C476 - Standard Specification for Grout for Masonry.

H. ASTM C780 - Standard Test Methods for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.

I. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete.

J. ASTM C1019 - Standard Test Method for Sampling and Testing Grout for Masonry.

K. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry.

L. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.

1.04 SUBMITTALS

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

B. Product Data: Include design mix and indicate whether the Proportion or Property specification of ASTM C270 is to be used. Also include required environmental conditions and admixture limitations.

C. Reports: Submit reports on mortar indicating compliance of mortar to property requirements of ASTM C270 and test and evaluation reports per ASTM C780.

D. Reports: Submit reports on grout indicating compliance of component grout materials to requirements of ASTM C476 and test and evaluation reports to requirements of ASTM C1019.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Manufacturer's Installation Instructions: Submit packaged dry mortar manufacturer's installation instructions.

1.05 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.07 FIELD CONDITIONS

A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.

B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

PART 2 PRODUCTS

2.01 MORTAR AND GROUT APPLICATIONS

A. Mortar Mix Designs: ASTM C270, Property Specification.
   1. Masonry below grade and in contact with earth: Type S.
   2. Exterior, Non-loadbearing Masonry: Type N.
   3. Interior, Loadbearing Masonry: Type N.
   4. Interior, Non-loadbearing Masonry: Type O.

B. Grout Mix Designs:
   1. Bond Beams and Lintels: 3,000 psi strength at 28 days; 8-10 inches slump; provide premixed type in accordance with ASTM C 94/C 94M.
      a. Fine grout for spaces with smallest horizontal dimension of 2 inches or less.
      b. Coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

2.02 MATERIALS

A. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
   1. Type: Type S.
   2. Color: Standard gray.

B. Packaged Dry Material for Grout for Masonry: Premixed cementitious materials and dried aggregates; capable of producing grout of the specified strength in accordance with ASTM C476 with the addition of water only.
   1. Type: Fine.

C. Portland Cement: ASTM C150/C150M.
   1. Type: Type I - Normal; ASTM C150/C150M.
   2. Color: Standard gray.

D. Masonry Cement: ASTM C91/C91M, non-staining, 22% maximum air content by volume, and proportioned to comply with requirements of ASTM C270.
   1. Type: Type N; ASTM C91/C91M.

E. Mortar Aggregate: ASTM C144.

F. Grout Aggregate: ASTM C404.

G. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
   1. Color(s): As selected by Architect from manufacturer's full range.

H. Water: Clean and potable.

I. Accelerating Admixture: Nonchloride type for use in cold weather.

2.03 MORTAR MIXING

A. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.

B. Maintain sand uniformly damp immediately before the mixing process.

C. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio; mix in accordance with manufacturer's instructions, uniform in coloration.

D. Add admixtures in accordance with manufacturer's instructions; mix uniformly.

E. Do not use anti-freeze compounds to lower the freezing point of mortar.

F. If water is lost by evaporation, re-temper only within two hours of mixing.

2.04 GROUT MIXING

A. Mix grout in accordance with ASTM C94/C94M.

B. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine and coarse grout.

C. Add admixtures in accordance with manufacturer's instructions; mix uniformly.

D. Do not use anti-freeze compounds to lower the freezing point of grout.

PART 3 EXECUTION

3.01 INSTALLATION

A. Do not install grout in lifts greater than 16 inches without consolidating grout by rodding.

3.02 GROUTING

A. Use either high-lift or low-lift grouting techniques, at Contractor's option, subject to other limitations of Contract Documents.

B. Low-Lift Grouting:
   1. Limit height of pours to 12 inches.
   2. Limit height of masonry to 16 inches above each pour.
   3. Pour grout only after vertical reinforcing is in place; place horizontal reinforcing as grout is poured. Prevent displacement of bars as grout is poured.
   4. Place grout for each pour continuously and consolidate immediately; do not interrupt pours for more than 1-1/2 hours.

C. High-Lift Grouting:
   1. Verify that horizontal and vertical reinforcement is in proper position and adequately secured before beginning pours.
   2. Place grout for spanning elements in single, continuous pour.

END OF SECTION

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SECTION 04 05 23
MASONRY ACCESSORIES

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 SECTION INCLUDES

A. Reinforcement and Anchorage.

B. Accessories.

1.03 RELATED REQUIREMENTS

A. Section 04 05 11 - Masonry Mortaring and Grouting.

B. Section 04 20 00 - Unit Masonry.

C. Section 04 26 13 - Masonry Veneer; Flashings embedded in masonry and installation of accessories.

D. Section 05 50 00 - Metal Fabrications: Loose steel lintels.

E. Section 06 10 00 - Rough Carpentry: Wood stud backup for masonry veneer.

F. Section 07 25 00 - Weather Barriers.

G. Section 09 21 16 - Gypsum Board Assemblies: Exterior sheathing.

1.04 REFERENCE STANDARDS

A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; American Concrete Institute International; 2011.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

D. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.06 SUBMITTALS

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

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, and mortar.

C. Samples: Submit four samples of facing brick units to illustrate color, texture, and extremes of color range.

D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.07 QUALITY ASSURANCE

A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

B. Handle and store masonry units in protective cartons or trays. Do not remove from protective packaging until ready for installation.

1.09 FIELD CONDITIONS

A. Cold and Hot Weather Requirements: Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 REINFORCEMENT AND ANCHORAGE

A. Manufacturers of Joint Reinforcement and Anchors:
   1. AA Wire Products Company.
   2. Blok-Lok Limited: www.blok-lok.com.
   3. Heckmann Building Products, Inc.
   4. Hohmann & Barnard, Inc (including Dur-O-Wal brand): www.h-b.com.
   5. Masonry Reinforcing Corp. of America.
   6. National Wire Products Corp.
   7. WIRE-BOND: www.wirebond.com.
   8. Substitutions: See Section 01 60 00 - Product Requirements.

B. Reinforcing Steel: ASTM A615/A615M, grade 60 (420) yield grade, deformed billet bars; galvanized.

C. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

D. Joint Reinforcement: Truss type; ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M, Class B; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.

E. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
   1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
   2. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.
   3. Vertical adjustment: Not less than 3-1/2 inches.

2.02 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
   1. Manufacturers:
      a. Blok-Lok Limited: www.blok-lok.com.
      b. Hohmann & Barnard, Inc (including Dur-O-Wal brand): www.h-b.com.
      c. WIRE-BOND: www.wirebond.com.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

B. Weep Vents and Cavity Vents: High density polyethylene and impervious to water and resistant to UV degradation.
   1. Manufacturers:
      a. Hohmann & Barnard, Inc; Product QV - Quadro-Vent: www.h-b.com.
      b. Mortar Net Solutions; Mortar Net CellVent: www.mortarnet.com.
      c. WIRE-BOND; Product #3601 Cell Vent: www.wirebond.com.
      d. Heckmann Building Products, Inc.; Product #85: Cell Vent. Available in Clear, Gray, and Brown only.
      e. Substitutions: See Section 01 60 00 - Product Requirements.

C. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
   1. Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations.
      a. Manufacturers:
         1) Advanced Building Products Inc; Mortar Break DT: www.advancedflashing.com.
         2) Advanced Building Products Inc; Mortar Break: www.advancedflashing.com.
         3) Mortar Net Solutions; Mortar Net with Insect Barrier: www.mortarnet.com.
         4) Blok-Lok Limited; Product Mortar-Mitt : www.blok-lok.com.
         5) Hohmann & Barnard, Inc; Product Mortar Trap: www.h-b.com.

6) Substitutions: See Section 01 60 00 - Product Requirements.

D. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials; as recommended in accordance with brick manufacturer requirements and recommendations.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 INSTALLATION

A. General: Install accessories in accord with manufacturer's product data and written instructions.

B. Install accessories, including but not limited to: weeps, cavity vents, cavity mortar control, reinforcement, and anchorage in accordance with Section 04 26 13 - Masonry Veneer.

3.03 WEEPS/CAVITY VENTS

A. Install weeps in veneer walls at 24 inches on center horizontally above through-wall flashing, above shelf angles and lintels, and at bottom of walls.

B. Install cavity vents in veneer walls at 32 inches on center horizontally below shelf angles and lintels and at top of walls.

3.04 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended in writing by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

END OF SECTION

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SECTION 04 20 00
UNIT MASONRY

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 SECTION INCLUDES

A. Non-Pigmented masonry units at utilitarian locations.

B. Integrally pigmented decorative concrete masonry units.

C. Mortar and grout.

D. Reinforcement and anchorage.

E. Flashings.

1.03 RELATED REQUIREMENTS

A. Section 04 05 11 - Masonry Mortaring and Grouting.

B. Section 04 05 23 - Masonry Accessories: Including but not limited to weeps, cavity control, and other accessories.

1.04 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

C. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement.

D. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

E. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units.

F. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units.

G. ASTM C150/C150M - Standard Specification for Portland Cement.

H. ASTM C270 - Standard Specification for Mortar for Unit Masonry.

I. ASTM C476 - Standard Specification for Grout for Masonry.

J. ASTM C744 - Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units.

K. ASTM C780 - Standard Test Methods for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.

L. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete.

M. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry.

N. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing.

O. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls.

P. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls.

Q. BIA Technical Notes No. 46 - Maintenance of Brick Masonry.

R. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.

S. UL (FRD) - Fire Resistance Directory.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

1.06 SUBMITTALS

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

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.

C. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

D. Manufacturer's Certificate: Certify that water-repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.

1.07 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

B. Fire Rated Assemblies: Comply with applicable code for UL (FRD) Assembly No. indicated on Drawings.

C. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum five years of documented experience.

1.08 MOCK-UPS

A. Provide materials described in this Section for use in Mockups and coordinate with Section 01 43 39 - Mock-Ups.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent damage and contamination by other materials.

B. Handle and store Integrally Pigmented Loadbearing Units in protective cartons or trays. Do not remove from protective packaging until ready for installation.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Integrally Pigmented Concrete Block: Comply with referenced standards and as follows:
   1. Stretcher unit dimensions: Nominal 4 inch high and nominal 16 inch long.
   2. Special Shapes: Provide non-standard blocks configured for corners, caps, and other detailed conditions.
      a. Provide bullnose or square edge units for outside corners, as indicated on Landscape Drawings.
   3. Load-Bearing Units: ASTM C90, normal weight.
      a. Unit Design: Modular two core units sized as indicated and scheduled. Provide special units for bond beams, control and expansion joints, and lintels.
         1) Provide units as required for indicated construction including sill units and solid cap units.
         2) Provide units with exposed faces, uniform in appearance.
   4. Nonloadbearing Units: ASTM C129.
      a. Hollow block.
   5. Pre-Faced Units: ASTM C90, hollow block, with smooth, resinous facing complying with ASTM C744.
      a. Colors and styles: As indicated on drawings.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample, matching units.
   1. As manufactured by Coosa
   2. Not more than 0.60 percent alkali.

B. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
   1. Locations: Decorative masonry walls in landscape areas at amenity above podium.

2. Color(s): As selected by Architect from manufacturer's full range.
3. Manufacturers:
    a. Argos: Color as selected from manufacturer's full range.
    b. Coosa: Color as selected from manufacturer's full range.
    c. Substitutions: See Section 01 60 00 - Product Requirements.

C. Water: Clean and potable.

D. Packaged Dry Material for Mortar for Unit Masonry: Premixed masonry cement and mason sand; complying with ASTM C1714/C1714M and capable of producing mortar of specified strength in accordance with ASTM C270 with addition of water only.
1. Locations: Masonry walls in utility areas.
2. Type: Type S.
3. Color: Standard gray.

2.03 REINFORCEMENT AND ANCHORAGE

A. Single Wythe Joint Reinforcement: ASTM A951/A951M.
1. Type: Truss or ladder.
2. Material: ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to 16 CFR 1201 Class B2.
3. Minimum wire size W1.7 (9 gage) and maximum wire size W2.8 (3/16 inch wire)
4. Width 1 1/2 to 2 inches less than wall thickness.

2.04 FLASHINGS

A. Stainless Steel/Polymer Fabric Flashing: ASTM A240/A240M; 2 mil type 304 stainless steel sheet bonded on one side to one sheet of polymer fabric.
1. Manufacturers:
    a. Hohmann & Barnard, Inc; Mighty-Flash Stainless Flashing: www.h-b.com.
    b. York Manufacturing, Inc; Multi-Flash SS: www.yorkmfg.com.
    c. Substitutions: See Section 01 60 00 - Product Requirements.

B. Stainless Steel/Polymer Fabric Drainage Plane Flashing: ASTM A240/A240M; 2 mil type 304 stainless steel sheet bonded between one sheet of polymer fabric and one sheet of non-woven drainage material.
1. Manufacturers:
    a. STS Coatings, Inc: www.stscoatings.com.
    b. York Manufacturing, Inc; Flash-Vent SS: www.yorkmfg.com.

C. Stainless Steel/Polymer Fabric Drainage Plane Flashing - Self-Adhering: ASTM A240/A240M; 2 mil type 304 stainless steel sheet with co-polymer butyl adhesive and a removable release liner on one side and a sheet of nonwoven drainage material bonded to the other side.
1. Manufacturers:
    a. York Manufacturing, Inc; Flash-Vent SA: www.yorkmfg.com.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

D. Factory-Fabricated Flashing Corners and End Dams: Stainless steel.
1. Manufacturers:
    a. Hohmann & Barnard, Inc: www.h-b.com.
    b. York Manufacturing, Inc; Stainless Steel Inside/Outside Corners and End Dams : www.yorkmfg.com.
    c. Substitutions: See Section 01 60 00 - Product Requirements.

E. Termination Bars: Stainless steel; compatible with membrane and adhesives.

2.05 LINTELS

A. Precast Concrete Lintels as indicated on Structural Drawings.
1. Compressive strength and size as required to meet structural loads as indicated on Structural Drawings
2. Mix design shall use white Portlandcement to color match unit. Color: GMS Snow White

2.06 MORTAR AND GROUT MIXING

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.

B. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

C. Establish Lines, Levels, and Coursing: Protect lines from disturbance and use non-corrosive materials in contact with masonry.

D. Surface Preparation: Prior to placing Quik-Brik® remove laitance, loose aggregate or other materials that would prevent mortar from bonding to the foundation.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.04 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of equal and uniform thickness.

C. Concrete Masonry Units:
   1. Bond: 1/2 running bond unless otherwise indicated on Drawings.
   2. Coursing: One unit and one mortar joint to equal 4 inches.
   3. Mortar Joints: Concave above grade and flush below grade.
      a. Provide flush joints at other locations as required by finish, including but not limited to sheet waterproofing, fluid applied WRB, stucco, and as indicated on Drawings.

3.05 PLACING AND BONDING

A. Joint Thickness: Construct 3/8-inch bed and head joints unless otherwise indicated. Construct bed joint at starting course on foundation not less than 1/4 inch and not more than 3/4 inch.

B. Remove masonry protrusions extending 1/2 inch or more into cells or cavities to be grouted.

C. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work. Fill holes not specified in exposed and below grade masonry with mortar.
   1. Webs are fully mortared in all courses of piers, columns, pilasters, starting course on footings or foundations, and where adjacent to cells or cavities to be reinforced or filled with concrete or grout.
   2. Spread out full mortar bed, including areas under cells, for starting course on footings where cells are not to be grouted.
   3. Vertical cells to be grouted are aligned and unobstructed openings for grout are provided in accordance with drawings.

D. Lay hollow masonry units with entire surfaces of face shell bedding on head and bed joints.

E. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

F. Remove excess mortar and mortar smears as work progresses. Dry brush exposed masonry prior to the end of each work day.

G. Protect wall from mud splatter and mortar droppings.
   1. Set scaffolds and scaffold boards so that mortar is not deflected onto masonry.

2. At end of each work day turn scaffold boards so that rainwater is not deflected onto masonry.
3. Place Quik-Brik® such that mortar does not run down the face of the wall or smear the masonry face.

H. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.

I. Interlock intersections and external corners, except for units laid in stack bond.

J. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove unit and mortar and replace.

K. After joints are tooled, cut off mortar tailings with trowel and dry brush excess mortar burrs and dust from the face of the masonry.

L. Fully bond external and internal corners and properly anchor intersecting walls.

M. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

N. Termination of Wall Height: For fire-rated walls, construct walls to finish against bottom of roof or floor deck and fill voids with firestopping.

O. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.

P. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.06 WEEPS/CAVITY VENTS

A. Install weeps in veneer and cavity walls at 24 inches on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.

B. Install cavity vents in veneer and cavity walls at 32 inches on center horizontally below shelf angles and lintels and near top of walls.

3.07 REINFORCEMENT AND ANCHORAGES

A. Basic Requirements:
1. Place reinforcement and anchorages in accordance with the sizes, types, and locations indicated on the drawings, and as specified.
2. DO NOT Place dissimilar metals in contact with each other.

B. Details of Reinforcement:
1. Completely embed reinforcement in grout in accordance with Article 3.08.
2. Maintain clear distance between reinforcing bars and any face of masonry unit or formed surface:
   a. Not less than 1/4 inch for fine grout.
   b. Not less than 1/2 inch for coarse grout.
3. Splice only where indicated on Drawings, unless otherwise specified.
4. DO NOT bend reinforcing bars after embedded in grout.
5. Place vertical reinforcing bars supported and secured against displacement by means of bar positioners.
6. Support bars other than vertical bars and tie to prevent displacement.
7. Placement tolerances:
   a. Tolerances for the placement of reinforcing bars:
      1) 1/2 inch when the distance from the centerline of the reinforcing bar to the opposite outside face of the masonry is 8 inches or less.
      2) 1 inch when the distance from the centerline of the reinforcing bar to the opposite outside face of the masonry is 24 inches or less but more than 8 inches.
      3) 1 1/4 inch when the distance from the centerline of the reinforcing bar to the opposite outside face of the masonry is more than 24 inches.
   b. Place vertical reinforcing bars within 2 inches of required location along the length of the wall.

c. If it is necessary to move bars more than one bar diameter or a distance exceeding the tolerances provided in Section 3.06.C.7.a. to avoid interference with other reinforcing bars, conduit, or embedded items, notify the Architect/Owner's Representative for the acceptance of the resulting arrangement of bars.

C. Joint Reinforcement:
   1. Placement:
      a. Install joint reinforcement at 16 inches on center vertically, except space at 8 inches on center in parapet walls and below finished floor unless otherwise indicated on Drawings.
      b. Place joint reinforcement continuous in first bed joints below top of masonry wall and bed joint 8 inches below first bed joint below top of wall.
      c. Place joint reinforcement so that longitudinal wire are embedded in mortar:
         1) Minimum cover of 1/2 inch when not exposed to weather.
         2) Minimum cover of 5/8 inch when exposed to weather or earth.
      d. Lap joint reinforcement ends minimum 6 inches.
      e. Do not extend joint reinforcement through control joints.

D. Wall Ties:
   1. Embed ends of wall ties in mortar joints at least 1/2 inch into outer face shell of hollow masonry construction.
   2. Unless otherwise required, install adjustable wall ties in accordance with the following:
      a. One tie for each 1.77 sq. ft. of wall area.
      b. DO NOT exceed 16 in. on center horizontally or vertically.
   3. Install wire ties perpendicular to a vertical line on the face of the wythe from which they protrude.
   4. Unless otherwise provided, install additional unit ties around all openings larger than 16 inches in either dimension. Space ties around the opening at a maximum of 3 feet on center and place ties within 12 inches of the opening.

3.08 BUILT-IN AND EMBEDDED ITEMS AND ACCESSORIES

A. A. Incorporation: As work progresses build in metal door frames, fabricated metal frames, window frames, anchor bolts, diaphragm anchors, embedded plates, and other items in the work supplied in other Sections.

B. Metal Door and Glazed Frames:
   1. Embed anchors in mortar joints.
   2. Fill frame void solid with grout.
   3. Fill masonry cores with grout minimum 12 inches from framed openings.

C. Chases: Construct chases as masonry units are laid.

D. Pipes and Conduits: When required, place pipes and conduits passing horizontally through masonry beams or walls in steel sleeves or cored holes.
   1. Place pipes and conduits passing horizontally through non-load-bearing partitions piers, pilasters, or columns.
   2. When required, place horizontal pipes and conduits in and parallel to the plane of the masonry wall.

E. Accessories: Install and secure connectors, flashing, weep holes, nailing blocks, reglets and other accessories.
   1. Install reglet level and parallel to building lines. Set reglet as indicated on Drawings to coordinate with sloped roof surface.

F. Organic Materials: Do not build in organic materials subject to deterioration.

3.09 BRACING

A. Design and Installation: Design, provide and install bracing for walls, lintels, and other masonry work that will assure stability of masonry during construction.

B. Duration: Maintain bracing in place until roof or other structural elements are complete and provide permanent support.

3.10 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.

B. Terminate flashing up 8 inches minimum on vertical surface of backing:

C. Install flashing in accordance with manufacturer's written instructions and project Drawing details.

D. Extend metal flashings to within 1/2 inch of exterior face of masonry and adhere to top of stainless steel angled drip with hemmed edge.

E. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

3.11 MASONRY FILL INSULATION

A. Install insulation in masonry unit cells of exterior walls.

B. Granular Fill Insulation:
   1. Verify that holes and openings have been sealed to prevent escape of insulation.
   2. Place masonry fill insulation in accordance with manufacturer’s instructions.
   3. Ensure spaces are free of mortar to allow free flow of insulation.
   4. Place as masonry is erected, completely filling spaces. Place in lifts and rod to eliminate air pockets. Place prior to covering cores with bond beams or lintels.
   5. Place temporary signs on face of insulated walls warning workers to use caution to prevent loss of insulation if cutting into walls.

C. Foamed-In-place Insulation:
   1. Confirm that selected foam insulation material is compatible and non-detrimental to referenced fire resistance assemblies before use.
   2. Installer shall be certified and/or approved by manufacturer of insulation. Install foam insulation in strict accordance with manufacturer’s published instructions.
   3. Pump foam insulation bored into mortar joints around entire wall area 3 feet from floor level. Repeat at height no greater than 10 feet until completion of wall area.
   4. Plug holes with mortar after completion.

D. Blown-In Expanded Polystyrene Bead Insulation:
   1. Verify that holes and openings have been sealed to prevent escape of insulation.
   2. Installer shall be certified or approved by manufacturer of insulation.
   3. Install expanded polystyrene beads in accordance with manufacturer’s published instructions.
   4. Blow-in expanded polystyrene beads from top of wall prior to installation of bond beams.

3.12 LINTELS

A. Install precast concrete lintels over openings as scheduled.

B. Maintain minimum 8 inch bearing on each side of opening, unless otherwise indicated or allowed on Drawings. Use reinforcing bars of one-piece lengths only. Place and consolidate grout without disturbing reinforcing.

C. Allow lintels to reach strength before removing temporary supports.

3.13 GROUTED COMPONENTS

A. Provide reinforcing and grouting in accordance with notes on Structural Drawings.

B. Place grout within 1 1/2 hours of introducing mixing water and prior to initial set.

C. Prevent grout from flowing onto or otherwise staining faces of CMU intended to be exposed.

D. Grout Pour Height: Use fine or coarse grout in accordance with requirements on Drawings.

E. Grout Lift Height: Place grout in lifts not to exceed 5 feet.

F. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

G. Place and consolidate grout fill without displacing reinforcing.
   1. Consolidate grout pours 12 inches or less in height by mechanical vibration or puddling.

2. Consolidate grout pours exceeding 12 inches in height by mechanical vibration and consolidate by mechanical vibration after initial water loss and settlement has occurred.

3.14 TOLERANCES

A. Install masonry within the site tolerances found in TMS 402/602.

B. Maximum Variation from Alignment of Columns and Walls: 1/2 inch at bearing and 3/4 inch at non-bearing.

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

E. Maximum Variation from Level Coursing: 1/4 inch in 10 ft; 1/2 inch in 30 ft.

F. Maximum Variation of Mortar Joint Thickness: Bed joint, minus 1/8 inch, plus 1/8 inch.

G. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

H. Maximum Variation of Mortar Joint Thickness: Collar joint, minus 1/4 inch, plus 3/8 inch.

3.15 CUTTING AND FITTING

A. Cut and fit for chases, pipes, conduit, sleeves, grounds, and bearing plates. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

C. Cutting Method: Perform jobsite cutting with proper tools to provide straight un-chipped edges and take care to prevent breaking masonry unit corners or edges.

3.16 FIELD QUALITY CONTROL

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

B. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

3.17 CLEANING

A. Remove excess mortar and mortar droppings as Work progresses. Dry brush to remove mortar fins and smears before tooling joints.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

E. Final Cleaning:

1. After mortar has set, reached initial curing; within 7 days of completion of work for custom masonry units, clean exposed masonry as follows:
    a. Remove large mortar particles by hand with wooden paddles and non-metallic scrape hoes or chisels.
    b. Cut out any defective mortar joints and holes and re-point with mortar.
    c. Protect non-masonry surfaces from contact with cleaning solution by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
2. Clean Quik-Brik® with proprietary masonry cleaner.
    a. Materials:
        1) Light Duty Concrete Cleaner, by Prosoco, Kansas City, Missouri (800) 255-4255, diluted one part cleaning solution to at least three parts water.
        2) NMD 80, by EaCo Chem Inc, New Castle, Pennsylvania (800) 313-8505, diluted one part cleaning solution to four parts water.
    b. Thoroughly wet surface of masonry.
    c. Scrub using non-metallic brushes
    d. Immediately rinse with water.
    e. Do small sections at a time.
    f. Work from top to bottom.

3. Do not use high pressure cleaning methods.
    a. Do not exceed nozzle pressure of 500 psi.
    b. Use water flow of at least 4 gallons per minute.
    c. Use at least 40º fan nozzle.
    d. Keep nozzle at least 18-inches from face of Quik-Brik®.
4. Cleaned surfaces shall appear as represented by mockup wall panel.

3.18 SEALING

A. Seal Quik-Brik® with proprietary masonry cleaner recommended in writing by manufacturer.

3.19 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

B. Base of Walls: Protect the base of walls from rain-splashed mud and mortar droppings.

C. Environmental: At end of day, cover completed masonry to prevent moisture infiltration. Use the following provisions unless otherwise required for environmental conditions specified elsewhere in this Section.

D. Load Application:
1. Do not apply uniform floor or roof loading for at least 12 hours after building masonry columns or walls.
2. Do not apply concentrated loads for at least three days after building masonry columns or walls

END OF SECTION

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SECTION 04 24 00
AUTOCLAVED AERATED CONCRETE PANELS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

A. Fabrication, transportation, and erection of Autoclaved Aerated Concrete (AAC) units.

1.03 RELATED REQUIREMENTS

A. Section 01 40 00 - Quality Requirements: Procedures for testing, inspection, mock-ups, reports, certificates; use of reference standards.

B. Section 01 60 00 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.

C. Section 01 78 00 - Closeout Submittals: Project record documents, operation and maintenance (O&M) data, warranties and bonds.

1.04 DEFINITIONS

A. AAC unit: Autoclaved Aerated Concrete Unit.

B. Bed joint: Horizontal mortar joint between two AAC units.

C. Head joint: Vertical joint between two AAC units.

D. Jumbo block: Nominally square face size AAC unit, 40” (1000 mm) in length by 24” (610 mm) in height.

E. Standard block: Nominally rectangular face AAC unit 24” (610 mm) in length by 8” (200 mm) in height.

F. Strength Class: AAC-2 and AAC-4.

1.05 REFERENCE STANDARDS

A. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

B. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete.

C. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.

D. ASTM C270 - Standard Specification for Mortar for Unit Masonry.

E. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.

F. ASTM C476 - Standard Specification for Grout for Masonry.

G. ASTM C1694 - Standard Specification for Reinforced Autoclaved Aerated Concrete (AAC) Elements.

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

I. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

J. UL (DIR) - Online Certifications Directory.

1.06 SUBMITTALS

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

B. Product Data: Provide product data showing compliance with the specified requirements.

C. Certificate: Certify that products of this section from the AAC manufacturer indicating AAC product is manufactured in accordance with UL (DIR) design indicatd on Drawings.

D. Evaluation Service Reports: Show compliance with specified requirements.

1.07 QUALITY ASSURANCE

A. Source Limitations: For each type of material required to complete the work of this Section, provide products from a single manufacturer.

B. Furnish AAC units from single manufacturer.

C. Installer qualifications:
   1. Completion of AAC training session.
   2. Not less than five years experience in similar construction.

1.08 COORDINATION

A. Coordinate the Work of this Section with other interfacing work in direct contact with the products listed herein. Consult with manufacturer for compatibility of materials specified in other sections that will be in contact with the products listed in this Section.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Storage and protection:
   1. Offload AAC units with pallets resting on ground. Placing AAC units in direct contact with earth is prohibited.
   2. Protect AAC units from oil and chemical staining.

1.10 FIELD CONDITIONS

A. Cold and hot weather installation practices:
   1. Cold weather precautions for AAC masonry work:
      a. When temperature of AAC units is below 20°F, do not install.
      b. Remove visible ice on AAC units prior to installation. Use of de-icing chemicals on AAC is prohibited.
      c. Heat mortar sand or mixing water to produce mortar temperatures between 40°F and 120°F at time of mixing. Maintain mortar temperature above freezing until placed.
      d. Ambient temperature requirements:
         1) Between 25°F and 20°F: Use heat sources on both sides of AAC walls under construction. Install wind breaks when wind velocity is in excess of 15 mph.
         2) Below 20°F: Provide enclosure for AAC walls under construction. Use heat sources to maintain temperatures above 32°F within enclosures.
      e. Daily mean temperature requirements:
         1) Between 40°F and 32°F: Protect completed AAC walls from rain or snow by covering with weather resistive membrane for a minimum of 24 hours after construction.
         2) Between 32°F and 25°F: Completely cover completed AAC walls with weather resistive membrane for a minimum of 24 hours after construction.
         3) Between 25°F and 20°F: Completely cover completed AAC walls with insulating blankets or equal protection for a minimum of 24 hours after construction.
         4) Below 20°F: Maintain AAC wall construction above 32°F for 24 hours after completion by enclosure with supplementary heat, electric heating blankets, infrared heat lamps, or other acceptable methods outlined to Architect.
   2. Hot weather precautions for AAC masonry work:
      a. When erected in ambient air temperature of 100°F or ambient air temperature of 90°F with wind velocity in excess of 8 mph, implement the following:
         1) Protect AAC wall construction from direct exposure to wind and sun.
         2) Spreading mortar beds more than 4’-0” ahead of AAC units is prohibited.
         3) Setting AAC unit more than one minute after spreading mortar is prohibited.

1.11 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.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

A. Manufacturers:
   1. Products of manufacturers similar in type, quality, structural performance, and fire performance are acceptable, subject to compliance with specified requirements and submission of required data indicated in Product Substitution Procedures.

a. Coordinate with Authority Having Jurisdiction where products used vary from UL assembly listed on Drawings.

B. AAC units:
1. Composition: Autoclaved aerated concrete mixture consisting of quartz, sand, lime, cement, proprietary additives, and water.
2. Nominal dimensions:
a. Wall Panels:
1) 24 inches wide.
2) Thickness as indicated on Drawings for "field" wall panel and at doors/openings.
3) Coordinate length with field limitations and construction tolerances for horizontal or vertical orientation. Maximum length 10'-0" unless otherwise indicated in UL Assembly.
3. Manufactured in accordance with ASTM C1694.

C. Fire ratings: In accordance with Underwriters Laboratories assemblies listed on Drawings and ASTM E119.

2.02 ACCESSORIES

A. Mortar materials:
1. AAC unit head joint and bed joint mortar; Thin Bed Mortar matching AAC unit manufacturer.
2. Leveling bed mortar: ASTM C270, Type “M”.
3. Aggregate:
a. Leveling bed mortar: ASTM C404, clean, hard, natural, wash hed sand in accordance with ASTM C144.
b. Masonry grout:
1) Fine aggregate: ASTM C404, Size No. 1.
2) Coarse aggregate: ASTM C404, Size No. 89.
4. Water: Clean, potable, free from deleterious amounts of alkali’s, acids, and organic materials.

B. Bond beam reinforcement: ASTM A615/A615M, Grade 60 deformed type for #3 and larger bars; actual sizes indicated on Drawings.

C. Backer rods and sealants: Specified in Joint Sealants Section.

D. Flexible flashing: Specified in Flexible Flashing Section.

E. Fire-rated insulation for penetrations of rated walls: Specified in Firestopping Section.

F. Fasteners and Anchors: Compatible with AAC materials.
1. Attachment Clips: Aluminum angles 0.048 in. - 0.060 in. thick and 2 inches wide with one 2-inch leg and one 2- 1/2 inch leg.

2.03 MIXES

A. Mortar proportions:
1. ACC unit head joint and bed joint mortar: Mix in accordance with manufacturer’s mixing instructions.
2. Proportion materials by volume in accordance with ASTM C270 for leveling course only. Use Hebel thin-bed mortar for head and bed joints and other joints in AAC work.

B. Grout proportions:
1. Fine and Coarse Grout: Proportion materials by volume in accordance with ASTM C476.
2. Slump: 8” to 11” measured in accordance with ASTM C143/C143M.

2.04 FABRICATION

A. Shop assembly:
1. Fabricate reinforced AAC panels in accordance with approved shop drawings

PART 3 EXECUTION

3.01 SEQUENCING AND SCHEDULING

A. Loading AAC unit walls or columns is prohibited prior to the following:

1. Uniform floor or roof loads: 12 hours, minimum.
2. Concentrated loads: Three days, minimum.

B. Construction activities coordination specified in other Sections for work built into walls:
1. Work required under this Section includes chase and routing coordination with construction activities specified in other Sections.
2. As walls are completed, coordinate with work required in other Sections for chases or routing areas required in AAC walls for electrical, plumbing, and other items.
3. Request relevant construction activities to mark actual routing or chase locations; include required depth.
4. Filling in chases and routed areas specified in other Sections.

3.02 PREPARATION

A. Protection:
1. Keep walls dry during erection by covering at end of each work period with non-staining waterproof membrane covering.
2. Protect partially completed walls not being worked on with non-staining waterproof membrane until construction activities specified in other sections completes protection of walls.
3. Covering: Overhang at least 2'-0" on each side of wall; anchor on each side of wall.
4. Protect finished exposed work from stains.
5. Take particular care to keep AAC units clean.
6. Brace walls during construction to protect from wind damage.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Workmanship:
1. Lay AAC units plumb, level, and true to line for range.
2. Lay units in running bond with 4 inch minimum head joints lap in alternate courses.
3. Cut AAC units with unit manufacturer recommended hand type saw or electric bandsaw specially designed for cutting AAC units. Lay out units to minimize cutting. Proper dust protection is recommended when cutting AAC.

C. Building in other work:
1. Install work of other sections required to be incorporated with AAC units as work progresses; include anchors, and accessories. Space and align built-in parts; exercise care not to disturb other materials from position.
2. Coordinate with SEQUENCING AND SCHEDULING Article for required routing and chases.
3. Fill in interior spaces around built-in items with fine grout or interior plaster.
4. Fill in exterior spaces around built-in items with fine grout or stucco.
5. Fill hollow metal frames in AAC unit walls with fine grout as wall is laid. Rake back ½" joint between hollow metal frame and adjacent AAC unit to receive sealant at butt type frames.

D. Mortar joints:
1. Head and bed joints:
   a. Lay first course in full bed of leveling bed mortar in thickness necessary to level AAC unit top; not less than 1/2 inch.
   b. Apply AAC unit head joint and bed joint mortar on full face of AAC unit already laid.
2. Make adjustment while mortar is still soft and plastic by tapping to plumb and bringing to alignment.
3. Check each AAC unit as laid with mason's level for level and plumb with wall below.
4. Remove and replace mortar with fresh mortar, where adjustment must be made after mortar has started to set.
5. Keep bed and head joints uniform in width.
6. Standard thickness for both horizontal and vertical mortar joints:
   a. Base course bed joint: 1/2 inch, nominal, +/- 1/4 inch
   b. Other vertical coursing and head joints: 1/16 inch, nominal.

7. Take particular care to avoid spreading mortar on exposed face of AAC unit. Only normal mortar droppings will be accepted on face of AAC unit; remove only after mortar has dried enough not to smear.

E. Grout Filled Cells
   1. Provide a clean-out opening at the base of the AAC wall at each vertical reinforcing bar locations.
   2. Remove debris through-out from core area prior to placement of concrete grout.
   3. Pre-wet the core cells with clean water prior to placement of concrete grout.
   4. Fill core cell with concrete grout using appropriate lift procedures to avoid wall blow-outs.
   5. Consolidate the grout filled core with a needle vibratory device.

F. Flexible flashing:
   1. Clean AAC unit surfaces smooth; maintain free from projections capable of puncturing flashing material.
   2. Follow requirements indicated in Flexible Flashing Section.

G. Joint treatment: Remove excess extruded mortar immediately after laying AAC unit; tooling joints is not required.

H. Control joints:
   1. Make joint ½" wide, unless indicated otherwise, rake out control joints to depth of 3/4 inch while mortar is still plastic.
   2. Provide joints at 15'-0" O.C. unless otherwise indicated.
   3. Follow recommendations of finish manufacturer for proper treatment at control joints when finish is applied directly to AAC surface.
   4. Chases routed on wall surface are considered to act as a control joint.
   5. Leave joint open and clean for caulking in accord with Joint Sealants Section.

3.04 TOLERANCES

A. Tolerances:
   1. Maximum variation from plumb: 1/4 inch in 10'-0"; not to exceed 3/8" in 20'-0".
   2. Maximum variation from level: 1/4 inch in 20'-0", not to exceed ½" in 49'-0" or more.
   3. Maximum variation in linear building line from location indicated: 1/4 inch" in 20'-0".

3.05 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

3.06 CLEANING AND PATCHING

A. Keep AAC unit work free of mortar droppings as work progresses and, at completion of work, rub AAC unit to remove excess mortar

B. Patch AAC units with excessive spalls or chips.

3.07 PROTECTION

A. Protect installed AAC units from subsequent construction operations.

END OF SECTION

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SECTION 04 26 13
MASONRY VENEER

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 SECTION INCLUDES

A. Clay facing brick.

B. Flashings.

C. Installation of lintels.

D. Installation of Accessories.

1.03 RELATED REQUIREMENTS

A. Section 03 20 00 - Concrete Reinforcing

B. Section 04 05 11 - Masonry Mortaring and Grouting: Mortar and Grout for masonry veneer.

C. Section 04 05 23 - Masonry Accessories; Reinforcement, anchorage, and accessories.

D. Section 04 20 00 - Unit Masonry: Unit Masony substrate, mortar and grout for Unit Masonry.

E. Section 05 50 00 - Metal Fabrications: Loose steel lintels.

F. Section 06 10 00 - Rough Carpentry: Wood stud backup for masonry veneer.

G. Section 07 25 00 - Weather Barriers

H. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal through-wall masonry flashings.

I. Section 07 92 00 - Joint Sealants: Sealing control and expansion joints.

J. Section 09 21 16 - Gypsum Board Assemblies: Exterior sheathing.

1.04 REFERENCE STANDARDS

A. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

C. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

D. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale).

E. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing.

F. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this Section.

1.06 SUBMITTALS

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

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, and mortar.

C. Samples: Submit four samples of facing brick units to illustrate color, texture, and extremes of color range.

D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.07 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

1.08 MOCK-UP

A. Construct a masonry wall as a mock-up panel sized 8 feet long by 6 feet high; include mortar and accessories and structural backup in mock-up.

B. Locate where directed.

C. Mock-up may not remain as part of the Work.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

B. Handle and store masonry units in protective cartons or trays. Do not remove from protective packaging until ready for installation.

1.10 FIELD CONDITIONS

A. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 BRICK UNITS

A. Facing Brick: ASTM C216, Type FBS Smooth, Grade SW.
   1. Color and Texture: As indicated on Drawings.
   2. Nominal Size: As indicated on Drawings.
   3. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect. Provide shapes, including but not limited to, special fabricated water tables, arches, and solid units; same quality, color and texture as face brick.

2.02 MORTAR AND GROUT MATERIALS

A. Mortar and Grout: As specified in Section 04 05 11.

2.03 REINFORCEMENT AND ANCHORAGE

A. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi) yield strength, deformed billet bars; galvanized.

B. Joint Reinforcement: Type specified in Section04 05 23 - Masonry Accessories; galvanized finish.

C. Masonry Veneer Anchors: Type specified in Section 04 05 23 - Masonry Accessories; galvanized finish.

2.04 FLASHINGS

A. Metal Flashing Materials:
   1. Stainless Steel Flashing: ASTM A666/A666M, Type 304, soft temper; 26 gauge, 0.0187 inch thick; finish 2B to 2D.

B. Stainless Steel/Polymer Fabric Flashing: ASTM A240/A240M; 2 mil type 304 stainless steel sheet bonded on one side to one sheet of polymer fabric.
   1. Locations: Veneer walls other than base of wall.
   2. Manufacturers:
      a. Hohmann & Barnard, Inc: www.h-b.com.
      b. WIRE-BOND: www.wirebond.com.
      c. York Manufacturing, Inc; Multi-Flash SS: www.yorkmfg.com.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

C. Stainless Steel/Polymer Fabric Drainage Plane Flashing: ASTM A240/A240M; 2 mil type 304stainless steel sheet bonded between one sheet of polymer fabric and one sheet of non-woven drainage material.
   1. Locations: Base of wall
   2. Manufacturers:
      a. STS Coatings, Inc: www.stscoatings.com.
      b. York Manufacturing, Inc; Flash-Vent SS: www.yorkmfg.com.

c. Substitutions: See Section 01 60 00 - Product Requirements.

D. Stainless Steel/Polymer Fabric Drainage Plane Flashing - Self-Adhering: ASTM A240/A240M; 2 mil type 304 stainless steel sheet with 8 mil (min.) of butyl adhesive and a removable release liner on one side and a sheet of non-woven drainage material bonded to the other side.
   1. Locations: Window & door sill pan flashing.
   2. Manufacturers:
      a. York Manufacturing, Inc; York 304 SA and York 304SS: www.yorkmfg.com.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

E. Factory-Fabricated Flashing Corners and Ends: Stainless steel.
   1. Available manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to the following:
      a. Cheney Flashing Company: www.cheneyflashing.com.
      b. Hohmann & Barnard, Inc: www.h-b.com.
      c. York Manufacturing, Inc: www.yorkmfg.com.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

F. Flashing Sealant/Adhesives: Silicone, polyurethane, or silyl-terminated polyether/polyurethane, or other type required or recommended by flashing manufacturer; type capable of adhering to type of flashing used.

G. Termination Bars: Stainless steel; compatible with membrane and adhesives.

H. Drip Edge: Stainless steel; compatible with membrane and adhesives.
   1. Base of wall: Flat Drip Plate (Flush-End) with factory-formed hemmed edge set flush with face of veneer.
   2. Window Sill at first level above grade and adjacent to walking surfaces: Flat Drip Plate (Flush-End) with factory-formed hemmed edge set flush with face of veneer.
   3. All other locations: Standard Drip Plate with factory-formed hemmed edge.
   4. Manufacturers:
      a. Cheney Flashing Company: www.cheneyflashing.com.
      b. Heckmann Building Products: www.heckmannbuildingprods.com.
      c. Hohmann & Barnard, Inc.: www.h-b.com.
      d. York Manufacturing, Inc: www.yorkmfg.com.
      e. Substitutions: See Section 01 60 00 - Product Requirements.

I. Lap Sealants and Tapes: As recommended by and acceptable to flashing manufacturer with written confirmation; compatible with membrane and adhesives.

2.05 ACCESSORIES

A. Masonry Accessories as specified in Section 04 05 23 - Masonry Accessories

B. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials; as recommended in accordance with brick manufacturer requirements and recommendations.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

D. Before installation, examine rough-in and built-in construction for utilities and penetrations to verify actual locations of piping

3.02 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Use full-size units without cutting where possible.

D. Brick Units:
   1. Bond: Running.
   2. Coursing: Three units and three mortar joints to equal 8 inches.
   3. Mortar Joints: Concave.

3.03 PLACING AND BONDING

A. Lay solid and hollow masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

C. Remove excess mortar as work progresses.

D. Interlock intersections and external corners, except for units laid in stack bond.

E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

F. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

G. Isolate top joint of masonry veneer from horizontal structural framing members or support angles with compressible joint filler.

3.04 WEEPS/CAVITY VENTS

A. Install weeps in veneer walls at 24 inches on center horizontally on top of through-wall flashing above shelf angles and lintels, at bottom of walls, and at other locations shown on Drawings.

B. Install cavity vents in veneer walls at 32 inches on center horizontally below shelf angles and lintels, at top of walls, and at other locations shown on Drawings.

3.05 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.

C. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.06 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Install horizontal joint reinforcement 16 inches on center.

B. Lap joint reinforcement ends minimum 6 inches.

C. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically and 24 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

D. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches on center.

3.07 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
   1. Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up at least 1 inch, minimum, to form watertight pan at non-masonry construction.
   2. Remove or cover protrusions or sharp edges that could puncture flashings.
   3. Seal lapped ends and penetrations of flashing before covering with mortar.

B. Terminate flashing up 8 inches minimum on vertical surface of backing:
   1. Install vertical leg of flashing as indicated on Drawings.

C. Unless otherwise indicated, extend cavity flashings through exterior face of masonry and terminate flush with exterior face of veneer and seal between the angled drip with a hemmed edge. Install joint sealer below drip edge to prevent moisture migration under flashing.

D. At base of wall and other locations indicated in PART 2, extend cavity flashings through exterior face of masonry and terminate flush with exterior face of veneer and omit the projecting drip. Install joint sealer below drip edge to prevent moisture migration under flashing.

E. Support flexible flashings across gaps and openings.

3.08 LINTELS

A. Install loose steel lintels over openings.

B. Maintain minimum 8 inch bearing on each side of opening.

3.09 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's written instructions.

C. Size control joints as indicated on Drawings; if not indicated, 1/2 inch wide and deep.
   1. Horizontal joint size at sills and veneer material transitions may increase based on height of supported brick.

D. Space control joints as indicated on Drawings, but not greater than 25'-0" along the length of any exterior wall.

E. Place perimeter control joints around openings as indicated on Drawings, but not less than 3/8 inch wide and deep.

3.10 TOLERANCES

A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

C. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

E. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

3.11 CUTTING AND FITTING

A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

B. Cut and fit for pipes and conduit. Coordinate with other sections of work to provide correct size, shape, and location.

C. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.12 CLEANING

A. Remove excess mortar and mortar smears as work progresses.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.13 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

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SECTION 04 26 16
ADHERED MASONRY VENEER

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 SECTION INCLUDES

A. Thin brick.

B. Mortar.

C. Adhesives.

D. Accessories.

1.03 RELATED REQUIREMENTS

A. Section 04 05 11 - Masonry Mortaring and Grouting.

B. Section 07 62 00 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.

C. Section 09 22 36 - Lath: Metal furring and lathing for plaster.

1.04 REFERENCE STANDARDS

A. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar.

B. ASTM C1088 - Standard Specification for Thin Veneer Brick Units Made from Clay or Shale.

C. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation.

1.05 SUBMITTALS

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

B. Product Data: Provide data for masonry units, mortar, grout, and adhesive.

C. Samples: Submit four samples of masonry units to illustrate color, texture, and extremes of color range.

D. Manufacturer's Certificate: Certify masonry units, adhesives, mortar, and grout meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience.

1.07 MOCK-UPS

A. Incorporate the Work of this section with the exterior building envelope mock-up.

B. Locate where directed.

C. Mock-up may not remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's written instructions.

B. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

1.09 FIELD CONDITIONS

A. Do not install adhesives in an unventilated environment.

B. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

1.10 WARRANTY

A. Correct defective Work within a five year period after Date of Substantial Completion.

B. Manufacturer Warranty: Provide 20-year manufacturer warranty for coverage against defects in materials when installed in accordance with manufacturer's written installation instructions, commencing on the Date of Substantial Completion. Complete forms in Owner's name and register with manufacturer.

C. Installer Warranty: Provide 2-year warranty. signed by Installer, covering work of this Section, commencing on the Date of Substantial Completion. Complete forms in Owner's name and register with installer.

PART 2 PRODUCTS

2.01 THIN BRICK

A. Thin Brick: ASTM C1088.
   1. Type: TBX.
   2. Size: Manufacturer's standard Modular.
   3. Thickness: 5/8 inch.
   4. Tolerances: 1/16 inch.
   5. Color, Texture, Range, Special Shapes: As selected by Architect from manufacturer's standard range of colors, textures and blends.
   6. Protective Coating: Wax.

2.02 ADHESIVE MATERIALS

A. Manufacturers:
   1. Basis of Design: LATICRETE International, Inc; LATICRETE MVIS Hi-Bond Veneer Mortar: www.laticrete.com.
   2. Other Manufacturers: As approved in writing by masonry veneer manufacturer.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Thin-Set Mortar: ANSI A118.4, polymer-modified; freeze-thaw stable.

2.03 MORTAR MATERIALS

A. Mortar and Grout: See Section 04 05 11.

2.04 FLASHINGS

A. Metal Flashing Materials: Stainless Steel, see Section 07 62 00.

2.05 LATH

A. Metal Lath Materials: See Section 09 22 36 - Lath.

2.06 ACCESSORIES

A. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

B. Air and Water Barrier: Single component, fluid applied, vapor permeable; waterproofing, crack isolation, and air barrier membrane as specified in Division 07.

C. Drainage Mat: 3-dimensional rainscreen membrane with drainage and ventilation channels and integral, factory-installed mortar screen.
   1. Acceptable Products: The following products, though different in composition, are acceptable. Subject to compliance with requirements indicated on Drawings or specified, Contractor may choose from any products listed below. Contractor is responsible for coordination with other systems relating to the exact thickness of the product selected.
      a. Dorken Systems, Inc.; Delta®-Dry Stucco & Stone; www.dorken.com.
      b. Keene Building Products; Driwall™ Rainscreen 020-1, 1/4 inch thick; www.keenebuilding.com.
      c. Advanced Building Products, Inc.; Mortairvent® RAIN SCREEN, 1/4 inch thick; www.advancedbuildingproducts.com/mortairvent.
      d. Masonry Technology Inc.; Sure Cavity™ Rainscreen Drainage Plane, 3/16 inch thick; www.mtidry.com.
      e. Stuc-O-Flex; Waterway™ 7mm Rainscreen Drainage Mat, 5/16 inch thick; www.stucoflex.com.

f. Substitutions: Not permitted.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify field conditions meet masonry manufacturer's requirements to receive masonry veneer.

B. Verify utility penetrations located within areas to receive this work have been flashed and sealed.

C. Verify that openings and penetrations are in place and ready to receive weather resistant barrier.

D. Verify that related items provided under other sections are properly sized and located.

E. Verify built-in items are in required location and ready for installation of masonry veneer.

F. Verify mechanical and electrical equipment and services located within areas to receive this work have been properly tested and approved.

3.02 INSTALLATION

A. Thin Brick:
   1. Exterior Applications: Comply with TCNA (HB) Method W201, W202, or W244E.

B. Lath Installation:
   1. Apply metal lath taut, with long dimension perpendicular to supports.
   2. Lap ends minimum 1 inch. Secure end laps with tie wire where they occur between supports.
   3. Lap sides of diamond mesh lath minimum 1-1/2 inches.
   4. Attach metal lath to metal supports using tie wire at maximum 6 inches on center.
   5. Attach metal lath to concrete using wire hair pins. Attach anchors to backup surface; space at maximum 24 inches on center.
   6. Continuously reinforce internal angles with corner mesh, except where the metal lath returns 3 inches from corner to form the angle reinforcement; fasten at perimeter edges only.
   7. Place corner bead at external wall corners; fasten at outer edges of lath only.
   8. Place 4 inch wide strips of metal lath centered over junctions of dissimilar backing materials. Secure rigidly in place.
   9. Place lath vertically above each top corner and each side of door frames to 6 inches above ceiling line.
   10. Place additional strip mesh diagonally at corners of lathed openings. Secure rigidly in place.

3.03 COURSING

A. Establish lines, levels, and coursing as indicated on drawings. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Brick Units:
   1. Bond: Running.
   2. Coursing: Three units and three mortar joints to equal 8 inches.
   3. Mortar Joints: Concave.

3.04 PLACING AND BONDING

A. Remove excess mortar as work progresses.

B. Interlock intersections and external corners, except for units laid in stack bond.

C. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove and replace.

D. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

3.05 MASONRY FLASHINGS

A. Whether or not specifically indicated on drawings, install masonry flashing to divert water to exterior at locations where downward flow of water is interrupted.

3.06 TOLERANCES

A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

B. Maximum Variation from Plane of Wall: 1/4 inch in 10 feet and 1/2 inch in 20 feet or more.

C. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

D. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.

3.07 CUTTING AND FITTING

A. Cut and fit for pipes, other exterior wall penetrations, conduit, other exterior wall penetrations, and other exterior wall penetrations. Coordinate with other sections of work to provide correct size, shape, and location.

3.08 CLEANING

A. Remove excess mortar and mortar smears as work progresses.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.09 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 05 16 35
POST-TENSIONED VEHICULAR BARRIER CABLE SYSTEMS

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 SECTION INCLUDES

A. All labor, materials, equipment, special tools, and services to complete barrier cable systems work for the Project as herein specified, and as indicated on the Drawings.

B. Field installed barrier cable ralings for parking decks, including all mounting hardware and accessories for a complete installed system.

C. Delegated Design Engineering of cable railing system.

1.03 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Placement of plastic and/or metal fabrications in concrete.

B. Section 05 12 00 - Structural Steel Framing: Structural steel supports and columns for materials used as end terminations where concrete is not used to anchor cable railing system.

C. Section 05 50 00 - Metal Fabrications: Embed plates and other miscellaneous steel interfacing with the work of this Section.

1.04 REFERENCE STANDARDS

A. ACI 318 - Building Code Requirements for Structural Concrete.

B. AISC (MAN) - Steel Construction Manual.

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

D. PTI M10.2 - Specification for Unbonded Single Strand Tendons.

E. PTI TAB.1 - Post-Tensioning Manual.

F. UL (DIR) - Online Certifications Directory.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of barrier cables with size, location and installation of concrete parking structures to which they are attached..

1.06 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: Complete details of vehicular barrier system, including arrangement and number of tendons, methods of maintaining hole and alignment through column, detailing of anchorage devices, live end anchor locations, sequence of tensioning, and strand repair procedures. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
   1. Include the design engineer's seal and signature on each sheet of shop drawings.
   2. Include detailed calculations bearing the design engineer's seal and signature.

D. Samples: Submit two sets of tendon samples including wires, tensioning anchorages, and associated hardware.

E. Design Data: As required by authorities having jurisdiction.

F. Design Data: Indicate calibration certificates for every jack and gauge used on the Project.

G. Test Reports: Indicate static and fatigue test reports of representative anchorage assemblies to be used on the Project in accordance with PTI Specification for Un-bonded Single Strand Tendons.

H. Manufacturer Reports: Provide written certification that the plant manufacturing the post-tensioned Vehicular Barrier Cable System complies with the PTI Certification Program.

I. Submit copies of certified mill test reports for each coil or pack of strand used for the Project in accordance with PTI Specification for Seven Wire Steel Strand Barrier Cable Application.

J. Installer's Qualification Statement: Submit experience records of post-tension system installer. Records to include list of project experience of installer's superintendent.

K. Certification letter from Installer on company letterhead demonstrating that installed system complies with applicable codes, signed by the Installer and Contractor.

1.07 QUALITY ASSURANCE

A. Installation shall be performed by individuals holding a current certificate as a PTI Certified Installer of Un-bonded Post-Tensioning. Furthermore, all barrier cable work shall be under the immediate control of the Barrier Cable Subcontractor's superintendent, who shall have supervised at least five (5) prior projects of similar magnitude and design. Barrier Cable superintendent shall exercise rigid control of all operations as necessary for full compliance with Contract Document requirements.

B. Plant Certification:
   1. Post-tension barrier cable system shall be manufactured in a plant certified to comply with the PTI Program for Certification of Plants Producing Un-bonded Single Strand Tendons.
   2. Plant to be certified as of the date bids are received by the Owner of this Project, and at the time post-tensioning system is manufactured and delivered for this Project.

C. Source Limitations: For each type of material required to complete the work of this Section, provide products from a single manufacturer.

1.08 COORDINATION

A. Coordinate the Work of this Section with other interfacing work in direct contact with the products listed herein. Consult with manufacturer for compatibility of materials specified in other sections that will be in contact with the products listed in this Section.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and accessories to Project site in original packages, containers, or bundles, labeled with manufacturer's name, product brand name, and lot number.
   1. Comply with PTI’s Field Procedures manual.

B. Use nylon straps during loading, unloading and handling of materials.

C. Protect and store accessory and auxiliary products in accordance with manufacturer’s written instructions.

D. Store materials inside, under cover, dry, protected from weather, direct sunlight, condensation, surface contamination, aging, corrosion, and damage from construction traffic and other causes.

1.10 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.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design metal stair and railing system using performance requirements and design criteria indicated. Submit comprehensive engineering analysis signed and sealed by a qualified Structural Engineer licensed in Louisiana.

B. Meet requirements given in Section 1607.8 for Vehicle Barriers in the International Building Code.

2.02 APPLICATIONS

A. Parking Decks: Vehicular Barrier Cable System in locations indicated on Drawings.

2.03 VEHICULAR BARRIER CABLE SYSTEM

A. Basis of Design Manufacturer: Structural Technologies LLC (VSL).

B. Other Acceptable Manufacturers:
   1. Structural Technologies LLC (VSL
   2. Substitutions: See Section 01 60 00 - Product Requirements.

C. Design Criteria:
   1. Provide a complete system that meet code required loading criteria for vehicular barriers in parking structures.

2.04 PERFORMANCE CRITERIA

A. General System Design:
   1. The Contractor shall be responsible for the structural design and detailing of vehicular barrier system. The structural design and detailing of connections shall be in accordance with the following provisions and those identified on the Drawings.
   2. Design vehicular cable barrier system per Chapter 16 of the PTI Post-Tensioning Manual.
      a. PTI M10.2.
      b. PTI TAB.1.
   3. Design system under the direct supervision of a suitably qualified and experienced Professional Engineer, registered in the state in which this project is being constructed, who shall sign and seal the shop drawings of the work for which he was responsible.
   4. Adequacy load path through all structural members shall be the responsibility of the Engineer of Record. Vehicle barrier cable system supplier will provide detailed loading calculations to the anchorage and preliminary anchorage details for review and use.

B. Design System to meet the following live loads:
   1. IBC 2021 section 1607.9.1 Pedestrian Distributed load of 50 lbf / ft.
   2. IBC 2021 section 1607.9.1.1 Pedestrian Concentrated load of 200 lbf.
   3. IBC 2021 section 1607.10 Vehicle Concentrated 6,000lbf horizontally apply load at 1’-6” above floor or 2’-3” above floor. Assume load is applied in 1 square foot.

C. Design system geometry requirements:
   1. IBC 2021 section 1015.3 Height shall be a minimum of 42 inches.
   2. IBC 2021 section 1015.4 Opening shall be a maximum of 4 inches.

D. Design system deflection requirements:
   1. Limit sag in the strand to 0.007 in / ft.
   2. Limit maximum horizontal deflection to 18 inches under impact loading.

E. Structural steel shall use AISC manual of steel construction AISC (MAN).

F. Concrete structural members shall use ACI 318.

2.05 POST-TENSIONING STEEL

A. Vehicular barrier cable tendons shall be 0.5” diameter galvanized strands. End anchorage sizes shall be selected by Vehicular Barrier Subcontractor and submitted to Architect/Engineer for review.

B. Strands
   1. Conform to ASTM A475: Standard Specification for Zinc-Coated Steel Wire Strand.
   2. Strand to have a minimum ultimate tensile strength of 270,000 psi.

C. Temporary stress shall not exceed eighty (60) percent of the minimum ultimate tensile strength of the strand.

D. Broken strands, and strands showing severe fabrication defects, shall be removed and replaced.

2.06 ANCHORAGES AND COUPLERS

A. Anchorages and couplers shall comply with PTI Specification for Un-bonded Single Strand Tendons and ACI 318. Anchors shall be designed for transfer at 2,500 psi concrete strength.

B. Size bearing plates of anchorages to satisfy requirements of ACI 318 and PTI Specification for Un-bonded Single Strand Tendons unless certified test reports are submitted providing acceptable deviation.

C. Anchorages and couplers shall be capable of developing at least 95% of the actual breaking strength of the pre-stressing steel without excessive deformation. Total elongation of the tendon under ultimate load shall not be less than 2% measured in a minimum gauge length of (3) feet.

D. Insert devices may be preset prior to column placement. All inserts shall meet the ultimate pull-out and shear load requirements of the design and as a minimum, shall meet the impact load requirements. Inserts shall be rated on a minimum 4 to 1 factor of safety for ultimate pull-out and/or shear.

2.07 CORROSION PREVENTIVE COATING

A. Galvanized Coating
   1. Provide zinc coating complying with ASTM Specification A-475 Class A, Table 4 coating weight
   2. Apply coating by either hot-dip, hot-dip and post-drawing, or electro-plating process that ensures complete zinc coating around each individual wire of the strand.

2.08 FASTENERS

A. Use stainless steel nails to secure post-tensioning to forms or surfaces which will be exposed in the finished structure.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Verify that all embedded plates and anchors are ready to receive the Work. Report any deviations from the approved shop drawings to the Architect and Engineer in writing.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings.

3.03 INSTALLATION OF BARRIER CABLES THROUGH COLUMNS

A. Provide a hole at intermediate columns that is a minimum of 1/8 inch diameter larger than the barrier cable diameter, including coating material.

B. Prior to column concrete placement provide one of the following anchorages at end columns:
   1. Recessed stressing anchors
   2. Threaded anchoring devices and concrete inserts capable of developing the single strand design load.

C. Firmly support conduits and anchorages to prevent displacement during subsequent operations. Place with a vertical tolerance of plus or minus 1/8 inch.

3.04 TENSIONING

A. Stress all barrier cables to a minimum force of 2 kips to prevent sagging. Seating loss and length of cable shall be considered to ensure the specified force is achieved after back-stressing.

B. All fixed and stressing anchorages shall be back-stressed. Back-stressing is performed after cable is stressed. Place jack on the opposite side of bearing member, stress cable to a force equal to 65% of the strand’s minimum ultimate tensile strength. Use a slotted bearing plate to prevent damage to the backside of the member by the jack nose.

C. Jack chucks shall be checked for uneven wear before each use and shall be replaced if such wear is evident.

D. Stressing pockets shall be a minimum of 2 inches deep. Pockets shall be filled with non-shrink mortar as soon as practical after tendon stressing and cutting.
   1. Within one work day after tendon tails are cut, coat exposed strand and wedge areas with tendon coating material and apply watertight cap over the coated area.

2. Prior to installing pocket mortar, inside concrete surfaces of the pocket shall be coated or sprayed with a resin bonding agent.
3. Under no circumstances shall grout or mortar used for pocket filling contain chlorides or other chemicals known to be deleterious to pre-stressing steel.
4. Grout to conform to Section 03 30 00 - Cast-in-Place Concrete.
5. Finish grout pockets flush with surrounding concrete.
6. Cure grout in accordance with Section 03 30 00 - Cast-in-Place Concrete.
7. Rub out all stressing pockets.

3.05 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

3.06 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

3.07 PROTECTION

A. Protect installed barrier cable systems from subsequent construction operations.

B. No material shall be stored on pre-stressed slabs before final stressing of the slabs and supporting beams is complete. At no time shall the weight of stored material and construction live loads placed on the slabs exceed the total superimposed design load of the slab or beams.

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SECTION 05 50 00
METAL FABRICATIONS

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 SECTION INCLUDES

A. Shop fabricated steel and aluminum items, including, but not limited to:
   1. Steel for elevator pit ladders and elevator sump pit covers.
   2. Steel bollards.
   3. Masonry support steel.
   4. Sleeves in concrete walls and slabs.
   5. Light steel framing and supports, not included as part of work of other trades.
   6. Steel gratings and frames (including mechanical dunnage racks).
   7. Steel Hoist Beams, Separator Beams, and support rails at elevators.
   8. Rain leader and other pipe protection at parking areas.
   9. Steel framing, bracing, supports, anchors, bolts, shims, fastenings, and all other supplementary parts indicated on Drawings or as required to complete each item of the Work.
   10. Prime painting, touch-up painting, galvanizing and separation of dissimilar metals for work of this Section.
   11. Cutting, fitting, drilling and tapping work of this Section to accommodate work of other Sections and of concrete, masonry or other materials as required for attaching and installing work of this Section.

1.03 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.

B. Section 04 20 00 - Unit Masonry: Placement of metal fabrications in masonry.

C. Section 05 12 00 - Structural Steel Framing: Structural steel column anchor bolts and hoist beams.

D. Section 05 51 33 - Metal Ladders: Ships ladders and other pre-manufactured ladders not specified in this Section.

E. Section 09 91 13 - Exterior Painting: Field paint finish for exterior metals.

F. Section 09 91 23 - Interior Painting: Field paint finish for interior metals.

G. Section 14 21 00 - Electric Traction Elevators.

1.04 REFERENCE STANDARDS

A. AAMA 611 - Specification for Anodized Architectural Aluminum.

B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

C. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

D. ASME B18.2.1 - Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).

E. ASME B18.6.3 - Machine Screws, Tapping Screws, and Metallic Drive Screws (Inch Series).

F. ASME B18.21.1 - Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series).

G. ASME B18.22M - Metric Plain Washers.

H. ASTM A27/A27M - Standard Specification for Steel Castings, Carbon, for General Application.

I. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

J. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings.

K. ASTM A48/A48M - Standard Specification for Gray Iron Castings.

L. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

M. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

N. ASTM A143 - Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.

O. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

P. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.

Q. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

R. ASTM A385 - Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip).

S. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

T. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

U. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.

V. ASTM A568/A568M - Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low- Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.

W. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

X. ASTM A924/A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

Y. 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.

Z. 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.

AA. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

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

CC. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.

DD. ASTM E488/E488M - Standard Test Methods for Strength of Anchors in Concrete Elements.

EE. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

FF. ASTM F594 - Standard Specification for Stainless Steel Nuts.

GG. ASTM F1941/F1941M - Standard Specification for Electrodeposited Coatings on Mechanical Fasteners, Inch and Metric.

HH. 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.

II. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.

JJ. AWS D1.1/D1.1M - Structural Welding Code - Steel.

KK. AWS D1.2/D1.2M - Structural Welding Code - Aluminum.

LL. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172.

MM. SSPC-PA 1 - Shop, Field, and Maintenance Coating of Metals.

NN. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.

OO. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).

PP. SSPC-SP 2 - Hand Tool Cleaning.

QQ. SSPC-SP 6 - Commercial Blast Cleaning.

1.05 SUBMITTALS

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

B. Manufacturer's Literature: Submit manufacturer's specifications, load tables, dimension diagrams, anchor details and installation instructions for products to be used in the fabrication of miscellaneous metal work, including paint products.

C. Shop Drawings: For the fabrication and erection of all assemblies of miscellaneous iron work which are not completely shown by manufacturer's data sheets, 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, size and spacing (if not continuous).
   2. Include plans and elevations at not less than 1" to 1'-0" scale, and include details of sections and connections at not less than 3" to 1'-0" scale. Show anchorage and accessory items.
   3. Show all load conditions and design calculations relative to connections, fastening devices and anchorage, as well as size and gauge of members. Calculations and drawings must be prepared by a Structural Engineer licensed in Louisiana, and shall be signed and sealed by this Engineer.

D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

E. Galvanizer Certificates: For items to be hot-dip galvanized, identify each item and show compliance of application. Certificate shall be signed by the galvanizer and contain a detailed description of the material processed and the ASTM standard used for the coating and, the weight of the coating. In addition, and as attachment to Certification, submit reports of testing and inspections indicating compliance with the provisions of this Section.

F. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.07 PROJECT COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.08 QUALITY ASSURANCE

A. Design steel components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in Louisiana.

B. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 PRODUCTS

2.01 PERFORMANCE STANDARDS

A. Railings shall be designed to resist loads in accordance with the International Building Code.

2.02 GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For Metal Fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.03 MATERIALS - STEEL

A. Steel Sections, including plates, shapes, bars, and bar grating: ASTM A36/A36M.

B. Steel Tubing: ASTM A500/A500M, Grade B cold-formed structural tubing.

C. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

D. Plates: ASTM A283/A283M.

E. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

F. Structural Steel Sheet: Hot rolled, ASTM A1011/A1011M; or cold rolled, ASTM A1008/A1008M, Class 1; of grade required for design loading.

G. Galvanized Structural Steel Sheet: ASTM A924/A924M, of grade required for design loading. Coating designation G90.

H. Gray Iron Castings: ASTM A48/A48M, Class 30, unless another class is indicated or required by structural loads.

I. Malleable Iron Castings: ASTM A47/A47M, grade as selected by fabricator.

J. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.

K. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A47/A47M, or cast steel, ASTM A27/A27M. Provide bolts, washers and shims as required, hot-dip galvanized, ASTM A153/A153M

L. Hot-rolled carbon steel sheets and strips: Meeting ASTM A568/A568M and ASTM A1011/A1011M.

M. Cold-rolled carbon steel sheets: Meeting ASTM A1008/A1008M.

N. Other steel: Mild steel.

O. Fasteners: As indicated on Drawings, and.
   1. Compatible with materials being fastened; type consistent with design and specified quality level.
   2. Non-Corrosive, non-staining, and concealed except as indicated on Drawings.
   3. Provide anchors, bolts, shims, and accessory items for buildings into and fastening to adjacent work.

P. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.

Q. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

R. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

S. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.04 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

B. Bolts, Nuts, and Washers: Stainless steel.

C. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.05 ACCESSORIES

A. Fasteners

1. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with ASTM B633 coating or ASTM F1941/F1941M, Class Fe/Zn 5, for exterior use or where built into exterior walls. Select fasteners for the type, grade and class required.
    a. Provide stainless steel fasteners for fastening aluminum, stainless steel, or nickel silver.
    b. Provide bronze fasteners for fastening bronze
2. Steel Bolts and Nuts: Regular hexagon head bolts, ASTM A307, Grade A; with hex nuts ASTM A563; flat washers where indicated.
3. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 3, heavy-hex steel structural bolts; with hex nuts ASTM A563, Grade DH3 heavy-hex carbon-steel nuts; flat washers where indicated.
4. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593; with hex nuts ASTM F594; flat washers where indicated, Group 1 (A1).
5. Lag Bolts: ASME B18.2.1.
6. Machine Screws: ASME B18.6.3.
7. Plain Washers: Round, carbon steel, ASME B18.22M.
8. Masonry Anchorage Devices: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.
9. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M
10. Torque-controlled expansion anchors
    a. Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
    b. Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless steel bolts, ASTM F593, and nuts, ASTM F594.
11. Toggle Bolts: Tumble-wing type, FS FF-B-588, type, class and style as required.
12. Lock Washers: Helical spring type carbon steel, ASME B18.21.1.

B. Shop Paint: Shop prime all non-galvanized miscellaneous metal items.
    1. If steel is to receive high performance coating as noted in Section 09 96 00, shop prime using primer noted in Section 09 96 00.

C. Bituminous Paint: Cold applied asphalt emulsion complying with ASTM D1187/D1187M.

D. Galvanize Repair Coating: For touching up galvanized surfaces after erection, provide repair coating that is VOC compliant. Apply to a dry film thickness of 1.5 to 3.0 mils.

2.06 FABRICATION

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Fit and shop assemble items in largest practical sections, for delivery to site.
    1. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

C. Fabricate items with joints tightly fitted, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.
    1. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated.
    2. Weld corners and seams continuously to comply with AWS recommendations.

D. Continuously seal joined members by continuous welds to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

E. 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.

F. Form exposed work with accurate angles and surfaces and straight edges.

G. Form bent-metal corners to smallest radius possible without causing grain separation, dents, scratches, cracks or otherwise impairing work.

H. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

I. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

J. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

K. Provide for anchorage of type indicated on reviewed shop drawings; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

L. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

2.07 FABRICATED ITEMS

A. Elevator Pit Ladders: Steel; in compliance with ANSI A14.3; 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. Coordinate with elevator manufacturer at elevator pits.

B. Bollards: Steel pipe, concrete filled, with molded cap, as detailed; prime paint finish.

C. Loose Bearing and Leveling plates
1. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
2. Galvanize plates.

D. Door Frames for Overhead Door Openings and Wall Openings: Channel sections; prime paint finish.

E. Elevator Hoistway Divider Beams: Beam sections; prime paint finish.

F. Toilet Partition Suspension Members: Steel channel sections; prime paint finish.

G. Corner guard angles: 4 inch by 4 inch by 1/4 inch by 4 feet long. Locate at corners exposed to vehicular traffic and where indicated.

H. Counter support brackets, welded construction.

I. Hanger rods not provided by other trades. Provide in size and length indicated; threaded full length or at ends only.

J. Tube columns and shapes, connectors, flitch plates, steel channel door frames, and other miscellaneous items not covered in Section 05 12 00 - Structural Steel Framing.

K. Elevator sump pit covers, sill angles, guide rails and cylinder supports, separator beams, and other miscellaneous steel fabrications associated with the elevator and elevator pit for a complete installation.
   1. Elevator Sump Pit Covers:
      a. Fabricate from welded or pressure-locked steel bar grating. Limit openings in gratings to no more than 1 inch in least dimension.
      b. Provide steel angle supports unless otherwise indicated

2.08 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
   1. Fabricate units from slotted channel framing where indicated.
   2. Furnish inserts for units installed after concrete is placed.

C. Prime miscellaneous framing and supports with primer specified in Division 09 Section where indicated.

D. Galvanize miscellaneous framing and supports where indicated.

2.09 MISCELLANEOUS METALS ITEMS

A. Rough Hardware
   1. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 Sections.
   2. Fabricate items to sizes, shapes and dimensions required. Furnish malleable iron washers for heads and nuts which bear on wood connections; elsewhere, furnish steel washers.

B. Elevator Pit Ladders
   1. Vertical steel ladders shall be eighteen (18) inches wide with 3/4" diameter
   2. non-slip steel rungs spaced twelve (12) inches o.c. Stringers shall be 3/8" thick by 2-1/2" wide steel bars; rungs welded to bars. Attach ladders to walls six (6) inches from top and bottom and maximum thirty-six (36) inches o.c. from these points. At the roof, gooseneck the rails back to the structure to provide secure ladder access.
   3. Provide sloping ladders (ship's ladders) where noted. Fabricate open type construction with structural steel channel or steel plate stringers, pipe handrails, and open steel grating treads. Provide all necessary brackets and fittings for installation.
   4. Ladders shall be fabricated to support a live load of one hundred (100) lbs. per square foot and a concentrated load of three hundred (300) lbs. per rung; loads not to act simultaneously.

C. Miscellaneous Light Steel Framing
   1. Light steel framing, bracing, supports, framing, clip angles, shelf angles, plates, etc., shall be of such shapes and sizes as indicated on the drawings and details or as required to suit the condition and shall be provided with all necessary supports and reinforcing such as hangers, braces, struts, clip angles, anchors, bolts, nuts, welds, etc., as required to properly support and rigidly fasten and anchor same in place and to steel, concrete, masonry and all other connecting and adjoining work.
   2. All light steel framing steel shall be furnished and erected in accordance with the applicable requirements of the "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" by the American Institute of Steel Construction and as specified herein.

D. Steel Bollards: Provide six (6) inches O.D. extra strong (Schedule 80) steel pipe, concrete filled, with base of steel plate for mounting to anchor bolts in concrete foundation. Rabbet top

of steel pipe and insert 1/4" steel plate cap, flush with top of pipe. Weld top of cap to pipe and grind smooth and flush.

E. Sleeves in Concrete Walls and Slabs
   1. Sleeves through concrete walls shall be of Schedule 40 steel pipe with i.d. two (2) inches larger than o.d. of pipe or conduit (including insulation, if any) to be accommodated. Sleeves shall project one-half (1/2) inch on each side of finished wall. Provide rectangular one-quarter (1/4) inch steel plate collar at center, continuously welded to the perimeter of the sleeve, and six (6) inches wider than the o.d.
   2. Slots in slabs shall be 12 gauge steel sheet, galvanized, of dimensions indicated, with strap anchors welded in place not more than twelve (12) inches on centers.

2.10 FINISHES - STEEL

A. Prime paint all steel items.
   1. Exceptions: Galvanize items to be embedded in concrete, items to be embedded in masonry, items specified for fireproofing finish, and where indicated on Drawings.
   2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
   3. Exceptions: Steel to get high performance coating as noted in Section 09 96 00 - High-Performance Coatings shall be cleaned as per SSPC-SP 6 "Commercial Blast Cleaning."

B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

D. Prime Painting: One coat.

E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements.

F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.11 GALVANIZING

A. Scope: All ferrous metal exposed to the weather, and all ferrous metals indicated on drawings or in specifications to be galvanized, shall be cleaned and then hot-dipped galvanized after fabrication.
   1. Coordinate galvanization requirements with contract documents.

B. Avoid fabrication techniques that could cause distortion or embitterment of steel items to be hot-dip galvanized. Fabricator shall consult with hot-dip galvanizer regarding potential warpage problems or handling problems during the galvanizing process that may require adjustment of fabrication techniques or design before finalizing shop drawings and beginning of fabrication.

C. Cleaning: Thoroughly clean metal surfaces of all mill scale, rust, dirt, grease, oil, moisture and other contaminants prior to galvanizing.

D. Application: Hot-dip galvanizing shall be applied in accordance with:
   1. ASTM A143: Safeguard against the possible embrittlement of steel hot-dip galvanized after fabrication.
   2. ASTM A123/A123M: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   3. ASTM A153/A153M: Galvanized Coating on Iron and Steel Hardware - Table 1.
   4. ASTM A385: Practice for Providing High Quality Zinc Coatings.
   5. ASTM A924/A924M: Galvanized Coating on Steel Sheets.
   6. Minimum weight of galvanized coating shall be two (2) oz. per square foot of surface.

E. Fabricate joints which will be exposed to weather in a manner to exclude water or provide weep holes where water may accumulate.

F. All galvanized materials must be inspected for compliance with these specifications and marked with a stamp indicating the name of the galvanizer, the weight of the coating, and the appropriate ASTM number.

G. To minimize surface imperfection (e.g.: flux inclusions), material to be galvanized shall be dipped into a solution of Zinc Ammonium Chloride (pre-flux) immediately prior to galvanizing.

The type of galvanizing process utilizing a flux blanket overlaying the molten zinc will not be permitted.

H. After galvanizing all materials not exposed to view must be chromated by dipping material in a 0.2% chromic acid solution.

I. Galvanized surfaces, where exposed to view, must have a smooth, level surface finish. Where this does not occur, piece shall be rejected and replaced to the acceptance of the Architect.

2.12 PROTECTIVE COATINGS

A. Whenever dissimilar metals will be in contact, separate contact surfaces by coating each contact surface prior to assembly or installation with one coat of specified bituminous paint, which shall be in addition to the specified shop prime paint. Mask off those surfaces not required to receive protective coating.

2.13 FINISHES - ALUMINUM

A. Interior Aluminum Surfaces: Class I natural anodized.

B. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

C. Pigmented Organic Coating System: AAMA 2603 polyester or acrylic baked enamel finish; color as indicated at interior locations only.

D. Superior Performance Organic Coating System: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride system; color as indicated.

E. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

2.14 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 INSTALLATION, GENERAL:

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

3.02 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive the Work.

B. Correct any conditions detrimental to the proper and timely completion of the Work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the Work.

3.03 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.

3.04 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components as indicated on drawings.

D. Perform field welding in accordance with AWS D1.1/D1.1M.
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

E. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

F. Cutting, fitting, and placement: Perform cutting, drilling, and fitting for installation of Work. Set Work in location, alignment, and elevation, plumb level, true, and free of rack; measure from established lines and levels. Install Work in accord with reviewed shop drawings.
   1. Obtain approval prior to site cutting or making adjustments not scheduled.

G. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

H. After erection, prime welds, abrasionsand surfaces not shop primed or galvanized , except surfaces to be in contact with concrete.

I. Loose Metal Fabrications Items: Provide for completion of Work in other sections.

J. Installation of bearing and leveling plates;
   1. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
   2. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
      a. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations unless otherwise indicated.
      b. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

K. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; including

threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

L. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry, or similar construction.

M. Fitting Connections: Fit exposed connections accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Grind exposed joints smooth and touch up shop paint coat. Do not weld, cut or abrade the surfaces of exterior units which have been hot dip galvanized after fabrication, and are intended for bolted or screwed field connections.

N. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance, and quality of welds made, and methods used in correcting welding work.

O. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

P. Field Touch-Up of Galvanized Surfaces: Touch-up shop applied galvanized coatings damaged during handling and installation. Use galvanizing repair coating specified herein for galvanized surfaces.

3.05 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

3.06 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION

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SECTION 05 51 00
METAL STAIRS

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 SECTION INCLUDES

A. Stairs with concrete treads.

B. Structural steel stair framing and supports.

C. Handrails and guards.

D. Testing of installed railing systems.

1.03 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete fill in stair pans; mesh reinforcement for landings.

B. Section 03 30 00 - Cast-in-Place Concrete: Placement of metal anchors in concrete.

C. Section 04 20 00 - Unit Masonry: Placement of metal fabrications in masonry.

D. Section 05 50 00 - Metal Fabrications.

E. Section 05 55 16.01 - Photoluminescent Stair Nosings and Egress Path Markings: Photoluminescent stair markings.

F. Section 09 91 13 - Exterior Painting: Paint finish.

1.04 REFERENCE STANDARDS

A. AISC 207 - Standard for Certification Programs.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

F. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

G. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

H. 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.

I. 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.

J. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.

K. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.

L. AWS D1.1/D1.1M - Structural Welding Code - Steel.

M. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172.

N. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.

O. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).

P. SSPC-SP 2 - Hand Tool Cleaning.

1.05 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design metal stair and railing system using performance requirements and design criteria indicated. Submit comprehensive engineering analysis signed and sealed by a qualified Structural Engineer licensed in Louisiana.

B. Performance Requirements for Guard Assembly:
   1. Support distributed load of 50 pounds per linear foot (0.73kN/M), applied horizontally at right angles in any direction to the top/grab rail.
   2. Support concentrated horizontal load of 200 pounds (0.89kN), applied in any direction at any point along top/grab rail.
   3. 50 lbs. (0.22kN) on 1 sf (0.093m2) perpendicular to guard at any location.
   4. Wind loads 25 psf or as otherwise specified.
   5. These loads need not to be assumed to act concurrently.
   6. Maximum deflection at top of glass is height/24.

C. Field Testing: Provide Field Test and Certification Letter.

1.06 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.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
   2. Include the design engineer's seal and signature on each sheet of shop drawings.

C. Design Data: As required by authorities having jurisdiction.

D. Certification letter from Installer on company letterhead demonstrating that installed system complies with applicable codes, signed by the Installer and Contractor.

1.07 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in Louisiana.

B. Fabricator Qualifications:
   1. A qualified steel fabricator that is certified by the American Institute for Steel Construction (AISC) under AISC 207.
   2. A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.
   3. A company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

PART 2 PRODUCTS

2.01 METAL STAIRS - GENERAL

A. Metal 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 that comply with most stringent requirements of local, state, and federal regulations; where requirements of Contract Documents exceed those of regulations, comply with Contract Documents.
   2. Structural Design: Provide complete stair and railing assemblies that comply with the applicable local code.
   3. Dimensions: As indicated on Drawings.
   4. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
   5. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.

6. Separate dissimilar metals using paint or permanent tape.

B. Metal Jointing and Finish Quality Levels:
   1. Commercial: Exposed joints as inconspicuous as possible, whether welded or mechanical; underside of stair not covered by soffit IS considered exposed to view.
      a. Welded Joints: Intermittently welded on back side, filled with body putty, and sanded smooth and flush.
      b. Welds Exposed to View: Ground smooth and flush.
      c. Mechanical Joints: Butted tight, flush, and hairline.
      d. Bolts Exposed to View: Countersunk flat or oval head bolts; no exposed nuts.
      e. Exposed Edges and Corners: Eased to small uniform radius.
      f. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for satin or matte finish.

C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.02 METAL STAIRS WITH FIELD INSTALLED CONCRETE TREADS

A. Jointing and Finish Quality Level: Commercial, as defined above.

B. Risers: Closed.

C. Treads: Metal pan with field-installed concrete fill.
   1. Concrete Depth: 1-1/2 inches, minimum.
   2. Tread Pan Material: Steel sheet.
   3. Tread Pan Thickness: As required by design; 14 gauge, 0.075 inch minimum.
   4. Pan Anchorage to Stringers: Bolted to carrier angles welded or bolted to stringers.
   5. Concrete Reinforcement: Welded wire mesh.
   6. Concrete Finish: light broom finish per Division 03 Section 03 30 00 - Cast-in-Place Concrete.

D. Risers: Same material and thickness as tread pans.
   1. Riser/Nosing Profile: Sloped riser with rounded nosing of minimum radius.
   2. Nosing Depth: Not more than 1-1/2 inch overhang.
   3. Nosing Return: Flush with top of concrete fill, not more than 1/2 inch wide.

E. Stringers: Rolled steel channels.
   1. Stringer Depth: 10 inches.
   2. End Closure: Sheet steel of same thickness as risers welded across ends.

F. Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity.

G. Railings: Steel pipe railings.

H. Finish: Shop- or factory-prime painted.

I. Under Side of Stair: Exposed to view, to be finished same as specified for other exposed to view surfaces.

2.03 HANDRAILS AND GUARDS

A. Wall-Mounted Rails: Round pipe or tube rails unless otherwise indicated.
   1. Outside Diameter: 1-1/4 inch, minimum, to 1-1/2 inches, maximum.

B. Guards:
   1. Top Rails: Round pipe or tube rails unless otherwise indicated.
      a. Outside Diameter: 1-1/4 inch, minimum, to 1-1/2 inches, maximum.
   2. Infill at Picket Railings: Vertical pickets.
      a. Horizontal Spacing: Maximum 4 inches on center.
      b. Material: Solid steel bar.
      c. Shape: Square.
      d. Size: 1/4 inch square.

e. Top Mounting: Welded to underside of top rail.
f. Bottom Mounting: As indicated on Drawings.

3. End and Intermediate Posts: Same material and size as top rails.
   a. Horizontal Spacing: As indicated on Drawings.
   b. Mounting: Welded to top surface of stringer.

2.04 MATERIALS

A. Steel Sections: ASTM A 36/A 36M.

B. Steel Tubing: ASTM A500/A500M or ASTM A501/A501M structural tubing, round and shapes as indicated.

C. Pipe: ASTM A 53/A 53M Grade B Schedule 40, black finish.

D. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
   1. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
   2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).

E. Concrete Fill: Portland cement Type I, 3000 psi 28 day strength, 2 to 3 inch slump.

2.05 ACCESSORIES

A. Cane detection rails:
   1. Locations: Lowest level at stair runs where head height is less than 6 feet 8 inches, standpipes, and other locations indicated on Drawings.
   2. Materials: Round or square tube.
   3. Mounting: Wall or floor mounted, but mounting height not less than 27 inches A.F.F.

B. Alternate Cane Detection Devices at Standpipes:
   1. Round plastic pavement markers approximately 4 inches in diameter and 0.72 inches tall, yellow.

C. Factory Fabricated Stair Tread and Nosing:
   1. Materials: Extruded aluminum, alloy type 6063-T5, mill finish.
      a. Tread Abrasive Filler: Virgin grain aluminum oxide epoxy-bonded to tread base.
      b. Tread Type: Ribbed bar.
      c. Nosing Types: Angled long nose for sloped stairs.
      d. Color: Black.

D. Steel Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.

E. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

F. Shop and Touch-Up Primer: SSPC-Paint 15, and comply with VOC limitations of authorities having jurisdiction.

G. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, and comply with VOC limitations of authorities having jurisdiction.

2.06 SHOP FINISHING

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Do not prime surfaces in direct contact with concrete or where field welding is required.

C. Prime Painting: Use specified shop- and touch-up primer.
   1. Preparation of Steel: In accordance with SSPC-SP 2 Hand Tool Cleaning.
   2. Number of Coats: One.

D. Galvanizing: Hot-dip galvanize to minimum requirements of ASTM A123/A123M.
   1. Touch up abraded areas after fabrication using specified touch-up primer for galvanized surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. When field welding is required, clean and strip primed steel items to bare metal.

B. Supply items required to be cast into concrete and embedded in masonry with setting templates.

3.03 INSTALLATION

A. Install components plumb, square, level, accurately fitted, and free from distortion or defects.

B. Provide anchors, plates, angles, hangers, and struts required for connecting stairs to structure.

C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

D. Provide welded field joints where specifically indicated on Drawings. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.

F. Obtain approval prior to site cutting or creating adjustments not scheduled.

G. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Field Test installed railing systems for structural performance compliance in accordance with applicable codes and specified performance requirements.

3.05 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

3.06 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. Provide Certification Letter to Owner stating installed railing system is compliant with code mandated loading and dimensional requirements.

END OF SECTION

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SECTION 05 51 33
METAL LADDERS

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 SECTION INCLUDES

A. Prefabricated ladders.

B. Prefabricated ships ladders.

1.03 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Steel ladders for roof access ladders and elevator pit ladders.

B. AAMA 611 - Specification for Anodized Architectural Aluminum.

C. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements.

D. ASTM B210/B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes.

E. ASTM B211/B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire.

F. AWS D1.1/D1.1M - Structural Welding Code - Steel.

1.04 SUBMITTALS

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

B. Product Data: Provide manufacturer's data sheets on each ladder safety system product to be used, including installation instructions.

C. Shop Drawings:
   1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and project specific details.

PART 2 PRODUCTS

2.01 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B211/B211M, 6063 alloy, T6 temper.

B. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210/B210M, 6063 alloy, T6 temper.

C. Aluminum-Alloy Bars: ASTM B211/B211M, 6061 alloy, T6 temper.

2.02 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by continuous welds.

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. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 PREFABRICATED LADDERS

A. Prefabricated Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.
   1. Components: Manufacturer's standard rails, rungs, treads, handrails. returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section.

2. Materials: Aluminum; ASTM B211/B211M 6063 alloy, T52 temper.
3. Finish: Manufacturer's standard clear anodized coating, comply with AAMA 611, Class 1.

B. Prefabricated Ships Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.
1. Components: Manufacturer's standard rails, rungs, treads, handrails. returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section.
2. Materials: Aluminum; ASTM B211/B211M 6063 alloy, T52 temper.
3. Incline: 60 degrees.
4. Finish: Manufacturer's standard clear anodized coating, comply with AAMA 611, Class 1.

2.04 LADDER SAFETY SYSTEMS

1. Install on new fixed ladders over 24 feet in height.
2. Anchorage: Fixed ladder meeting requirements of 29 CFR 1910.23.
3. Flexible Carrier: Fixed 3/8 inch diameter stainless steel wire rope lifeline with shock absorber and top, bottom and intermediate supports; meeting requirements of ANSI/ASSP Z359.16.
   a. Provide with stainless steel extension post at top of ladder; meeting requirements of ANSI/ASSP Z359.16.
4. Fall Arrester: Stainless steel and aluminum automatic pass-through carrier sleeve fall arrester meeting requirements of ANSI/ASSP Z359.15 and ANSI/ASSP Z359.16; compatible with carrier.
   a. If designed to be removable from carrier, arrester removable only by at least two deliberate manual action(s) by user.
   b. Includes an anti-inversion device to prevent installation of carrier sleeve upside down on carrier.
   c. Carrier sleeve movement is automatic and does not require continuous manual intervention during climbing or descending.
   d. Includes panic grab (secondary locking mechanism) feature.
5. Install on new fixed ladders over 24 feet in height.
6. Anchorage: Fixed ladder meeting requirements of 29 CFR 1910.23.
7. Flexible Carrier: Fixed 3/8 inch diameter stainless steel wire rope lifeline with shock absorber and top, bottom and intermediate supports.

2.05 FINISHES - ALUMINUM

A. Exterior Aluminum Surfaces: Class I natural anodized.

B. Interior Aluminum Surfaces: Class II natural anodized.

C. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

D. Class II Natural Anodized Finish: AAMA 611 AA-M12C22A31 Clear anodic coating not less than 0.4 mils thick.

2.06 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components as indicated on shop drawings.

D. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed , except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

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SECTION 05 70 13
DECORATIVE METAL GRILLES AND FRAMES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

A. Architectural screens.

1.03 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Non-decorative metal fabrications.

B. Section 09 91 13 - Exterior Painting: Finishes and references to Exterior Paint Schedule.

1.04 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).

B. ASTM A29/A29M - Standard Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

D. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings.

E. ASTM A48/A48M - Standard Specification for Gray Iron Castings.

F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

G. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes.

H. ASTM A312/A312M - Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.

I. ASTM A492 - Standard Specification for Stainless Steel Rope Wire.

J. ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing.

K. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

L. ASTM A743/A743M - Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.

M. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

N. 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.

O. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

P. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

Q. ASTM B247 - Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings.

R. ASTM B429/B429M - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.

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

T. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.

U. ASTM D6386 - Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting.

V. ASTM E488/E488M - Standard Test Methods for Strength of Anchors in Concrete Elements.

W. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

X. ASTM F594 - Standard Specification for Stainless Steel Nuts.

Y. ASTM F1941/F1941M - Standard Specification for Electrodeposited Coatings on Mechanical Fasteners, Inch and Metric.

Z. AWS D1.1/D1.1M - Structural Welding Code - Steel.

AA. AWS D1.2/D1.2M - Structural Welding Code - Aluminum.

BB. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel.

CC. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel.

DD. SSPC-PA 1 - Shop, Field, and Maintenance Coating of Metals.

EE. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).

FF. SSPC-SP 6 - Commercial Blast Cleaning.

GG. SSPC-SP 7 - Brush-Off Blast Cleaning.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, including finishing materials.

B. Shop Drawings: Show fabrication and installation details for decorative metal.
   1. Include plans, elevations, component details, and attachments to other work.
   2. Indicate materials and profiles of each decorative metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.

C. Patterns, Models, or Plaster Castings: Made from proposed patterns for each design of custom casting required.

D. Samples for Initial Selection: For products involving selection of color, texture, or design including mechanical finishes.

E. Samples for Verification: For each type of exposed finish required.
   1. Sections of linear shapes.
   2. Samples of welded joints showing quality of workmanship and color matching of materials.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified fabricator.

B. Mill Certificates: Signed by manufacturers of stainless-steel certifying that products furnished comply with requirements.

C. Welding certificates.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
   3. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
   4. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store decorative metal in a well-ventilated area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

B. Deliver and store cast-metal products in wooden crates surrounded by sufficient packing material to ensure that products will not be cracked or otherwise damaged.

1.09 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with decorative metal by field measurements before fabrication and indicate measurements on Shop Drawings.

1.10 COORDINATION

A. Coordinate installation of anchorages for decorative metal items. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 PRODUCTS

2.01 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. Provide materials without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

2.02 ALUMINUM

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.

B. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

C. Extruded Structural Pipe and Round Tubing: ASTM B429/B429M, Alloy 6063-T6.

D. Die and Hand Forgings: ASTM B247, Alloy 6061-T6.

E. Bolts, Nuts, and Washers: Stainless steel.

2.03 STAINLESS STEEL

A. Tubing: ASTM A554, Grade MT 304.

B. Pipe: ASTM A312/A312M, Grade TP 304.

C. Castings: ASTM A743/A743M, Grade CF 8 or CF 20.

D. Sheet, Strip, Plate, and Flat Bar: ASTM A666/A666M, Type 304.

E. Bars and Shapes: ASTM A276/A276M, Type 304.

F. Wire Rope and Fittings:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Cable Connection (The).
      b. Carl Stahl DecorCable, Inc.
      c. Esmet, Inc.
      d. Feeney Wire Rope & Rigging.
      e. Hayn Enterprises, LLC.
      f. Johnson, C. Sherman, Co., Inc.
      g. Loos & Co., Inc.
      h. Ronstan International Inc.
      i. Secosouth, Inc.
   2. Wire Rope: 1-by-19 wire rope made from wire complying with ASTM A492, Type 316.
   3. Wire-Rope Fittings: Connectors of types indicated, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.

2.04 STEEL AND IRON

A. Recycled Content of Steel Products: Post-consumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.

B. Bars: Hot-rolled, carbon steel complying with ASTM A29/A29M, Grade 1010.

C. Plates, Shapes, and Bars: ASTM A36/A36M.

D. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M unless otherwise indicated.

E. Steel Sheet, Cold Rolled: ASTM A1008/A1008M, either commercial steel or structural steel, exposed.

2.05 FASTENERS

A. Fastener Materials: Unless otherwise indicated, provide the following:
   1. Aluminum Items: Type 304 stainless-steel fasteners.
   2. Stainless-Steel Items: Type 304 stainless-steel fasteners.
   3. Titanium Items: Type 304 stainless-steel fasteners.
   4. Uncoated-Steel Items: Plated steel fasteners complying with ASTM B633, Class Fe/Zn 25 for electrodeposited zinc coating where concealed, Type 304 stainless-steel fasteners where exposed.
   5. Galvanized-Steel Items: Plated steel fasteners complying with ASTM B633, Class Fe/Zn 25 for electrodeposited zinc coating.
   6. Dissimilar Metals: Type 304 stainless-steel fasteners.

B. Fasteners for Anchoring to Other Construction: Unless otherwise indicated, select fasteners of type, grade, and class required to produce connections suitable for anchoring indicated items to other types of construction indicated.

C. Provide concealed fasteners for interconnecting components and for attaching decorative metal items to other work unless exposed fasteners are unavoidable.
   1. Provide Phillips flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

E. Post-Installed Anchors: Torque-controlled expansion type.
   1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5 unless otherwise indicated.
   2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

2.06 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
   1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Etching Cleaner for Galvanized Metal: Complying with ASTM D6386.

C. Low-Emitting Paints and Coatings: Paints and coatings applied to interior decorative metal items shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 SSPC-Paint 20 and compatible with paints specified to be used over it.

E. Shop Primers: Provide primers that comply with 09 Section, "Painting."

F. Universal Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
   1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
      a. Basis of Design: PPG 6-208 Speedhide Interior exterior Rust Inhibitive Steel Primer.

G. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
   1. Basis of Design: PPG 97-670 Aquapon Epoxy Zinc Rich primer or PPG Amercoat 68 HS Zinc Rich Epoxy Primer.

H. Shop Primer for Galvanized Steel: Water-based galvanized metal primer complying with MPI#134.
   1. Basis of Design: PPG 90-912 Pitt Tech Plus DTM Primer Finish

I. Intermediate Coats and Topcoats for Steel: Provide products that comply with 09 Section, “Painting."

J. Epoxy Intermediate Coat for Steel: Complying with MPI#77 and compatible with primer and topcoat.

K. Polyurethane Topcoat for Steel: Complying with MPI#72 and compatible with undercoat.

L. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.07 FABRICATION, GENERAL

A. Assemble items in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

B. Make up wire-rope assemblies in the shop to field-measured dimensions with fittings machine swaged. Minimize amount of turnbuckle take-up used for dimensional adjustment so maximum amount is available for tensioning wire ropes. Tag wire-rope assemblies and fittings to identify installation locations and orientations for coordinated installation.

C. Form decorative metal to required shapes and sizes, true to line and level with true curves and accurate angles and surfaces. Finish exposed surfaces to smooth, sharp, well-defined lines and arris.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.

E. Form simple and compound curves in bars, pipe, tubing, and extruded shapes by bending members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces.

F. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

G. Mill joints to a tight, hairline fit. Cope or miter corner joints. Fabricate connections that will be exposed to weather in a manner to exclude water.

H. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.

I. Provide necessary rebates, lugs, and brackets to assemble units and to attach to other work. Cut, reinforce, drill, and tap as needed to receive finish hardware, screws, and similar items unless otherwise indicated.

J. Comply with AWS for recommended practices in shop welding. Weld behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded joints of flux, and dress exposed and contact surfaces.
   1. Where welding cannot be concealed behind finished surfaces, finish joints to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 Welds: no evidence of a welded joint.

K. Provide castings that are sound and free of warp, cracks, blowholes, or other defects that impair strength or appearance. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks.

2.08 DECORATIVE MECHANICAL GRILLES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Architectural Grille.
   2. Beaux-Artes.
   3. Harrington & King Perforating Company, Inc.

4. Reggio Register Company, Inc.
5. Register & Grille Mfg. Co., Inc.

B. Fabricate decorative grilles from perforated aluminum sheet or plate of thickness, size, and pattern indicated. Form perforations by punching, cutting, or drilling to produce openings of sizes and shapes indicated. Roll, press, and grind perforated metal to flatten and to remove burrs and deformations.
   1. Form perforations to match existing grilles.
   2. Drawings indicate perforated metal patterns required and are based on products of one manufacturer. Perforated metal patterns produced by other manufacturers may be considered, provided deviations are minor and do not change design concept as judged solely by Architect.

C. Drill and countersink grilles for mounting screws at 2 inches (50 mm) from corners and at 10 inches (250 mm) or less o.c. Provide units with oval-head self-tapping machine screws.

D. Fabricate grille frames from extruded aluminum of profiles, and to sizes and shapes indicated. Miter frame members at corners and connect with concealed splice plates welded to back of frames.
   1. Secure grilles in frames with 0.5-inch- (12-mm-) long welds along perimeter of grilles at 4 inches (100 mm) o.c.
   2. Provide frame profiles to match existing frames.
   3. Drawings indicate frame profiles required and are based on products of one manufacturer. Similar frame profiles produced by other manufacturers may be considered, provided deviations are minor and do not change design concept as judged solely by Architect.

E. Drill and countersink frames for mounting screws at 4 inches (100 mm) from corners and at 16 inches (400 mm) or less o.c. Provide units with oval-head self-tapping machine screws.

2.09 ARCHITECTURAL SCREEN

A. To be coordinated with Owner and Architect.

B. Fabricate decorative grilles from perforated aluminum sheet or plate of thickness, size, and pattern indicated. Form perforations by punching, cutting, or drilling to produce openings of sizes and shapes indicated. Roll, press, and grind perforated metal to flatten and to remove burrs and deformations.
   1. Form perforations to match existing grilles.
   2. Drawings indicate perforated metal patterns required and are based on products of one manufacturer. Perforated metal patterns produced by other manufacturers may be considered, provided deviations are minor and do not change design concept as judged solely by Architect.

C. To be coordinated with Owner and Architect.

2.10 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.11 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
   1. Color and Gloss: As selected by Architect from manufacturer's full range.

2.12 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
   1. Run grain of directional finishes with long dimension of each piece.

C. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

D. Directional Satin Finish: No. 4.

E. Dull Satin Finish: No. 6.

F. Reflective, Directional Polish: No. 7.

G. Mirrorlike Reflective, Nondirectional Polish: No. 8.

H. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.13 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize products made from rolled, pressed, and forged steel shapes, castings, plates, bars, and strips indicated to be galvanized to comply with ASTM A123/A123M.
   1. Hot-dip galvanize steel and iron hardware indicated to be galvanized to comply with ASTM A123/A123M.
   2. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
   3. 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. Preparing Galvanized Items for Shop Priming: After galvanizing, thoroughly clean decorative metal of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

C. Preparing Nongalvanized Items for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with requirements indicated below:
   1. Exteriors (SSPC Zone 1B): SSPC-SP 6, "Commercial Blast Cleaning."
   2. Interiors (SSPC Zone 1A): SSPC-SP 7, "Brush-off Blast Cleaning."

D. Primer Application: Apply shop primer to prepared surfaces of items unless otherwise indicated. Comply with requirements in SSPC-PA 1 , "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
   1. Shop prime uncoated ferrous-metal surfaces with universal shop primer unless 09 Section, "Painting" are indicated.
   2. Do not apply primer to galvanized surfaces.

E. Shop-Painted Finish: Comply with 09 Section "Painting."
   1. Color: As selected by Architect from manufacturer's full range.

F. Powder-Coat Finish: Prepare, treat, and coat nongalvanized ferrous metal to comply with resin manufacturer's written instructions and as follows:
   1. Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6 "Commercial Blast Cleaning."
   2. Treat prepared metal with iron-phosphate pretreatment, rinse, and seal surfaces.
   3. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils (0.04 mm).
   4. Color: As selected by Architect from manufacturer's full range.

G. Powder-Coat Finish: Prepare, treat, and coat galvanized metal to comply with resin manufacturer's written instructions and as follows:
   1. Prepare galvanized metal by thoroughly removing grease, dirt, oil, flux, and other foreign matter.
   2. Treat prepared metal with zinc-phosphate pretreatment, rinse, and seal surfaces.
   3. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils (0.04 mm).
   4. Color: As selected by Architect from manufacturer's full range.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative metal.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Provide anchorage devices and fasteners where needed to secure decorative metal to in-place construction.

B. Perform cutting, drilling, and fitting required to install decorative metal. Set products accurately in location, alignment, and elevation, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry, or similar construction.

C. Fit exposed connections accurately together to form tight, hairline joints or, where indicated, uniform reveals and spaces for sealants and joint fillers. Where cutting, welding, and grinding are required for proper shop fitting and jointing of decorative metal, restore finishes to eliminate evidence of such corrective work.

D. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.

E. Install concealed gaskets, joint fillers, insulation, and flashings as work progresses.

F. Restore protective coverings that have been damaged during shipment or installation. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at same location.
   1. Retain protective coverings intact; remove coverings simultaneously from similarly finished items to preclude nonuniform oxidation and discoloration.

G. Field Welding: Comply with applicable AWS specification for procedures of manual shielded metal arc welding and requirements for welding and for finishing welded connections in "Fabrication, General" Article. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.

H. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.03 INSTALLING DECORATIVE MECHANICAL GRILLES

A. Mount decorative grilles at heights and in positions indicated, adjusting ductwork to be centered on grilles if any.
   1. Secure to framing and blocking with specified fasteners.
   2. On marble, brick, and other solid surfaces, secure with wood screws in lead plugs.

3.04 CLEANING AND PROTECTION

A. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.

B. Clean copper alloys according to metal finisher's written instructions in a manner that leaves an undamaged and uniform finish matching approved Sample.

C. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

D. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M .

E. Protect finishes of decorative metal from damage during construction period with temporary protective coverings approved by decorative metal fabricator. Remove protective covering at time of Substantial Completion.

F. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

SECTION 05 71 00
DECORATIVE METAL STAIRS

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 SECTION INCLUDES

A. Decorative metal stairs.

1.03 RELATED REQUIREMENTS

A. Section 05 12 13 - Architecturally-Exposed Structural Steel Framing: Exposed steel at decorative metal stairs.

B. Section 05 73 00 - Decorative Metal Railings: Railing and guardrail assemblies.

C. Section 06 20 00 - Finish Carpentry: Tread and guardrail cap finish material.

D. Section 09 91 23.01 - Painting Schedule Interior: Paint finish of all steel surfaces, regardless of exposure to view.

E. Section 09 96 00 - High-Performance Coatings: Paint finish of all steel surfaces, regardless of exposure to view

1.04 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

C. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

D. 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.

E. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.

F. AWS D1.1/D1.1M - Structural Welding Code - Steel.

G. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172.

H. NAAMM AMP 510 - Metal Stairs Manual.

I. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Schedule and conduct a preinstallation meeting one week before starting work of this section. Attendees shall include, but not be limited to:
   1. Contractor.
   2. Manufacturer's representative.
   3. Owner's representative.
   4. Other subcontractors of adjacent work.

1.06 SUBMITTALS

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

B. Product Data: Submit manufacturer's product data, including description of materials, components, finishes, fabrication details, anchors, and accessories.

C. Shop Drawings: Indicate stair plans, elevations, and sections, details of profiles, dimensions, sizes, connection attachments, anchorage, size and type of fasteners, and accessories. Indicate anchor and joint locations, brazed connections, transitions, and terminations.

1. Indicate detailed stair configuration, support loads, supporting accessories and connections, floor opening details, required floor opening and stair height tolerances, and other measurements affecting the stair.
2. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
3. Include the design engineer's seal and signature on each sheet of shop drawings.

D. Samples: Submit one (1) of below for each type and condition shown.
1. Metal Mesh: 6 inch by 6 inch sample of each type of cladding, illustrating finish.

E. Installer's qualification statement.

F. Executed warranty.

1.07 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in Louisiana or personnel under direct supervision of such an engineer.

B. Fabricator Qualifications:
1. Accredited by International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.

1.08 MOCK-UPS

A. Provide mock-up of decorative stair with railing system, freestanding center rail, wall-mounted handrail, guardrail, smoke baffle system, and wood elements specified in Section 05 70 00, 4 feet long by 4 feet wide, illustrating each type of material, cladding, and finish.

B. Mock-up may not remain as part of the work.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in factory-provided protective coverings and packaging.

B. Protect materials against damage during transit, delivery, storage, and installation at site.

C. Inspect materials for damage upon delivery. Replace damaged and unrepairable materials. Ensure replacement materials are indistinguishable from undamaged parts and finishes.

D. Prior to installation, store materials and components under cover in a dry location.

1.10 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Decorative Metal Stairs:
1. Acadia Stairs: www.acadiastairs.com.
2. Couturier Iron Craft, Inc: www.couturierironcraft.com.
3. C.R. Laurence Co., Inc. (CRL): www.crlaurence.com.
4. Duvinage LLC: www.duvinage.com.
5. Paragon Stairs; Spiral and Floating Stairs: www.paragonstairs.com.
6. The Wagner Companies: www.wagnercompanies.com.
7. Substitutions: See Section 01 60 00 - Product Requirements.

B. Metal Mesh Infill Panels:
1. Any manufacturer listed above in Decorative Metal Stairs
2. Cambridge Architectural Mesh, A Rexnord Business: www.cambridgearchitectural.com.
3. The G-S Company: www.g-sco.com.
4. The Western Group: www.architecturalwire.com.
5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DECORATIVE METAL STAIRS

A. Decorative Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings and guards, fabricated for anchorage to each other and to building structure.

1. Regulatory Requirements: Comply with the most stringent requirements of local, state, and federal regulations; where requirements of Contract Documents exceed those of regulations, comply with Contract Documents.
2. Configuration and Dimensions: As indicated on Drawings.
3. Assembly:
    a. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
    b. Eliminate sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
    c. Separate dissimilar metals using paint or permanent tape.

B. Metal Jointing and Finish Quality Levels: Architectural, as defined below.
1. Architectural: Inconspicuous joints, whether welded or mechanical.
    a. Welded Joints: Continuously welded and ground smooth and flush.
    b. Mechanical Joints: Butted tight, flush, and hairline; concealed fastenings only.
    c. Exposed Edges and Corners: Eased to small uniform radius.
    d. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for highest quality gloss finish.

C. Provide required fasteners and anchors:
1. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.
2. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise.

2.03 FABRICATED SPIRAL STAIRS

A. Load Design: NAAMM AMP 510.
1. Uniform Live Load to Stair: 100 lbs/sq ft minimum.
2. Concentrated Live Load to Stair: 300 lbs minimum.
3. Maximum Lateral Load to Handrail Without Permanent Set: 200 lbs.

2.04 COMPONENTS

A. Treads: Concrete-filled steel pan treads.
1. Concrete Depth: 1-1/2 inches, minimum.
2. Tread Pan Material: Steel sheet.
3. Tread Pan Thickness: As required by design; 14 gauge, 0.075 inch minimum.
4. Pan Anchorage to Stringers: Welded to carrier angles welded to stringers.
5. Concrete Reinforcement: None.
6. Concrete Finish: Applied abrasive grit.

B. Risers: Closed and Open as indicated on Drawings.

C. Risers: Solid steel sheet.
1. Riser Thickness: As required by design; 14 gauge, 0.075 inch minimum.
2. Riser/Nosing Profile: Vertical riser with underside of nosing sloped up from bottom of tread pan at not less than 60 degrees from horizontal, with rounded top of nosing of radius no greater than 1/2 inch.
3. Nosing Depth: 1-1/2-inch overhang, maximum.
4. Nosing Return: Flush with top of concrete fill, not more than 1/2 inch wide.

D. Stringers: Steel channels.
1. Stringer Depth: As required to meet structural loads, but not less than 10 inches.
2. End Closure: Sheet steel of same thickness as risers welded across ends.

E. Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity.
1. Coordinate with wood material matching tread species and color.

F. Handrail: Wood of oak species.

G. Finish: Shop- or factory-prime painted in accordance with Section 09 91 23.01 - Painting Schedule Interior.

H. Under Side of Stair: Exposed to view, to be finished same as specified for other exposed to view surfaces.

I. Handrails and Guards:
   1. Post-Mounted Handrails: Round pipe or tube rails unless otherwise indicated.
      a. Outside Diameter: 1-1/4 inch, minimum, to 1-1/2 inches, maximum.
      b. Provide handrail support centered at each post.
      c. Handrail support bracket: Square cross section, unless otherwise detailed on Drawings.
   2. Guards:
      a. Top Rails: Flat stock steel with wood cap, as detailed, unless otherwise indicated.
         1) Profile Dimension 1-1/2 inches.
         2) Mounting: Welded to posts.
      b. Intermediate Rails: Square tube, 1-1/2 inches, unless otherwise indicated.
         1) Spacing: As indicated on Drawings.
         2) Mounting: Welded to posts.
      c. Bottom Rails: Square tube, 1-1/2 inches, unless otherwise indicated.
         1) Mounting: Welded to posts.
      d. End and Intermediate Posts: Square tube, 1-1/2 inches, unless otherwise indicated.
         1) Horizontal Spacing: As indicated on Drawings.
         2) Mounting: Welded to top surface of stringer.
      e. Infill at Mesh Railings: Mesh panels.
         1) Material and Finish: As scheduled on Drawings.
         2) Mounting: Mesh welded to steel bar frame, frame welded to posts, unless otherwise indicated on Drawings.

2.05 MATERIALS

A. Steel Components:
   1. Sections, Shapes, Plate and Bar: ASTM A36/A36M.
   2. Ungalvanized Steel Sheet: Cold-rolled only.
      a. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).

B. Concrete Fill: Portland cement Type I, 3000 psi 28-day strength, 2- to 3-inch slump.

2.06 ACCESSORIES

A. Anchors and Fasteners: Provide anchors and other materials as required to attach to structure, made of same materials as stair components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
   1. For anchorage to concrete, provide inserts to be cast into concrete for bolt anchors.
   2. For anchorage to masonry, provide brackets to be embedded in masonry for bolt anchors.
   3. For anchorage to stud walls, provide backing plates for bolt anchors.
   4. Exposed Fasteners: No exposed bolts or screws.

B. Steel Bolts, Nuts, and Washers: ASTM A307, Grade A, galvanized to ASTM A153/A153M where connecting galvanized components.

C. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

D. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate and site conditions are acceptable and ready to receive work.

B. Verify field dimensions of locations and areas to receive work.

C. Notify Architect immediately of conditions that would prevent satisfactory installation.

D. Do not proceed with work until detrimental conditions have been corrected.

E. Furnish components to be installed in other work to installer of that other work, including but not limited to blocking, sleeves, inserts, anchor bolts, embedded plates, and supports for attachment of anchors.

3.02 PREPARATION

A. Review installation drawings before beginning installation. Coordinate diagrams, templates, instructions, and directions for installation of anchorages and fasteners.

B. Clean surfaces to receive units. Remove materials and substances detrimental to installation.

3.03 INSTALLATION

A. Comply with approved shop drawings and written instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, and with tight joints, except where necessary for expansion.

C. Anchor securely to structure.

D. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

E. Weld connections that cannot be shop welded due to size limitations.
   1. Weld in accordance with AWS D1.1/D1.1M.
   2. Match shop welding and bolting.
   3. Clean welds, bolted connections, and abraded areas.
   4. Touch up shop primer and factory-applied finishes.

F. Isolate dissimilar materials with bituminous coating, bushings, grommets, or washers to prevent electrolytic corrosion.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

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.

3.06 PROTECTION

A. Protect installed components and finishes from damage after installation.

B. Repair damage to exposed finishes to be indistinguishable from undamaged areas.
   1. If damage to finishes and components cannot be repaired to be indistinguishable from undamaged finishes and components, replace damaged items.

END OF SECTION

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SECTION 05 73 00
DECORATIVE METAL RAILINGS

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 SECTION INCLUDES

A. Railing systems.

B. Windscreen system.

1.03 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Structural substrate for exterior balconies.

B. Section 04 20 00 - Unit Masonry: Structural wall substrate for exterior balconies.

C. Section 05 50 00 - Metal Fabrications: Supports.

D. Section 08 80 00 - Glazing.

1.04 REFERENCE STANDARDS

A. AAMA 611 - Specification for Anodized Architectural Aluminum.

B. ADA Standards - 2010 ADA Standards for Accessible Design.

C. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

D. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

E. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

F. ASTM B211/B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire.

G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

I. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

J. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.

K. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.

L. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.

M. AWS D1.1/D1.1M - Structural Welding Code - Steel.

N. AWS D1.2/D1.2M - Structural Welding Code - Aluminum.

O. NAAMM AMP 500-06 - Metal Finishes Manual.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meeting: Schedule and conduct a preinstallation meeting one week prior to the start of the work of this section. Invite all affected subcontractors and trades.

B. Preinstallation Meeting: Convene preinstallation meeting one week prior to the start of the work of this section. Invite all affected subcontractors and trades.

1.06 SUBMITTALS

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

B. Product Data: Submit manufacturer's product data, including description of materials, components, finishes, fabrication details, glass, anchors, and accessories.

C. Shop Drawings: Indicate railing system elevations and sections, details of profile, dimensions, sizes, connection attachments, anchorage, size and type of fasteners, and accessories. Indicate anchor and joint locations, brazed connections, transitions, and terminations.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
   2. Include design engineer's seal and signature on each sheet of shop drawings.

D. Design Data: As required by authorities having jurisdiction.

E. Test Reports: Submit test reports from independent testing agency showing compliance with specified design and performance requirements.

F. Certification letter from Installer on company letterhead demonstrating that installed system complies with applicable codes, signed by the Installer and Contractor.

G. Manufacturer's Instructions: Indicate installation.

H. Designer's qualification statement.

I. Executed warranty.

J. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.07 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in Louisiana or personnel under direct supervision of engineer.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least five years of documented experience.

C. Installer Qualifications:

D. Welder Qualifications: Welding processes and welding operators certified in accordance with AWS B2.1/B2.1M within 12 months of scheduled welding work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in factory-provided protective coverings and packaging.

B. Protect materials against damage during transit, delivery, storage, and installation at site.

C. Inspect materials upon delivery for damage. Replace damaged items.

D. Prior to installation, store materials and components under cover in dry location.

1.09 WARRANTY

A. Manufacturer Warranty: Provide 2-year manufacturer warranty for defects in materials, fabrication, finishes, and installation. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 RAILING SYSTEMS

A. General: Factory- or shop-fabricated to suit project conditions, for proper connection to building structure, and in largest sizes practical for delivery to site.

B. Performance Requirements:

C. Performance Requirements: Applying loads simultaneously not required; design and fabricate railings and anchorages to resist loads without failure, damage, or permanent set, including:
   1. Lateral Force: 75 lb minimum, when tested in accordance with ASTM E935.
   2. Distributed Load: 50 lbf/ft minimum, applied vertically and horizontally at top of handrail, when tested in accordance with ASTM E935.
   3. Concentrated Loads: 200 lb minimum, applied to handrail horizontally and vertically, in accordance with ASTM E935.

D. Assembly: Use slip-on, nonweld mechanical fittings, flanges, escutcheons, and wall brackets to join lengths, seal open ends, and conceal exposed mounting bolts and nuts.

E. Joints: Machined smooth with hairline seams; tightly fitted and secured.

F. Field Connections: Provide sleeves to accommodate site assembly and installation.

G. Metal Railing: Engineered, post-supported railing system with metal infill.
   1. Configuration: Guardrail only.
   2. Top Rail: 1-1/2- by 1-1/2-inch square tube, aluminum.
   3. Bottom Rail: 1-1/2 by 1-1/2 inch, square tube.
   4. Decorative Flanges for Embedded Posts: Collared cover plate without screw holes.
   5. Wall-Mounted Components: Support railing with 1-1/2-inch clearance from wall using the following:
      a. Wall Return without Support: Terminates 1/4 inch from side wall.
   6. Fasteners: Concealed.
   7. Infill at Picket Railings: Vertical pickets.
      a. Horizontal Spacing: Maximum 4 inches on center.
      b. Material: Aluminum tube.
      c. Shape: Square.
      d. Size: Not less than 3/4 inch square and of sufficient wall thickness for this application, and as required per structural calculations.
      e. Size: Not less than 3/4-inch square and of sufficient wall thickness for this application, and as required per structural calculations.
      f. Top Mounting: Welded to underside of top rail.
      g. Bottom Mounting: Welded to bottom rail.
   8. End and Intermediate Posts: Same material and size as top rails.
      a. Intermediate Post Spacing: As required to comply with building codes and project specific railing system calculations.
      b. Mounting: Welded.
   9. Swing Gates: Same material and size as top rails.
      a. Infill Material: Matching railing infill.
      b. Hinges: Finished to match fence components.
         1) Closing: Self.
         2) Mechanism: Hydraulic.
         3) Mounting: Flush.
         4) Brackets: Square.
         5) Bearings: Ball.
      c. Latches: Finished to match fence components.
         1) Mechanism: Gravity.
         2) Locking: Mechanical.
         3) Mounting: Same material and profile as railing system.
         4) Brackets: Square.

2.02 WINDSCREEN SYSTEM

A. Windscreen System:
   1. Locations: At perimeter of elevated amenity where indicated on Drawings.
   2. Configuration: As indicated on Drawings.
   3. Posts: Rectangular, aluminum 2 by 2 inches.
   4. Anchors: Stainless steel bolts with plastic isolator sleeves.
   5. Glass: See Section 08 80 00.
   6. Aluminum Finish, Exposed Surfaces: Color anodized finish.

2.03 MATERIALS

A. Aluminum Components: ASTM B221 or ASTM B221M.
   1. Tubes: Schedule 40 pipe.
   2. Extruded Aluminum: ASTM B221 or ASTM B221M, 6063 alloy, T6 temper.
   3. Sheet Aluminum: ASTM B209/B209M, 5052 alloy, H32 or H22 temper.
   4. Aluminum-Alloy Bars: ASTM B211/B211M, 6061 alloy, T6 temper.
   5. Sheet Thickness: 0.125 inch, minimum.
   6. Bolts, Nuts, and Washers: Stainless steel.

7. Welding Materials: AWS D1.2/D1.2M.

2.04 FABRICATION

A. Welded and Brazed Joints: Make visible joints butt tight, flush, and hairline; use methods that avoid discoloration and damage of finish; grind smooth, polish, and restore to required finish.
   1. Ease exposed edges to small uniform radius.
   2. Welded Joints:

2.05 FINISHES

A. General: Comply with NAAMM AMP 500-06.
   1. Complete mechanical finishes before fabrication. After fabrication, finish joints, bends, abrasions, and surface blemishes to match sheet.
   2. Protect mechanical finishes on exposed surfaces from damage.
   3. Apply organic and anodic finishes to formed metal after fabrication.
   4. Appearance: Limit variations in appearance of adjacent pieces to one-half of range represented in approved samples. Noticeable variations in same piece are not acceptable. Install components within range of approved samples to minimize contrast.

B. Aluminum Finishes:
   1. Class I Color Anodized Finish: AAMA 611 AA-M12C22A44, electrolytically deposited, colored anodic coating not less than 0.7 mil, 0.007 inch thick.
   2. Color: As indicated on Drawings.

2.06 ACCESSORIES

A. Welding Fittings: Factory- or shop-welded from matching pipe or tube; joints and seams ground smooth.

B. Anchors and Fasteners: Provide anchors, fasteners, and other attachment devices required to attach to structure.
   1. Stainless Steel Fasteners: Type 304.
   2. Exposed Fasteners: Not allowed.
   3. For anchorage to steel framed exterior stud walls, provide backing plates for bolt anchors. See Sections 05 40 00 - Cold-Formed Metal Framing and 05 50 00 - Metal Fabrications.
   4. For anchorage to wood framed exterior stud walls, provide backing plates for bolt anchors. See Sections 06 10 00 - Rough Carpentry and 05 50 00 - Metal Fabrications.

C. Hydraulic Expansion Cement: ASTM C1107/C1107M.

D. Bituminous Coating: Cold-applied asphalt mastic, noncorrosive compound free of asbestos, sulfur, and other deleterious impurities; 0.015-inch dry film thickness per coat.

E. Sealant: Silicone; black.

F. Finish Touch-Up Materials: As recommended in writing by manufacturer for field application, based on metal substrate and specified finish; comply with VOC limitations of authorities having jurisdiction.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate and site conditions are acceptable and ready to receive work.

B. Verify field dimensions of locations and areas to receive work.

C. Notify Architect immediately of conditions that would prevent satisfactory installation.

D. Do not proceed with work until detrimental conditions are corrected.

3.02 PREPARATION

A. Furnish components to be installed in other work to installer of that other work, including but not limited to blocking, sleeves, inserts, anchor bolts, embedded plates, and supports for attachment of anchors.

B. Protection of In-Place Conditions: Protect existing work before proceeding with installation.

C. Review installation drawings before beginning installation. Coordinate diagrams, templates, instructions, and directions for installation of anchorages and fasteners.

D. Clean surfaces to receive railings. Remove materials and substances detrimental to installation.

3.03 INSTALLATION

A. Install in accordance with manufacturer's written instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, and with tight joints, except where necessary for expansion.

C. Anchor securely to structure.

D. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

E. Weld connections that cannot be shop welded due to size limitations.
   1. Weld in accordance with AWS D1.1/D1.1M.
   2. Match shop welding and bolting.
   3. Clean welds, bolted connections, and abraded areas.
   4. Touch up shop primer and factory-applied finishes.
   5. Repair galvanizing with galvanizing repair paint in accordance with ASTM A780/A780M.

F. Isolate dissimilar materials with bituminous coating, bushings, grommets, or washers to prevent electrolytic corrosion.

3.04 INSTALLATION TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per floor level, noncumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

3.05 FIELD QUALITY CONTROL

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

B. Test railings for structural performance in accordance with ASTM E935.

C. Manufacturer Services: Provide services of manufacturer's field representative to observe railing installation.

3.06 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 written recommendations; do not use abrasive materials or chemicals, detergents, or other substances that may damage material or finish.

3.07 PROTECTION

A. Protect installed components and finishes from damage after installation.

B. Repair damage to exposed, making finishes indistinguishable from undamaged areas.

C. Replace finishes and components that have irreparable damage. Ensure damaged areas are indistinguishable from undamaged finishes and surfaces.

3.08 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. Provide Certification Letter to Owner stating installed railing system is compliant with code mandated loading and dimensional requirements.

END OF SECTION

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SECTION 05 73 13
GLAZED DECORATIVE METAL RAILINGS

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 SECTION INCLUDES

A. Glass and metal railing system for balconies, amenity deck, and pool enclosure in locations indicated on Drawings.

1.03 RELATED REQUIREMENTS:

A. Section 03 30 00 - Cast-in-Place Concrete; Substrate for attachment of railing system.

B. Section 05 12 00 - Structural Steel Framing: Steel building framing.

C. Section 05 73 00 - Decorative Metal Railings: Railing and guardrail assemblies without glass infill panels.

D. Section 08 80 00 - Glazing; Glass as part of handrails specified in this Section.

1.04 REFERENCE STANDARDS

A. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

C. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.

D. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass.

E. ASTM E894 - Standard Test Method for Anchorage of Permanent Metal Railing Systems and Rails for Buildings.

F. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.

G. National Association of Architectural Metal Manufacturers (NAAMM): Metal Finishes Manual.

H. National Association of Architectural Metal Manufacturers (NAAMM): Pipe Railing Manual.

1.05 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design glazed railing and guardrail system using performance requirements and design criteria indicated. Submit comprehensive engineering analysis signed and sealed by a qualified Structural Engineer licensed in Louisiana

B. Performance Requirements for Guard Assembly:
   1. Support distributed load of 50 pounds per linear foot (0.73kN/M), applied horizontally at right angles in any direction to the top/grab rail.
   2. Support concentrated horizontal load of 200 pounds (0.89kN), applied in any direction at any point along top/grab rail.
   3. 50 pounds (0.22kN) on 1 sf (0.093m2) perpendicular to guard at any location
   4. Wind loads 25 psf or as otherwise specified.
   5. These loads need not to be assumed to act concurrently.
   6. Maximum deflection at top of glass is height/24.

C. Rail Tested per ASTM E894 - Standard Test Method for Anchorage of Permanent Metal Railing Systems and Rails for Buildings.

D. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.

1.06 SUBMITTALS

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

B. Product Data: Manufacturer to submit approval drawings to include the following:

1. Section-thru details.
2. Mounting methods for metal components and for glazing.
3. Typical elevations.
4. Key plan layouts.

C. Delegated-Design Submittal: For glazed handrail system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation. Calculations showing point support reactions and glass stresses.

D. Shop Drawings: Drawings showing fabrication and installation of handrails including plans, elevations, sections, details of components, anchor details, and attachment to adjoining units of work.
1. Elevations; include joint locations, transitions, and terminations.
2. Glass light fabrication plans with dimensions, holes and finishes.
3. Point support layout, details and attachment to support structure.
4. Manufacturer’s installation and maintenance instructions.

1.07 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in Louisiana.

B. Source Limitations: Obtain each type of railing through one source from a single manufacturer.

C. All glass shall be fabricated to a tolerance of 1/32” for the light size and hole locations.

D. Thermal Action and Corrosion Control:
1. Allow for thermal action resulting from the maximum range change in ambient temperature in the design, fabrication and installation of rail systems, to prevent opening of joints, buckling, and other detrimental effects, including over-stressing of connections and components.
2. Prevent galvanic action, and other forms of corrosion by isolating dissimilar metals to prevent them from being in direct contact with each other.

E. Fabricator Qualifications: Company specializing in manufacturing products specified in this section with not less than five years of documented experience.

F. Installer Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver handrails, guardrails, and railing systems and related components in manufacturer's original protective packaging with labels intact and store components to avoid damage from moisture, abrasion, and other construction activities.
1. All materials must be delivered, stored and handled by manufacturer approved technicians only.

B. Store on site in a location and manner to avoid damage. Stacking shall be done in a manner that will prevent bending in accordance with and my manufacturer approved technicians.

C. Store material in a clean, dry location away from uncured concrete and masonry. Any protection on the railings during transportation should remain uninstalled.

D. Keep handling on site to a minimum. Exercise caution to avoid damage to finishes of material.

1.09 PROJECT CONDITIONS

A. Field Measurements: Where handrails and railings are indicated to fit to other construction, check actual dimensions of other construction by accurate field measurements before fabrication; show recorded measurements on final shop drawings.

B. Where field measurements cannot be made without delaying the railing fabrication and delivery, obtain guaranteed dimensions in writing by the Contractor and proceed with fabrication of products to not delay fabrication, delivery, and installation.

C. Coordinate fabrication and delivery schedule of handrails with construction progress and sequence to avoid delay of railing installation.

1.10 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior window and door asemblies by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
   1. Temperature Change: Design system to accommodate without deformation anticipated thermal movement over ambient temperature range of 120 degrees F, ambient; 180 degrees F material surfaces.

2.02 MANUFACTURERS

A. The Wagner Companies, R&B Wagner, Inc.: www.wagnercompanies.com. (Basis of Design)
   1. Phone (888) 243-6914.
   2. Email: info@mailwagner.com.

B. C.R. Laurence Co., Inc. (CRL).: www.crlaurence.com.
   1. Phone (800) 421-6144.
   2. Email: railings@crlaurence.com.

C. P + P Artec; Chicago stainless steel railing system: www.artec-rail.com.
   1. Phone (603) 860-2990.
   2. Email: info@artec-rail.com.

D. AGS Stainless, Inc.; Glacier Panel Railing System: www.agsstainless.com.
   1. Phone (888) 842-9492; Fax (206) 842 8179.
   2. Email: info@agsstainless.com.

E. Greco Architectural Metal Products, a CSW Industrials Company: www.grecorailings.com. (Basis of Design)
   1. Phone (727) 372-1100
   2. Email:

F. VGM Holdings, LLC: www.vgmholdings.com.

G. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 MATERIALS AND FINISHES

A. Material quality: Provide materials free from surface blemishes where exposed to view in the finished installation.

B. Materials:
   1. All stainless steel to be ASTM A666/A666M, Type 304 or 316 welded stainless steel, ornamental, brushed finish.
   2. All fittings to be ASTM A666/A666M, Type 304 or 316 stainless steel.
   3. Glass: Refer to Division 08 Section “Glass and Glazing.”
   4. Shoe: Cast Aluminum, ASTM B221, 6063-T52 Alloy.
   5. Standard wet glaze system.

C. Finish: Brushed stainless steel #4.

D. Balusters: Solid 5/8 inch X 2 1/2 inch bar, Type 304 stainless steel.

E. Connection fittings: Type 304 stainless steel.

F. Railing Cap Profile: Profile as indicated on Drawings
   1. Round: 1 1/2 inch diameter.

G. Through Glass Handrail Brackets:
   1. Material: Stainless Steel Type 304 or 316 to match other components.
   2. Fabrication: Machined.
   3. Finish: Match handrail cap finish.

H. Glazing: Fully tempered in accordance with ASTM C1048 Kind FT, Quality q3 and laminated in accordance with ASTM C1172. As specified in Section 08 80 00 - Glazing.
   1. Thickness: 1/2 inch (12 mm) minimum.
   2. Color: Clear.
   3. Edge Finish: Chamfered and polished.

I. Mixes: Use Ceramic 6 Epoxy to cast Baluster into concrete.

2.04 FASTENERS

A. All mechanical fasteners used shall be manufactured from stainless steel. Types and sizes indicated on shop drawings and engineering report.

2.05 FABRICATION

A. Fabricate handrail assembly components to lengths and configurations complying with shop drawings.

B. Machine joint edges smooth and plane to produce hairline seams when site assembled; supply concealed sleeve connectors for joints.

C. Isolate dissimilar metals to prevent electrolytic action by applying primer to concealed surfaces of metal components.

D. All mitered and welded corners and end caps shall be ground smooth to match finish.

E. Make exposed joints butt tight and flush.

F. Interior sleeves shall be used for typical splices.

G. Fasteners are allowed at splice connection.

H. Verify dimensions on site prior to shop fabrication.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine system components, substrate and conditions where railing systems are to be installed.

B. Coordinate scope of field measurements with manufacturer requirements.

3.02 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages. These include items such as sleeves, concrete inserts, anchor bolts, and miscellaneous items having integral anchors that are to be imbedded in concrete and masonry construction.
   1. Coordinate delivery of anchorages to project site.
   2. Coordinate that blocking is in place for all mounting fasteners.

B. Clean debris and dust from surfaces and embed holes thoroughly prior to installation.

C. Prepare surfaces using the methods recommended in writing by the manufacturer for achieving proper results given the substrate and project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer’s written installation instructions and approved shop drawings.

B. Standoffs shall be located to a tolerance of 1/32 inch.

C. All bushings, spacers, bearing pads and other components shown in the shop drawings must be properly installed.

D. Fit exposed connections accurately together to form tight joints except as necessary for expansion.

E. Perform cutting, drilling, and fitting required for installation of handrails. Accurately set handrails in location, alignment, and elevation, measured from established lines and levels.

F. Set railing plumb within a tolerance of 1/8 inch.

G. When fastening to in-place construction, provide anchorage devices and fittings to properly secure rail to in-place construction. Examples of such devices include threaded fittings (for concrete inserts), toggle bolts and through-bolts. Separate dissimilar materials with bushings, grommets or washers to prevent electrolytic corrosion.

3.04 CLEANING

A. Clean glazing surfaces after installation, complying with requirements contained in the manufacturer's written instructions. Remove excess glazing sealant compounds, dirt or other substances.
   1. Use manufacturer approved silicon-free stainless steel cleaner.
   2. Do not use abrasive agents or harsh chemicals.
   3. Provide plastic sheet protection for all surfaces of completed installations to prevent damage during remainder of construction activities.

B. Remove protective films from metal surfaces.

C. Clean railing surfaces with clean water and mild detergent. Do not use abrasive chemicals, detergents, or other implements that may mar or gouge the material.

3.05 PROTECTION

A. Upon delivery railing may have protective wrapping. At completion of railing installation, immediately remove any protective wrapping and clean all work for inspection and approval.

B. After installation, Contractor shall be responsible for protection of railings during the balance of construction.

C. When cleaning stainless steel surfaces use plain water containing a mild soap or detergent. No abrasive agents or harsh chemicals shall be used.

D. Repair components damaged by subsequent construction activities in accordance with manufacturer's written recommendations; replace damaged components that cannot be repaired to Architect's acceptance.

END OF SECTION

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SECTION 05 75 00
DECORATIVE FORMED METAL

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 SECTION INCLUDES

A. Interior fabrications made of formed metal sheet, secondary supports, and anchors to structure.

1.03 RELATED REQUIREMENTS

A. Section 03 53 15 - Lightweight Concrete Floor Topping Accessories: Balcony topping and edge detailing.

B. Section 05 73 13 - Glazed Decorative Metal Railings: Balcony railings.

C. Section 07 92 00 - Joint Sealants.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

E. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes.

F. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.

G. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

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

I. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

J. ASTM C834 - Standard Specification for Latex Sealants.

K. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.

L. ASTM D523 - Standard Test Method for Specular Gloss.

M. ASTM D1056 - Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber.

N. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.

O. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.

P. ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.

Q. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C.

R. ASTM E488/E488M - Standard Test Methods for Strength of Anchors in Concrete Elements.

S. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

T. ASTM F594 - Standard Specification for Stainless Steel Nuts.

U. ASTM F1941/F1941M - Standard Specification for Electrodeposited Coatings on Mechanical Fasteners, Inch and Metric.

V. NAAMM AMP 500-06 - Metal Finishes Manual.

W. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).

1.05 SUBMITTALS

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

B. Shop Drawings: Show layout and elevations, dimensions and thickness of panels, connections, details and location of joints, sealants and gaskets, method of anchorage, number of anchors, supports, reinforcement, trim, flashings, and accessories.
   1. Differentiate between shop and field fabrication.
   2. Indicate substrates and adjacent work with which the fabrications must be coordinated.
   3. Include large-scale details of anchorages and connecting elements.
   4. Include large-scale details or schematic, exploded or isometric diagrams to fully explain connection details at not less than full scale.

C. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

D. Installer’s Qualification Statement.

E. Maintenance Data: Care of finishes and warranty requirements.

F. Executed Warranty: Submit warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating products specified in this section.
   1. With not less than five years of documented experience.
   2. Approved by manufacturer of components.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section.
   1. With minimum five years of documented experience.
   2. Approved by fabricator.

C. Mock-Up: Provide a mock-up for evaluation of fabrication workmanship.
   1. Locate where directed.
   2. Provide products finished as specified.
   3. Mock-up may not remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.
   1. Protect finishes by applying heavy duty removable plastic film during production.
   2. Package for protection against transportation damage.
   3. Provide markings to identify components consistently with drawings.
   4. Exercise care in unloading, storing and installing panels to prevent bending, warping, twisting and surface damage.

B. Store products protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
   1. Store in well ventilated space out of direct sunlight, on elevated platforms in a dry location.
   2. Protect from moisture and condensation with tarpaulins or other suitable weathertight covering installed to provide ventilation.
   3. Store at a slope to ensure positive drainage of accumulated water.
   4. Do not store in enclosed space where ambient temperature can exceed 120 degrees F.
   5. Avoid contact with other materials that might cause staining, denting, or other surface damage.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer’s Finish Warranty: Provide manufacturer's written warranty stating that the finish will perform as follows for minimum of 5 years:

1. Chalking: No more than that represented by a No.8 rating based on ASTM D4214.
2. Color Retention: No fading or color change in excess of 5 Hunter color difference units, calculated in accordance with ASTM D2244.
3. Gloss Retention: Minimum of 30 percent gloss retention, when tested in accordance with ASTM D523.

PART 2 PRODUCTS

2.01 FORMED METAL FABRICATIONS - GENERAL

A. General: Provide sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections where exposed to view on finished units.

B. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so post-consumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.

C. Shop Assembly: Preassemble items to greatest extent possible. Minimize field splices and field assembly. Disassemble only as necessary for transportation and handling. Mark items clearly for assembly and installation.

D. Coordination: Match dimensions and attachment of formed metal items to adjacent construction. Produce integrated assemblies. Closely fit joints; align edges and flat surfaces unless indicated otherwise.

E. Forming: Profiles indicated. Maximize lengths. Fold exposed edges to form hem indicated or ease edges to radius indicated with concealed stiffener. Provide flat, flush surfaces without cracking or grain separation at bends.

F. Reinforcement: Increase metal thickness; use concealed stiffeners, backing materials or both. Provide stretcher leveled standard of flatness and stiffness required to maintain flatness and hold adjacent items in flush alignment.

G. Anchors: Straps, plates and anchors as required to support and anchor items to adjacent construction.

H. Supports: Miscellaneous framing, mounting, clips, sleeves, fasteners and accessories required for installation.

I. Welding and Brazing: Weld or braze joints continuously. Grind, fill or dress to produce smooth, flush, exposed surfaces. Do not discolor metal. Grind smooth, polish, and restore damaged finishes to required condition.

J. Performance Requirements:
1. Delegated Design: Design exterior decorative formed metal items, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Structural Performance: Decorative formed metal items, including anchors and connections, shall withstand the effects of gravity loads and the design loads indicated on the Drawings and stresses without exceeding the allowable design working stress of materials involved and without exhibiting permanent deformation in any components:
3. Thermal Movements:
   a. Allow for thermal movements in exterior metal fabrications due to temperature changes. Prevent buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
   b. Temperature Change Range: 120 degrees F, ambient; 180 degrees F, on material surfaces.
4. Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

2.02 MATERIALS

A. General: Provide sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections exposed to view on finished units.

B. Filler Metal and Electrodes: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded or brazed and as necessary for strength, corrosion resistance, and compatibility in fabricated items.

C. Anchors, Clips and Accessories: Use one of the following:
   1. Stainless steel complying with ASTM A276/A276M, ASTM A480/A480M, ASTM A666, ASTM A276/A276M, ASTM A480/A480M, ASTM A666, ASTM A276/A276M, ASTM A480/A480M, or ASTM A666.
   2. Steel complying with ASTM A36/A36M and hot-dipped galvanized to ASTM A153/A153M.
   3. Steel complying with ASTM A36/A36M and hot-dipped galvanized to ASTM A123/A123M Coating Grade 35.
   4. Interior Locations: Carbon steel; zinc coated in accordance with ASTM B633 or ASTM F1941/F1941M Class Fe/Zn 5.
   5. Exterior Locations or in Contact with Stainless Steel:
      a. Bolts: Stainless steel; ASTM F593, Group 1 (A1).
      b. Nuts: Stainless steel; ASTM F594.
   6. Structural Anchors: Provide anchors where work is indicated to comply with design loads.
      a. Type: Provide chemical or torque-controlled expansion anchors.
      b. Capacity: When tested according to ASTM E488/E488M; four times the load imposed when installed in concrete.
   7. Nonstructural Anchors: Provide powder-actuated fasteners where work is not indicated to comply with design loads. Provide size and number required for load, installation, and as recommended by manufacturer, unless indicated otherwise.

D. Fasteners, General: Same basic metal and alloy as formed metal sheet unless indicated otherwise. Do not use metals incompatible with the materials joined.

E. Gaskets: As required to seal joints in decorative formed metal and remain airtight; as recommended in writing by decorative formed metal manufacturer.
   1. ASTM D1056, Type 1, Class A, grade as recommended by gasket manufacturer to obtain seal for application indicated.

F. Bituminous Coating: Cold-applied asphalt mastic, noncorrosive compound free of asbestos, sulfur, and other deleterious impurities; 15 mil dry film thickness per coat.

G. Joint Sealer, Exterior: ASTM C920; elastomeric silicone sealant; of type, grade, class, and use classifications required to seal joints in decorative formed metal and remain weathertight; and as recommended in writing by decorative formed metal manufacturer.

H. Joint Sealer, Interior: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C834; of type and grade required to seal joints in decorative formed metal; as recommended in writing by decorative formed metal manufacturer and with a VOC content of not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

I. Backing Materials: Provided or recommended by decorative formed metal manufacturer.

J. Sound Deadening Materials:
   1. Insulation: Unfaced, mineral-fiber blanket insulation; ASTM C665, Type I, and passing ASTM E136 test.
   2. Mastic: ASTM D1187/D1187M; cold-applied asphalt emulsion.

K. Laminating Adhesive: Recommended by metal fabricator; fully bond metal to metal, prevent telegraphing and oil canning; compatible with substrate; noncombustible after curing. VOC contents calculated according to 40 CFR 59, Subpart D (EPA Method 24) listed below.
   1. Contact Adhesive: 80 g/L or less.
   2. Metal-to-Metal Adhesive: 30 g/L or less..
   3. Multipurpose Construction Adhesive: 70 g/L or less.
   4. Special-Purpose Contact Adhesive: 250 g/L. Use for to bond melamine-covered board, metal, unsupported vinyl, ultrahigh molecular weight polyethylene, and rubber or wood veneer, 1/16 inch thick or less, to any surface.

L. Isolation Coating: Manufacturer's standard alkali-resistant coating, bituminous paint, or epoxy coating.

2.03 PAINTS AND COATINGS

A. Galvanizing Repair Paint: High-zinc-dust-content paint; comply with SSPC-Paint 20, compatible with other coatings specified for galvanized metal.

B. Universal Shop Primer for Ferrous Metal: Fast curing, lead and chromate free, universal modified alkyd primer; containing pigments easily distinguishable from color of zinc-rich primer.

C. Epoxy Zinc-Rich Primer: Compatible with top coat.

D. Shop Primer for Galvanized Steel: Cementitious galvanized metal primer.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.04 FINISHES

A. Finishes, General: Comply with NAAMM AMP 500-06.
   1. Complete mechanical finishes before fabrication. After fabrication, finish joints, bends, abrasions and surface blemishes to match sheet.
   2. Protect mechanical finishes on exposed surfaces from damage.
   3. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.
   4. Appearance: Limit variations in appearance of adjacent pieces to one-half of range represented in approved samples. Noticeable variations in same piece are not acceptable. Install components within range of approved samples to minimize contrast.

2.05 FABRICATION, GENERAL

A. Shop Assembly: Preassemble decorative formed metal items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Form metal to profiles indicated, in maximum lengths to minimize joints. Produce flat, flush surfaces without cracking or grain separation at bends. Fold back exposed edges of unsupported sheet metal to form a 1/2-inch- (12-mm-) wide hem on the concealed side, or ease edges to a radius of approximately 1/32 inch (1 mm) and support with concealed stiffeners.

C. Increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as needed to provide surface flatness equivalent to stretcher-leveled standard of flatness and sufficient strength for indicated use.

D. Build in straps, plates, and brackets as needed to support and anchor fabricated items to adjoining construction. Reinforce decorative formed metal items as needed to attach and support other construction.

E. Provide support framing, mounting and attachment clips, splice sleeves, fasteners, and accessories needed to install decorative formed metal items.

F. Where welding or brazing is indicated, weld or braze joints and seams continuously. Grind, fill, and dress to produce smooth, flush, exposed surfaces in which joints are not visible after finishing is completed.

2.06 CLOSURES AND TRIM

A. Form closures and trim from metal of type and thickness indicated. Fabricate to fit tightly to adjoining construction.

B. Conceal fasteners where possible; otherwise, locate where they are as inconspicuous as possible. Size fasteners to support closures and trim, with fasteners spaced to prevent buckling or waviness in finished surfaces.

C. Drill and tap holes needed for securing closures and trim to other surfaces.

D. Incorporate gaskets where indicated or needed for concealed, continuous seal at abutting surfaces.

E. Miter or cope trim members at corners and reinforce with bent metal splice plates to form tight joints.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and interfaces with other work.

B. Verify substrate on-site to determine that conditions are acceptable for product installation in accordance with manufacturer's written instructions.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

D. Notify Architect in writing of conditions detrimental to proper and timely completion of work. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Protect adjacent work areas and finish surfaces from damage during installation.

B. Deliver anchorage items to be cast into concrete or built into masonry to appropriate installer(s) together with setting templates.

C. Coat concrete and masonry surfaces that will be in contact with metal surfaces with bituminous coating.

3.03 INSTALLATION - SHEET METAL AND PLATE FABRICATIONS

A. Locate and place decorative formed sheet metal items level and plumb; align with adjacent construction. Cut, drill and fit as required to install.

B. Do not cut or abrade sheet metal finishes that cannot be completely restored in the field. Return such items to manufacturer or fabricator for required alterations and refinishing or provide new items.

C. Use concealed anchorages where possible. Provide washers of compatible materials with gaskets where needed on bolts or screws to protect metal surfaces and make weathertight connection.

D. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers indicated.

E. Install gaskets, joint fillers, insulation, sealants, and flashings as work progresses.
   1. Make exterior decorative formed sheet metal items weatherproof.
   2. Make interior decorative formed metal items soundproof or lightproof unless otherwise noted on Drawings.

F. Corrosion Protection: Apply permanent separation materials on concealed surfaces where metals would otherwise be in direct contact with incompatible substrate materials. Prevent corrosion damage to material and finish.

3.04 CLEANING

A. Shop Primer Touch-up and Repair: Clean field welds, bolted connections, and abraded areas of shop paint immediately after erection.
   1. Paint exposed areas with same material used for shop painting.
   2. Apply by brush or spray to provide a minimum 2.0 mil dry film thickness.

B. Restore finishes damaged during installation and construction period with no evidence of corrective work. Return items that cannot be refinished in the field to manufacturer or fabricator. Refinish entire unit or provide new units.

C. Remove protective film after installation of joint sealers, after cleaning of adjacent materials, and immediately prior to completion of work.

D. Remove temporary coverings and protection of adjacent work areas.

E. Clean installed products in accordance with manufacturer's instructions.

3.05 PROTECTION

A. Protect installed products from damage during construction.

B. Remove temporary protective coverings at time of Substantial Completion.

END OF SECTION

SECTION 06 10 53
MISCELLANEOUS ROUGH CARPENTRY

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 SECTION INCLUDES

A. Installation provisions for holes in load bearing and non-load bearing wood framed stud walls..

1.03 RELATED REQUIREMENTS

A. Section 01 93 15 - Schedule of Periodic Maintenance.

B. Section 06 10 00 - Rough Carpentry: Structural wall framing.

C. Section 07 84 00 - Firestopping: Installation of firestopping assemblies in partitions.

D. Section 09 21 16 - Gypsum Board Assemblies: Gypsum wallboard panels.

E. Division 21: Fire Protection: Installation of fire protection systems and materials.

F. Division 22: Plumbing: Installation of plumbing systems and materials.

1.04 PRICE AND PAYMENT PROCEDURES

A. Allowances: See Section 01 21 00 - Allowances, for cash allowances affecting this section.

1.05 REFERENCE STANDARDS

A. AFPA (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings.

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

1.06 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of framing with size, location and installation of service utilities.

1.07 COORDINATION

A. Coordinate the Work of this Section with other interfacing work in direct contact with the products listed herein. Consult with manufacturer for compatibility of materials specified in other sections that will be in contact with the products listed in this Section.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Wood Framed Assemblies:
   1. Wall assemblies in wood framed buildings, including load bearing and non-load bearing.

2.02 PERFORMANCE REQUIREMENTS

A. General:
   1. The edge of a hole shall be at least 5/8 inch from the edge of any stud.
   2. Do not locate holes near large or loose knots.
   3. Do not group too many in the same area of the stud.
   4. Comply with NEC requirements for setbacks at non-metallic cable or flexible metal cable.
   5. Comply with building and plumbing code requirements for setbacks at plumbing and fire protection piping.
   6. Provide metal plates of minimum 1/16 inch thickness and 3 inches in length over all holes on each side of the stud.
   7. Coordinate all penetrations with rated assemblies and provide firestopping in accordance with penetration firestop designs shown on Drawings and Section 07 84 00 - Firestopping.

B. Load Bearing walls:
   1. Holes in bearing wall studs (exterior and interior walls that bear the weight of the roof and/or other stories above) may not exceed 40 percent of the width of the stud.

2. Holes in bearing wall studs (exterior and interior walls that bear the weight of the roof and/or other stories above) may not exceed 60 percent of the width of the stud where studs are doubled and no more than two successive pairs of these doubled-up studs.
3. Notches in bearing wall studs may not exceed 25 percent of the stud's width.

C. Non-Load Bearing walls:
1. Holes in non-bearing walls can't exceed 60 percent of their width.
2. Notches in non-bearing walls can't exceed 40 percent of their width.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Verify that framing is complete and ready for the installation of penetrations.

3.02 PREPARATION

A. Protection of In-Place Conditions: Protect structural integrity of the wall assemblies at all times.

3.03 INSTALLATION

A. Gap above horizontal stud penetrations to allow for potential wood shrinkage:
1. Allow for one inch plus 1/2 inch for each consecutive story above, starting at the lowest level.
2. Maximum height of hole shall not exceed 6 inches.

B. Maximum opening in bearing or exterior wood stud framing:
1. 1 1/2 inches for 2x4 wood studs. (3.5 inches at 40% = 1.4 inches).
2. 2 1/4 inches for 2x6 wood studs. (5.5 inches at 40% = 2.2 inches)
3. 3 inches for 2x8 wood studs. (7.25 inches at 40% = 2.9 inches)

C. Install clothes washer discharge horizontal pipe penetration in accordance with details shown on Drawings.
1. In the absence of a detail, drill pipe penetrations in accordance with the above stated criteria..

3.04 REPAIR

A. Provide metal plates of minimum 1/16 inch thickness and 3 inches in length over all holes on each side of the stud.

3.05 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Framing Standard: Comply with AFPA (WFCM) document WCD #1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

3.06 CLEANING

A. Clean stud cavity from wood shavings and cut-outs left behind from drilled holes.

3.07 MAINTENANCE

A. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

END OF SECTION

SECTION 06 20 00
FINISH CARPENTRY

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 SECTION INCLUDES

A. Wood door frames, glazed frames.

B. Wood casings and moldings.

C. Hardware and attachment accessories.

1.03 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 06 41 00 - Architectural Wood Casework: Shop fabricated custom cabinet work.

C. Section 08 80 00 - Glazing: Glass and glazing of wood partitions and screens.

D. Section 09 91 23 - Interior Painting: Painting of interior finish carpentry items.

E. Section 09 93 00 - Staining and Transparent Finishing: Staining and transparent finishing of finish carpentry items.

1.04 REFERENCE STANDARDS

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

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition.

C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards.

D. AWPA U1 - Use Category System: User Specification for Treated Wood.

E. BHMA A156.9 - Cabinet Hardware.

F. NEMA LD 3 - High-Pressure Decorative Laminates.

G. WDMA I.S. 4 - Industry Specification for Preservative Treatment for Millwork.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with installation of associated and adjacent components.

B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.06 SUBMITTALS

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

B. Product Data:
   1. Provide data on fire retardant treatment materials and application instructions.
   2. Provide instructions for finish hardware.

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 information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
   3. Include certification program label.

1.07 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 within the past 5 years with value of woodwork within 20 percent of cost of woodwork for this project.
   2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
   3. Single Source Responsibility: Provide and install this work from single fabricator.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.

B. Protect from moisture damage.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by applicable code.

C. Wood fabricated from old growth timber is not permitted.

D. Interior Woodwork Items:
   1. Scope and profiles as indicated on Drawings.
   2. Pre-Hung Door Frames.

2.02 STANDING AND RUNNING TRIM

A. Wood Species and Cuts: Provide paint grade, kiln-dried (KD), finger-jointed pine. MDF or reconstituted poplar is considered a substitution and shall be used only with prior approval by the Owner.
   1. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 PREFABRICATED PRODUCTS

A. Wood Trim: Profiles as indicated on the Drawings. Field finish as specified in Sections 09 91 23 - Interior Painting and 09 91 23.01 - Painting Schedule Interior.

B. Hardboard Paneling: Provide Hardboard impact and moisture resistant interior fiber cement board manufactured by James Hardie Building Products.
   1. Fire-Test Characteristics: ASTM E84, Class A.
   2. Fasteners, Adhesive and Joint Compound: As recommended by manufacturer.
   3. Finish: Manufacturer's standard factory-applied primer.

2.04 PLASTIC LAMINATE MATERIALS

A. Plastic Laminate: NEMA LD 3; As scheduled on Interior Design Drawings.

2.05 FASTENINGS

A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.

B. Fasteners: Of size and type to suit application.

C. Concealed Joint Fasteners: Threaded steel.

2.06 ACCESSORIES

A. Adhesive: Type recommended by AWI/AWMAC to suit application.

B. Lumber for Shimming, and Blocking: Softwood lumber.

C. Edge Trim: Materials and profiles as scheduled and detailed on Drawings; smooth finish; self-locking serrated tongue; of width to match component thickness; color as selected.

D. Glass: Type GL-4 or GL-5 as specified in Section 08 80 00.

E. Primer: As scheduled in Sections 099113.01 - Painting Schedule Exterior and 09 91 23.01 - Painting Schedule Interior.

F. Wood Filler: Water base, tinted to match surface finish color.

2.07 HARDWARE

A. Hardware: Comply with BHMA A156.9.

B. Countertop Support Brackets: Fixed, L-shaped, corner reinforced, face-of-stud mounting.
   1. Material: Steel.

2. Finish: Manufacturer's standard, factory-applied powder coat.
3. Color: As scheduled.

C. Vanity Brackets: Fixed, ADA-Compliant, face-of-stud mounting.
1. Material: Steel; formed compound shapes.
2. Finish: Manufacturer's standard, factory-applied powder coat.
3. Color: As scheduled.

D. Vanity Brackets: Fixed, cantilevered support leg, face-of-stud mounting.
1. Finish: Manufacturer's standard, factory-applied, textured powder coat.
2. Color: As scheduled.

2.08 WOOD TREATMENT

A. Factory-Treated Lumber: Comply with requirements of AWPA U1 - Use Category System for pressure impregnated wood treatments determined by use categories, expected service conditions, and specific applications.

B. 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.

C. Wood Preservative by Pressure Treatment (PT Type): Provide AWPA U1 treatment using waterborne preservative with 0.25 percent retainage.

D. Water Repellent Preservative Treatment by Dipping Method: WDMA I.S. 4, with 0.25 percent retainage.

E. Wood Preservative (Surface Application): Clear type.

F. Shop pressure treat wood materials requiring fire rating to concealed wood blocking.

G. Provide identification on fire retardant treated material.

H. Deliver fire retardant treated materials cut to required sizes. Minimize field cutting.

I. Redry wood after pressure treatment to maximum 12 percent moisture content.

2.09 SITE FINISHING MATERIALS

A. Stain, Shellac, Varnish, and Finishing Materials: Comply with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

2.10 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. Fit exposed sheet material edges with 3/8 inch matching hardwood edging. Use one piece for full length only.

C. Cap exposed plastic laminate finish edges with plastic trim.

D. Shop prepare and identify components for book match grain matching during site erection.

E. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

F. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.

2.11 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. Apply wood filler in exposed nail and screw indentations.

C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.

D. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified.
1. Transparent:
a. Stain: As selected by Interior Designer.

b. Sheen: Flat.

2. Opaque:
   a. Color: As selected by Interior Designer.
   b. Sheen: Flat.

E. Back prime woodwork items to be field finished, prior to installation.

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.

C. See Section 06 10 00 for installation of recessed wood blocking.

3.02 INSTALLATION

A. Install custom fabrications in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

3.03 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment in accordance with manufacturer's instructions.

B. Brush apply one coats of preservative treatment on wood in contact with cementitious materials. Treat site-sawn cuts.

C. Allow preservative to dry prior to erecting members.

3.04 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

B. Site Finishing: See Section 09 91 23 and 09 93 00.

C. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.05 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

SECTION 06 41 00
ARCHITECTURAL WOOD CASEWORK

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 SECTION INCLUDES

A. Specially fabricated cabinetry in Amenity areas.

B. Hardware.

C. Preparation for installing utilities.

1.03 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 12 36 00 - Countertops.

1.04 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition.

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards.

C. BHMA A156.9 - Cabinet Hardware.

D. NEMA LD 3 - High-Pressure Decorative Laminates.

E. UL (DIR) - Online Certifications Directory.

1.05 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.

1.06 SUBMITTALS

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

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
   2. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

C. Product Data: Provide data for hardware accessories.

D. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.

E. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.

1.07 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.
   2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.

B. Quality Certification:
   1. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
   2. Provide designated labels on shop drawings as required by certification program.
   3. Provide designated labels on installed products as required by certification program.
   4. Submit certifications upon completion of installation that verifies this work complies with specified requirements.

5. Replace, repair, or rework all work for which certification is refused.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.09 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 CABINETS

A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI//AWMAC/WI (AWS) for Custom Grade.

B. Plastic Laminate Faced Cabinets: Custom grade.

C. Breakroom Cabinets: Plastic laminate faced, Custom grade.

D. Cabinetsat Amenity Areas:
   1. Finish - Exposed Exterior Surfaces: Wood fronts and doors as indicated on Interior Design Drawings.
   2. Finish - Exposed Interior Surfaces: Melamine; color as indicated on Interior Design Drawings.
   3. Finish - Concealed Surfaces: Manufacturer's option.
   4. Door and Drawer Front Edge Profiles: As indicated on Interior Design Drawings.
   5. Door and Drawer Front Retention Profiles: As indicated on Interior Design Drawings.
   6. Casework Construction Type: Type A - Frameless.
   7. Interface Style for Cabinet and Door: Style 1 - Overlay; flush overlay.
   8. Cabinet Design Series: As indicated on drawings.
   9. Adjustable Shelf Loading: 40 psf.
      a. Deflection: L/144.
   10. Cabinet Style: As indicated on Drawings.
   11. Cabinet Doors and Drawer Fronts: As indicated on Interior Design Drawings.
   12. Drawer Side Construction: Multiple-dovetailed.
   13. Drawer Construction Technique: As recommended by fabricator.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

B. Hardwood Edgebanding: Use solid hardwood edgebanding matching species, color, grain, and grade for exposed portions of cabinetry.

2.03 LAMINATE MATERIALS

A. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.

B. Provide specific types as follows:
   1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, colors as indicated, finish as indicated.
   2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, colors as indicated, finish as indicated.
   3. Post-Formed Horizontal Surfaces: HGP, 0.039 inch nominal thickness, colors as indicated, finish as indicated.
   4. Post-Formed Vertical Surfaces: VGP, 0.028 inch nominal thickness, colors as indicated, finish as indicated.
   5. Flame Retardant Surfaces: HGF, 0.048 inch nominal thickness, colors as indicated, finish as indicated.
   6. Cabinet Liner: CLS, 0.020 inch nominal thickness, colors as indicated, finish as indicated.
   7. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.04 LACQUERED PANELS

2.05 COUNTERTOPS

A. Countertops: See Section 12 36 00.

2.06 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Fasteners: Size and type to suit application.

C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

D. Concealed Joint Fasteners: Threaded steel.

E. Grommets: Standard finished exposed edge where located in solid surface or plastic laminate surfaces for cut-outs, in color as scheduled.

2.07 HARDWARE

A. Cabinet Hardware: Comply with BHMA A156.9 for hardware types and grades indicated below:
   1. Hardware Types: As indicated on Drawings.
   2. Product Grade: As required by specified woodworking quality grade.

B. Countertop Brackets; Flat, Single-Leg-Support, top of knee wall mounting.
   1. Locations: Countertops with overhangs.
   2. Materials: Steel plates.
   3. Finish: Manufacturer's standard, factory-applied, powder coat.
   4. Color: Black.
   5. Support Length: Matching overhang dimension.
   6. Plate Thickness and Width: 3/8 inch by 2-1/2 inches.

C. Drawer and Door Pulls: as scheduled on Drawings.

D. Cabinet Catches and Latches:
   1. Type: Push latch and Roller catch.

E. Drawer Slides:
   1. Type: Full extension with overtravel.
   2. Static Load Capacity: Heavy Duty grade.
   3. Mounting: Side mounted.
   4. Stops: Integral type.

F. Hinges: European style concealed self-closing type, steel with satin finish.

G. Other Hardware: As scheduled on Drawings.

2.08 SHOP TREATMENT OF WOOD MATERIALS

A. Provide UL (DIR) listed and approved identification on fire retardant treated material.

B. Deliver fire retardant treated materials cut to required sizes. Minimize field cutting.

2.09 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.
   1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
   2. Cap exposed plastic laminate finish edges with material of same finish and pattern.

E. Provide cutouts for plumbing fixtures and outlet boxes. Verify locations of cutouts from on-site dimensions. Provide finished cut edges where located in solid surface or plastic laminate surfaces.

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 in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. Color, tone, and wood substrate: As scheduled on Drawings.
      b. Sheen: As scheduled on Drawings.
   2. Opaque:
      a. Color, tone, and wood substrate: As scheduled on Drawings.
      b. Sheen: As scheduled on Drawings.

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 custom cabinets in place, assuring that they are rigid, plumb, and level.

B. Use concealed joint fasteners to align and secure adjoining cabinet units.

C. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

D. Secure cabinets and counter bases to floor using appropriate angles and anchorages.

E. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.03 ADJUSTING

A. Test installed work for rigidity and ability to support loads.

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 83 16
FIBERGLASS REINFORCED PANELING

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 SECTION INCLUDES

A. Fiberglass reinforced plastic panels.

B. Trim.

1.03 REFERENCE STANDARDS

A. 9 CFR 416.2 - Regulatory Requirements Under the Federal Meat Inspection Act and the Poultry Products Inspection Act, Part 416-Sanitation.

B. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.

C. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

D. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels.

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

F. ISO 846 - Plastics - Evaluation of the Action of Microorganisms.

G. ISO 2812-1 - Paints and Varnishes -- Determination of Resistance to Liquids -- Part 1: Immersion in Liquids Other than Water.

1.04 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. Samples: Submit two samples 8 by 8 inch in size illustrating material and surface design of panels.

D. 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 Panels: 10% of each type and size.
   3. Extra Panels: Quantity equal to 5 percent of total installed.

1.05 DELIVERY, STORAGE, AND HANDLING

A. 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.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fiberglass Reinforced Plastic Panels:
   1. Crane Composites, Inc: www.cranecomposites.com.
   2. Marlite, Inc; STANDARD FRP SYSTEM: www.marlite.com/. (Basis of Design)
   3. Nudo Products, Inc: www.nudo.com.
   4. Panolam Industries International, Inc; Panolam FRP: www.panolam.com.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PANEL SYSTEMS

A. Wall Panelsat Janitor Closets:
   1. Panel Size: 4 by 8 feet.
   2. Panel Thickness: 0.10 inch.
   3. Surface Design: Embossed.

4. Color: As indicated on Drawings.
5. Attachment Method: Adhesive only, with trim and sealant in joints.

2.03 MATERIALS

A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.
   1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. Impact Strength: Greater than 6 ft lb force per inch, when tested in accordance with ASTM D256.
   4. Sanitation and Cleanability: Comply with 9 CFR 416.2.
   5. Chemical Cleanability: Excellent chemical resistance to common cleaners and detergents when tested in accordance with ISO 2812-1.
   6. Biological Resistance: Rating of 0, when tested in accordance with ISO 846.

B. Trim: Vinyl; color coordinating with panel.

C. Fasteners: Nylon rivets.

D. Adhesive: Type recommended by panel manufacturer.

E. Sealant: Type recommended by panel manufacturer; color matching panel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions and substrate flatness before starting work.

B. Verify that substrate conditions are ready to receive the work of this section.

C. Verify that layout of panels will not interfere with components, equipment, junction boxes, and other wall mounted objects; make adjustments in layout as necessary.

3.02 INSTALLATION - WALLS

A. Install panels in accordance with manufacturer's instructions.

B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.

C. Pre-drill fastener holes in panels, 1/8 inch greater in diameter than fastener, spaced as indicated by panel manufacturer.

D. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.

E. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.

F. Install panels with manufacturer's recommended gap for panel field and corner joints.

G. Drive fasteners to provide snug fit, and do not over-tighten.

H. Place trim on panel before fastening edges, as required.

I. Fill channels in trim with sealant before attaching to panel.

J. Install trim with adhesive and screws or nails, as required.

K. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.

L. Remove excess sealant after paneling is installed and prior to curing.

END OF SECTION

SECTION 07 11 13
BITUMINOUS FOUNDATION COATING

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 SECTION INCLUDES

A. Bituminous foundation coating for below grade slab edge conditions behind masonry veneer.

B. Protection boards.

C. Drainage panels.

1.03 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Perimeter slab on grade foundation to receive the work of this section.

B. Section 04 26 13 - Masonry Veneer: Brick veneer concealing the work of this section.

1.04 REFERENCE STANDARDS

A. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.

B. ASTM D1227/D1227M - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.

C. ASTM D1227/D1227M - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.

D. ASTM D1668/D1668M - Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing.

E. ASTM D4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.

F. NRCA (WM) - The NRCA Waterproofing Manual.

1.05 SUBMITTALS

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

B. Product Data: Provide properties of primer, bitumen, and mastics.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's original unopened packaging with labels indicating product name and manufacturer.

B. Store products in a clean dry location on elevated platforms per manufacturer's instructions.

C. Maintain environmental conditions at temperatures 40 degrees (5 Deg C) or above. Do not store at temperatures above 90 degrees F (32 Deg. C) for extended periods.

D. Keep away from sparks and open flames.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with at least three years of documented experience.

B. Source Limitations: Obtain primary coating materials and primers from single source from single manufacturer.

1.08 FIELD CONDITIONS

A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit coating to be performed according to manufacturers' written instructions.

B. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application until coating has cured.

C. Do not apply materials when air or surface temperatures are below 35 degrees F (2 deg. C).

D. Ventilation: Provide adequate ventilation during application of coating in enclosed spaces. Maintain ventilation until coating has cured.

1.09 COORDINATION

A. Consult with product manufacturer for compatibility of other work requiring interface with coating.

PART 2 PRODUCTS

2.01 BITUMINOUS FOUNDATION COATING

A. Bituminous Foundation Coating: Cold-applied water-based emulsion; asphalt with mineral colloid or chemical emulsifying agent; with or without fiber reinforcement; asbestos-free; suitable for application on vertical and horizontal exterior foundation surfaces.
   1. Asphalt-Base Emulsion for Metal Protective Coating: ASTM D1187/D1187M, Type I - Continuous water exposure within few days after drying or Type II - Continuous weather exposure after drying.
   2. Emulsified Asphalt for Roofing Protective Coating: ASTM D1227/D1227M, Type II, Class 1 - Mineral colloid emulsifying agents with non-asbestos fibers.
   3. VOC Content: Not more than permitted by local, State, and federal regulations.
   4. Applied Thickness: 30 mils, minimum, wet film.
   5. Products:
      a. BAPI Construction Products; Masterseal 615: www.bapionline.com.
      b. ChemMasters, Inc.; MasterGard™ 400: www.chemmasters.net.
      c. Henry Company; Henry® 789: www.henry.com.
      d. Mar-flex Waterproofing & Building Products; Dampproofing WB: www.mar-flex.com.
      e. W.R. Meadows, Inc.; Sealmastic Emulsion Type I (spray-grade): www.wrmeadows.com. (Basis of Design)
      f. Substitutions: See Section 01 60 00 - Product Requirements.

B. Primers, Mastics, and Related Materials: Type as recommended by coating manufacturer.

2.02 ACCESSORIES

A. General: Furnish auxiliary materials recommended in writing by coating manufacturer for intended use and compatible with bituminous coating.

B. Emulsified-Asphalt Primer: ASTM D1227/D1227M, Type III, Class 1, except diluted with water as recommended in writing by manufacturer.

C. Asphalt-Coated Glass Fabric: ASTM D1668/D1668M , Type I.

D. Patching Compound: Epoxy or latex-modified repair mortar of type recommended in writing by coating manufacturer.

E. Drainage Panel: 1/4-inch thick formed plastic, hollowed sandwich.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions are acceptable prior to starting this work.

B. With Applicator present, verify substrate surfaces are durable, free of matter detrimental to adhesion or application of coating system.
   1. Test for surface moisture according to ASTM D4263.

C. Verify that items penetrating surfaces to receive coating are securely installed.

D. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Protect adjacent surfaces not designated to receive coating.

B. Clean and prepare surfaces to receive coating in accordance with manufacturer's instructions.

C. Do not apply coating to surfaces unacceptable to manufacturer.

D. Apply mastic to seal penetrations, small cracks, holes, honeycombs, reveals, gaps, voids and other imperfections in substrate; cover with asphalt-coated glass fabric where necessary to achieve uniform surface.

3.03 APPLICATION

A. Comply with manufacturer's written instructions for coating application unless more stringent requirements are indicated herein.
   1. Apply coating to provide continuous plane of protection.
   2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.

B. Perform this work in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.

C. Prime surfaces in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.

D. Apply bitumen using method recommended by manufacturer for application indicated.

E. Apply bitumen at a temperature limited by equiviscous temperature (EVT) plus or minus 25 degrees F; do not exceed finish blowing temperature for four hours.

F. Apply coating at rates recommended in written form from manufacturer or rates as indicated below, whichever is greater.
   1. Apply bitumen in two coats, continuous and uniform, at a rate of 25 sq ft/gal per coat.

G. Apply from 2 inches below finish grade elevation down to top of footings.

H. Seal items watertight with mastic, that project through coating surface.

3.04 CLEANING

A. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION

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SECTION 07 13 00
SHEET WATERPROOFING

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 SECTION INCLUDES

A. Self-adhered modified bituminous sheet membrane and accessories.

B. Blind-side waterproofing and accessories.

1.03 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete substrate.

B. Section 06 10 00 - Rough Carpentry: Substrate for self-adhering sheet membrane over wood framed balconies and under concrete.

C. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal parapet, coping, and counterflashing.

1.04 ABBREVIATIONS

A. HDPE - High-Density Polyethylene.

B. NRCA - National Roofing Contractors Association.

1.05 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension.

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

C. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.

D. ASTM D1876 - Standard Test Method for Peel Resistance of Adhesives (T-Peel Test).

E. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

F. ASTM D5295/D5295M - Standard Guide for Preparation of Concrete Surfaces for Adhered (Bonded) Membrane Waterproofing Systems.

G. ASTM D5385/D5385M - Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes.

H. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.

I. ASTM E154/E154M - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

J. NRCA (WM) - The NRCA Waterproofing Manual.

1.06 SUBMITTALS

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

B. Product Data: Provide data for membrane, surface conditioner, flexible flashings, joint and crack sealants, protection course, and drainage course.
   1. Submit manufacturer's product literature and installation instructions, including instructions for sealing joints, terminations, and protrusions.
   2. Include detailed requirements for preparation of surfaces, application, and protection requirements.
   3. Delete inapplicable data from product submittal.
   4. Do not submit MSDS sheets; not required for design team and will not be reviewed.

C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.

D. Manufacturer's Installation Instructions: Indicate special procedures.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.07 QUALITY ASSURANCE

A. Membrane Manufacturer Qualifications: Company specializing in waterproofing sheet membranes with ten years experience.
   1. Manufacturer's representative: Arrange to have trained representative of the manufacturer on-site periodically to review installation procedures.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years experience, and approved by selected product manufacturer in writing; indicate manufacturer has fully trained applicator in installation of specified materials.

C. Source Limitations: For each type of material required to complete the work of this section, provide products from a single manufacture. Obtain secondary materials including but not limited to Sheet flashing, joints sealants, termination device, t-bars, and substrate repair materials specified in other sections from a source acceptable to sheet waterproofing manufacturer.

D. Pre-Installation Conference: Prior to beginning waterproofing work, conference will be held to review Work to be accomplished.
   1. Contractor, waterproofing subcontractor, Owner's waterproofing consultant and all other subcontractors who have equipment penetrating waterproofing shall be present.
   2. Contractor shall notify Architect at least three days prior to time for conference.
   3. Contractor shall record minutes of meeting and distribute to attending parties, Owner, and Architect.

1.08 MOCK-UPS

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

B. Construct mock-up consisting of 100 sq ft of horizontal and vertical sheet waterproofing panel; to represent finished work including internal and external corners, seam jointing, attachment method, and project specific special conditions.

C. Locate where directed.

D. Mock-up may not remain as part of the Work, unless otherwise allowed in writing by the Owner.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels identifying product name and manufacturer.

B. Store materials in a clean dry area on elevated platforms in accordance with manufacturer's instructions.

C. Store adhesives at temperatures of 40 deg. F and above.

1.10 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until liquid or mastic accessories have cured.

B. Apply waterproofing to substrate with indicate moisture level of 15% or less when tested by moisture meter unless otherwise required by system manufacturer.

1.11 COORDINATION

A. Coordinate installation of sheet waterproofing with completion of weather resistant barrier, t-bar terminations and other work requiring interface with sheet waterproofing.

B. Consult with waterproofing manufacturer for compatibility of other work requiring interface with sheet waterproofing.
   1. Where waterproofing interfaces directly with horizontal and vertical applications, both products shall be by the same manufacturer.

1.12 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Contractor to correct defective Work within period of five years 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, except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

D. Special Warranty: Warrant waterproofing Work from defects in materials and workmanship, including leakage, for five year period beginning at Date of Substantial Completion; provide for prompt repair or replacement of defective materials or workmanship during warranty period.

E. Provide installer's warranty agreeing to correct leaking waterproofing unless leaking is caused by structural failure, movement of the structure, or other causes beyond the installer's control within the specified warranty period specified from the date of Substantial Completion.
   1. Warranty period: 1 year.

PART 2 PRODUCTS

2.01 SHEET WATERPROOFING APPLICATIONS

A. Self-Adhered Modified Bituminous Sheet Membrane:
   1. Location A: Vertical below grade applications.
   2. Cover with drainage panel and protection board.

B. Self-Adhered HDPE Sheet Membrane:
   1. Location: Horizontal and vertical below grade applications, including but not limited to footings and slabs.
   2. Cover with drainage panel and protection board at vertical applications.

C. Blindside HDPE Reinforced Sheet Membrane:
   1. Location: Elevator pits and other blind-side applications (including horizontal slabs).
   2. Cover with drainage panel.

2.02 SHEET WATERPROOFING MATERIALS

A. Self-Adhered Modified Bituminous Sheet Membrane:
   1. Thickness: 60 mil, 0.060 inch, minimum.
   2. Sheet Width: 36 inches, minimum.
   3. Tensile Strength:
      a. Film: 5,000 psi, minimum, measured in accordance with ASTM D882 and at grip-separation rate of 2 inches per minute.
      b. Membrane: 325 psi, minimum, measured in accordance with ASTM D412 Method A, using die C and at spindle-separation rate of 2 inches per minute.
   4. Elongation at Break: 300 percent, minimum, measured in accordance with ASTM D412.
   5. Water Vapor Permeance: 0.05 perm, maximum, measured in accordance with ASTM E96/E96M.
   6. Peel Strength: 7 pounds per inch, minimum, when tested according to ASTM D903.
   7. Lap Adhesion Strength: 5 pounds per inch, minimum, when tested according to ASTM D1876.
   8. Puncture Resistance: 50 lb, minimum, measured in accordance with ASTM E154/E154M.
   9. Hydrostatic Pressure Resistance: Membrane resists leakage for at least one hour from pressure equivalent to 200 feet head of water applied in accordance with test method ASTM D5385/D5385M.
   10. Adhesives, Sealants, Tapes, and Accessories: As recommended by membrane manufacturer.
   11. Products:
      a. AVM Industries, Inc; Aussie Mate 580-AL: www.avmindustries.com.
      b. Carlisle Coatings & Waterproofing Inc; MiraDRI 860/861: www.carlisleccw.com.
      c. CETCO, a division of Minerals Technologies Inc; ENVIROSHEET: www.mineralstech.com.
      d. GCP Applied Technologies; BITUTHENE® 3000: www.gcpat.com.
      e. Henry Company; Blueskin WP 200 or WP 100: www.henry.com.
      f. Polyglass Mapei Group; MAPETHENE™ LT60 or HT60: www.polyglass.us.

1) LT60: Low application temperature range, from 25°F and 60°F.
2) HT60: Low application temperature range, from 40°F to 120°F.

g. Polyguard Products, Inc; 650 Membrane: www.polyguardproducts.com. (Basis of Design)
1) Locations: Positive side sheet waterproofing.

h. W. R. Meadows, Inc; MEL-ROL: www.wrmeadows.com.

i. Substitutions: See Section 01 60 00 - Product Requirements.

B. Self-Adhered HDPE Sheet Membrane: Recommended by manufacturer for placement below concrete slabs and on outside face of below grade walls before placement of concrete.
1. Low Temperature Flexibility: Unaffected when tested in accordance with ASTM D1970/D1970M at minus 20 degrees F, 180 degree bend on 1 inch mandrel.
2. Hydrostatic Pressure Resistance: Membrane resists leakage for at least one hour from pressure equivalent to 231 feet head of water applied in accordance with test method ASTM D5385/D5385M.
3. Elongation at Break: 730 percent, minimum, measured according to ASTM D412.
4. Tensile Strength - Membrane: 841 psi; ASTM D412 Modified Die C.
5. Tensile Strength, Film: 6,300 pounds per square inch, minimum, measured according to ASTM D412.
6. Water Vapor Permeance: 0.01 perm, maximum, measured in accordance with ASTM E96/E96M.
7. Lateral Water Migration Resistance: Resists pressure of 231 ft head of water, when tested in accordance with ASTM D5385/D5385M.
8. Puncture Resistance - Membrane: 62 lbs; ASTM E154/E154M.
9. Adhesives, Sealants, Tapes, and Accessories: As recommended by membrane manufacturer.
10. Manufacturers: Products of the following manufacturer's comparable in type and quality are acceptable, subject to compliance with specified requirements
a. AVM Industries, Inc; Aussie Skin 550: www.avmindustries.com.
b. Carlisle Coatings & Waterproofing Incorporated: www.carlisleccw.com.
c. GCP Applied Technologies; Preprufe 300R Plus: www.gcpat.com. (horizontal applications)
d. Henry Company: www.henry.com.
e. W. R. MEADOWS, Inc.: www.wrmeadows.com.
f. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 BLINDSIDE SHEET WATERPROOFING

A. Blindside Sheet Waterproofing for Vertical Applications: Uniform, flexible, multilayered-composite sheet membrane that forms a permanent bond with fresh concrete placed against it; complete with accessories and preformed shapes for an unbroken waterproofing assembly; with the following physical properties:
1. AVM Industries, Inc; Aussie Skin 550: www.avmindustries.com.
2. CETCO: www.cetco.com.
3. GCP Applied Technologies: www.gcpat.com.
4. Henry Company: Blueskin PreSeal® 320 www.henry.com.
5. Polyguard Products, Inc.: www.polyguardproducts.com.
6. W. R. MEADOWS, Inc.: PRECON www.wrmeadows.com.
7. Substitutions: See Section 01 60 00 - Product Requirements.
8. Physical Properties:
a. Low-Temperature Flexibility: Pass at minus 20 deg F (minus 29 deg C); ASTM D1970/D1970M.
b. Peel Adhesion to Concrete: 5 lbf/in. (875 N/m) minimum; ASTM D903, modified.
c. Lap Adhesion: 5 lbf/in. (875 N/m) minimum; ASTM D1876, modified.
d. Hydrostatic-Head Resistance: 230 feet (70 m); ASTM D5385/D5385M, modified.
e. Puncture Resistance: 100 lbf (445 N) minimum; ASTM E154/E154M.
f. Water Vapor Permeance: 0.1 perm (6 ng/Pa x s x sq. m) maximum; ASTM E96/E96M, Water Method.

g. Ultimate Elongation: 335 percent minimum; ASTM D412, modified.

B. Blindside Sheet Waterproofing for Horizontal Applications: Uniform, flexible, multilayered-composite sheet membrane that forms a permanent bond with fresh concrete placed against it; complete with accessories and preformed shapes for an unbroken waterproofing assembly; with the following physical properties:
   1. CETCO: www.cetco.com.
   2. GCP Applied Technologies: www.gcpat.com.
   3. Henry Company: Blueskin PreSeal® 435 www.henry.com.
   4. Polyguard Products, Inc.; Underseal® Blindside™ Membrane: www.polyguardproducts.com.
   5. W. R. MEADOWS, Inc.: www.wrmeadows.com.
   6. Substitutions: See Section 01 60 00 - Product Requirements.
   7. Physical Properties:
      a. Low-Temperature Flexibility: Pass at minus 20 deg F (minus 29 deg C); ASTM D1970/D1970M.
      b. Peel Adhesion to Concrete: 5 lbf/in. (875 N/m) minimum; ASTM D903, modified.
      c. Lap Adhesion: 5 lbf/in. (875 N/m) minimum; ASTM D1876, modified.
      d. Hydrostatic-Head Resistance: 230 feet (70 m); ASTM D5385/D5385M, modified.
      e. Puncture Resistance: 200 lbf (890 N) minimum; ASTM E154/E154M.
      f. Water Vapor Permeance: 0.1 perm (6 ng/Pa x s x sq. m) maximum; ASTM E96/E96M, Water Method.
      g. Ultimate Elongation: 335 percent minimum; ASTM D412, modified.

2.04 ACCESSORIES

A. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrates and waterproofing materials. Type recommended and approved in writing by system manufacturer for application.

B. Mastic, Adhesives, and Detail Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.

C. Concrete primer, mastic, and liquid flashing: Type recommended and approved in writing by system manufacturer for application.

D. Protection Board: Provide type capable of preventing damage to waterproofing due to backfilling and construction traffic; approved in writing by manufacturer or from same manufacturer as sheet waterproofing.
   1. Polystyrene foam board, 1 inch thick.
   2. Recycled or reclaimed closed-cell foam plastic with nonwoven filter fabric cover; 1 inch thick.
   3. Semi-rigid glass fiber board; unaffected by water, freeze-thaw, fungus, or soil bacteria; containing no formaldehyde, phenol, acrylic, or artificial color; 3/4 inch thick, nominal.

E. Drainage Panel: Drainage layer with geotextile filter fabric on earth side. Type recommended and approved in writing by system manufacturer for application.
   1. Composition: Dimpled polystyrene, polyethylene, polypropylene, or other core; polypropylene filter fabric.
   2. Thickness: As indicated on Drawings.
      a. Products:
         1) Type recommended and approved in writing by system manufacturer for application.
         2) Substitutions: See Section 01 60 00 - Product Requirements.

F. Drainage Panel Accessories:
   1. Base Drain: Thickened base drain composite, 6 inches wide.
   2. Base Drain Outlets: Side and End Drains.
   3. Couplers, Inside Corners, and Outside Corners: Pre-fabricated units matching and connecting to base drain to form continuous drainage system.
   4. Base drain clips, tapes, mastics, sealers, and other miscellaneous accessories as required by manufacturer for a complete and warranted installation.

5. Base Drain Discharge: Corrugated HDPE (High Density Polyethylene) drain pipe with "sock" covering.

G. Cant Strips: Premolded composition material or Bitumen impregnated fiberboard, or type as recommended in writing by system manufacturer.

H. Flexible Flashings: Type recommended by membrane manufacturer. System manufacturer's 60-mil rubberized asphalt bonded to polyethylene flashing sheet to form 90 deg. angles.

I. Counterflashings: Pre-finished aluminum or stainless steel; see Section 07 62 00 or as recommended in writing by membrane and protection board manufacturer.

J. Termination Bars: Manufacturer's standard, predrilled aluminum or stainless steel bars; approximately 1 inch tall by 1/8 inch thick, predrilled at not more than 12-inch centers. Anchor type and spacing shall be compatible with manufacturer's membrane and adhesive requirements to maintain a fully warranted installation.
1. Bar shape and profile as required for application type.

K. Surface Conditioner: Approved in writing by and compatible with membrane manufacturer.

L. Adhesives: Approved in writing by and compatible with membrane manufacturer.

M. Thinner and Cleaner: As recommended by adhesive manufacturer, compatible with sheet membrane.

N. Seaming Materials: As recommended in writing by membrane manufacturer .

O. Membrane Sealant: As recommended in writing by membrane manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions are acceptable prior to starting work.
1. Verify openings and penetrations are in place.
2. Examine substrates, with installer and manufacturer's representative, for compliance with requirements and the conditions affecting performance of sheet waterproofing.
3. Verify compatibility with and suitability of substrates.
4. Submit copy of installer's report to Architect within 72 hours of report receipt.
5. Proceeding with construction activity of this section:
   a. Prior to correction of unacceptable conditions or substrates are prohibited.
   b. Indicates installer's acceptance of conditions and substrates.

3.02 PREPARATION

A. Protect adjacent surfaces from damage not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions. Vacuum substrate clean. Surfaces to be free from voids, loose material, projections, or other deleterious materials.

C. Do not apply waterproofing to surfaces unacceptable to membrane manufacturer.

D. Fill nonmoving joints and cracks with a filler compatible with waterproofing materials.

E. Seal moving cracks with sealant and nonrigid filler, using procedures recommended by sealant and waterproofing manufacturers.

F. Surfaces for Adhesive Bonding: Apply surface conditioner at a rate recommended by manufacturer, and protect conditioner from rain or frost until dry.

G. Concrete Surfaces for Adhesive Bonding: Prepare concrete substrate in accordance with ASTM D5295/D5295M.
1. Remove substances that inhibit adhesion including form release agents, curing compounds admixtures, laitance, moisture, dust, dirt, grease and oil.
2. Repair surface defects including honeycombs, fins, tie holes, bug holes, sharp offsets, rutted cracks, ragged corners, deviations in surface plane, spalling. and delamination, as described in the reference standard.
3. Remove and replace areas of defective concrete; see Section 03 30 00.

4. Prepare concrete for adhesive bonded waterproofing using mechanical or chemical methods described in referenced standard.
5. Test concrete surfaces as described in referenced standards, and verify surfaces are ready to receive adhesive bonded waterproofing membrane system.

3.03 INSTALLATION - MEMBRANE

A. Install membrane waterproofing in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.

B. Roll out membrane, and minimize wrinkles and bubbles.

C. Self-Adhering Membrane: Remove release paper layer, and roll out onto substrate with a mechanical roller to provide full contact bond.

D. Overlap edges and ends and seal by method recommended by manufacturer, minimum 3 inches at side laps and minimum 6 inches at end laps. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.

E. Provide cant strips at transitions from horizontal to vertical.

F. Form 1 in. by 1 in. cement grout fillets at internal corners and intersection of horizontal and vertical surfaces.

G. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.

H. Provide prefabricated outside corner boots installed per manufacturer's instruction. Inside corners to have a double membrane application of 11 in. wide membrane strip centered along corner. Cover completely with full width sheet.

I. Double membrane at corners by application of 11 in. wide membrane strip centered along corner. Cover strip completely with full width sheet.

J. Apply double layer of waterproofing membrane at protrusions; extend minimum 6 in. in each direction. Seal protrusions and membrane terminations with mastic.

K. Weather lap joints on sloped substrate in direction of drainage, and seal joints and seams.

L. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.

M. Extend membrane over cants and up intersecting surfaces at membrane perimeter minimum 6 inches above horizontal surface for first ply and at subsequent plies as stated in manufacturer's written instructions, laid in shingle fashion.

N. Seal membrane and flashings to adjoining surfaces.
1. Install termination bar along edges.
2. Install counterflashing over exposed edges.

O. Install sheet-waterproofing and auxiliary materials to tie into adjacent waterproofing.

P. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches (150 mm) beyond repaired areas in all directions.

Q. Repair punctures and tears in membrane by patching with membrane material prior to topping material installation and protection board installation.

R. Install protection board over membrane immediately upon installation. Secure to vertical surfaces with mastic.

3.04 INSTALLATION - DRAINAGE PANEL AND PROTECTION BOARD

A. Place drainage panel directly against membrane, butt joints, place to encourage drainage downward; scribe and cut boards around projections, penetrations, and interruptions.

B. Drainage Panel Installation:
1. At base of substrate, install base drains oriented horizontally.
2. Secure base drains to substrate with washer-head fasteners at 24 inches on center.
3. Use couplers and corner fittings to form continuous drains.
4. Install discharge outlet fittings to connect with discharge systems.
5. Mechanically fasten drainage mat units with fabric placed against substrate.

6. Shingle-lap filter fabric lap joints; adhere fabric with spray adhesive.
7. Penetrations and Tie-Back Heads: Cut drainage composite units to fit; wrap extra filter fabric around open core edge.
8. Top of Drainage Panel: Wrap filter fabric flaps behind top panel edge; secure panels and wrapped fabric to wall with termination bars fastened at 12 inches on center.
9. Connect base fittings to discharge pipe and run to sump or daylight. Properly compact soil under drain pipe to prevent settling of drain pipe or disruption of proper drainage slope.

C. Place protection board directly against drainage panel; butt joints, and scribe and cut boards around projections, penetrations, and interruptions.

D. Adhere protection board to drainage panel substrate with compatible adhesive.

3.05 BLINDSIDE SHEET-WATERPROOFING APPLICATION

A. Install blindside sheet waterproofing according to manufacturer's written instructions.

B. Place and secure molded-sheet drainage panels over substrate. Lap edges and ends of geotextile to maintain continuity.

C. Vertical Applications: Install sheet with face against substrate. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by membrane manufacturer. Overlap and seal seams, and stagger and tape end laps to ensure watertight installation. Mechanically fasten to substrate.
1. Securely fasten top termination of membrane with continuous metal termination bar anchored into substrate and cover with detail tape.

D. Horizontal Applications: Install sheet with face against substrate. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by membrane manufacturer. Overlap and seal seams, and stagger and tape end laps to ensure watertight installation.

E. Corners: Seal lapped terminations and cut edges of sheet waterproofing at inside and outside corners with detail tape.

F. Seal penetrations through sheet waterproofing to provide watertight seal with detail tape patches or wraps and a liquid-membrane troweling.

G. Install sheet-waterproofing and auxiliary materials to produce a continuous watertight tie into adjacent waterproofing.

H. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Tape perimeter of damaged or nonconforming area extending 6 inches (150 mm) beyond repaired areas in all directions. Apply a patch of sheet waterproofing and firmly secure with detail tape.

3.06 FIELD QUALITY CONTROL

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

B. Inspection:
1. Notify manufacturer's field representative for concurrent inspection of completed waterproofing with installer.
2. Inspect completed waterproofing areas prior to placing light-weight concrete.
3. Inspect completed waterproofed areas prior to backfilling operations.
4. Allowing placement of lightweight concrete over waterproofing not inspected by the manufacturer's representative or deficient is strictly prohibited.
5. Allowing backfilling over waterproofing manufacturer's representative not inspected or deficient installation is strictly prohibited.

C. Manufacturer's Field Service:
1. Provide services of waterproofing manufacturer authorized field representative to verify application of waterproofing under this section.
2. Verify application as installed; report acceptability of installation or deficiencies to be corrected, intent to warrant, and other pertinent information in writing.

D. Upon completion of horizontal membrane installation, dam installation area in preparation for flood testing.

E. Flood to minimum depth of 1 inch with clean water and inspect for leaks after 48 hours.

F. If leaking is found, remove water, repair leaking areas with new waterproofing materials as directed by Architect; repeat flood test, and repair damage to building.

G. When area is proven watertight, drain water and remove dam.

3.07 PROTECTION

A. Do not permit traffic over unprotected or uncovered membrane.

B. Protect sheet waterproofing materials from damage and wearing.

END OF SECTION

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SECTION 07 14 00
FLUID-APPLIED WATERPROOFING

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 SECTION INCLUDES

A. Hot-applied rubberized asphalt waterproofing.

B. Above-grade waterproofing accessories.

C. Molded sheet Drainage panels and Protection boards.

1.03 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete substrate and concrete topping.

B. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal counterflashings.

C. Division 22 Section for Plumbing Piping: Roof drain and plumbing vent flashing flanges.

D. Division 32 Paving Section for pavers and support sytem part of the warranted assembly.

1.04 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension.

B. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating.

C. ASTM D4259 - Standard Practice for Preparation of Concrete by Abrasion Prior to Coating Application.

D. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.

E. NRCA (WM) - The NRCA Waterproofing Manual.

1.05 SUBMITTALS

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

B. Product Data: Provide data for membrane, surface conditioner, flexible flashings, joint cover sheet, and joint and crack sealants.
   1. Submit each component of the waterproofing and paver system assembly under their respective Specification Sections, but include both submittal packages together for review.

C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.

D. Samples: Submit 1 ft by 1 ft samples for the following:
   1. Flashing sheet.
   2. Membrane-reinforcing fabric.
   3. Drainage panel.
   4. Protection course.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and acceptable installation temperatures.

G. Qualification Data:
   1. Manufacturer.
   2. Installer.

H. Field quality-control reports.

I. Warranty Documentation:
   1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture of fluid-applied waterproofing membranes with ten years experience.

B. Installer Qualifications: Company specializing in installation of fluid-applied waterproofing with minimum five years experience and is eligible to receive special warranties specified.

C. Source Limitations: Obtain waterproofing materials, primers, sheet flashings, protection course, and molded-sheet drainage panels from single source from single manufacturer.

D. Pre-Installation Conference: Prior to beginning waterproofing work, conference to be held to review Work to be accomplished.
   1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.
   2. Review installation of other materials by other trades that will interface with the waterproofing membrane.
   3. Conference shall include Contractor, hot fluid-applied waterproofing system subcontractor, Owner's waterproofing consultant, and all other subcontractors who have equipment penetrating waterproofing or otherwise will interface with waterproofing membrane.
   4. Contractor to notify Architect at least three days prior to time of conference.
   5. Contractor shall record minutes of meeting and distribute to attending parties, Owner, and Architect.

1.07 MOCK-UPS

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

B. Locate where directed.

C. Mock-up may not remain as part of this Work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store materials in accordance with manufacturer's written instructions with labels indicating product name and manufacturer.

B. Store materials in their original undamaged packaging in a clean, dry, protected location on elevated platforms and within the temperature range required by waterproofing manufacturer.

C. Remove and replace liquid materials that cannot be applied within their stated shelf life.

D. Protect stored materials from direct sunlight.

1.09 FIELD CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate, or when temperature is below 0 deg F (minus 18 deg C).
   1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during application and curing of waterproofing materials.

1.10 COORDINATION

A. Consult with manufacturer of hot fluid-applied waterproofing membrane for compatibility of concrete substrate for compatibility of finish texture, curing method, and form release agents.

B. Coordinate with paver manufacture for a complete warranted assembly.

1.11 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer warranty for waterproofing failing to resist penetration of water, except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

C. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace waterproofing and sheet flashings that do not comply with requirements or that fail to remain watertight within specified warranty period.

1. Warranty includes removing and reinstalling protection board, drainage panels, overburden, and pavers system on plaza decks.
2. Warranty Period: 20 years from date of Substantial Completion.

D. Coordinate Warranty with requirements of other assembly components specified elsewhere, including but not limited to Section 32 14 00 - Unit Paving for a complete warranted system.

PART 2 PRODUCTS

2.01 FLUID-APPLIED WATERPROOFING APPLICATIONS

A. Hot-Applied Rubberized Asphalt Waterproofing:
1. Location: Under sand set pavers at exterior elevated amenity decks.
2. Cover with drainage panel and protection course.

2.02 FLUID-APPLIED WATERPROOFING MATERIALS

A. Hot-Applied Rubberized Asphalt Waterproofing: Elasticized rubberized asphaltic compound, hot-applied and quick setting.
1. Suitable for installation over concrete, gypsum board, and plywood substrates.
2. Ultimate Elongation: 500 percent, minimum, measured in accordance with ASTM D412.
3. Water Vapor Permeance: 0.016 perms, maximum, measured in accordance with ASTM E96/E96M.
4. Reinforcing: Continuous; manufacturer's standard reinforcing fabric, approved for use with specified product.
5. Finished Coating Thickness: 215 mil, 0.215 inch, minimum.
6. Products:
a. Carlisle Coatings & Waterproofing, Inc; CCW 500-R: www.carlisleccw.com.
b. Henry Company; 790-11: www.henry.com.
c. Mar-flex Waterproofing & Building Products; Armor HRA 800: www.mar-flex.com.
d. Sika Roofing and Waterproofing; Hydrotech® Monolithic Membrane 6125® (MM 6125®): www.hydrotechusa.com.
e. Tremco Commercial Sealants & Waterproofing; TREMproof 6100: www.tremcosealants.com. (Basis of Design)
f. W.R. Meadows, Inc; HRM 714: www.wrmeadows.com.
g. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 ACCESSORIES

A. Primer/Surface Conditioner: Type, compatible with membrane compound; as recommended in writing by membrane manufacturer.

B. Sealant for Joints and Cracks in Substrate: Type compatible with waterproofing material and as recommended by waterproofing manufacturer.

C. Protection Board: Provide type capable of preventing damage to waterproofing due to backfilling and construction traffic.
1. Type as recommended by membrane manufacturer for full system warranty
2. Protection Sheet: Heavy duty modified bitumen protection board consisting of a medium-weight fiberglass mat with a SBS rubber and asphalt blend; 90 mils thickness.

D. Drainage Panel: Drainage layer with geotextile filter fabric on earth side.
1. Composition: Dimpled polyethylene, polypropylene, or polystyrene core; polypropylene or polyester filter fabric.
2. Thickness: As indicated on drawings.
3. Prefabricated drainage system consisting of a three dimension, high impact molded polystyrene core and a woven filter fabric bonded to dimples of core
a. Minimum thickness: As indicated on Landscape Drawing per location.
4. Products:
a. American Hydrotech, Inc; Hydrodrain: www.hydrotechusa.com.
b. Mar-flex Waterproofing & Building Products; ArmorDrain 110: www.mar-flex.com.
c. Tremco Commercial Sealants & Waterproofing; TREMDrain 1000 PF: www.tremcosealants.com.
d. W.R. Meadows, Inc; MEL-DRAIN: www.wrmeadows.com.

e. Substitutions: See Section 01 60 00 - Product Requirements.

E. Drainage Panel Accessories:
1. Base Drain: Thickened base drain composite, 6 inches wide.
2. Base Drain Outlets: Side and End Drains.
3. Couplers, Inside Corners, and Outside Corners: Pre-fabricated units matching and connecting to base drain to form continuous drainage system.
4. Base drain clips, tapes, mastics, sealers, and other miscellaneous accessories as required by manufacturer for a complete and warranted installation.
5. Base Drain Discharge: Corrugated HDPE (High Density Polyethylene) drain pipe with "sock" covering.

F. Cant Strips: Premolded composition material; compatible with and type as recommended in writing by waterproofing manufacturer.

G. Counterflashings: Stainless steel as specified in Section 07 62 00 or as recommended in writing by membrane and protection board manufacturer.

H. Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum termination bars; approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors; compatible with membrane and adhesives.

I. Reglet Strip Devices: As specified in Section 07 62 00.

J. Membrane Sealant: As recommended in writing by membrane manufacturer.

K. Root Barrier: 16-mil tightly woven HDPE scrim with 2-mil polymeric coating on both sides.

2.04 INSULATION

A. Board Insulation: Extruded-polystyrene board insulation complying with ASTM C 578, square edged.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. DiversiFoam Products.
b. Dow Chemical Company (The).
c. Owens Corning.
d. Pactiv Corporation.
e. T. Clear Corporation.
2. Type VII, 60-psi (414-kPa) minimum compressive strength.

B. Unfaced Plaza Deck Insulation Drainage Panels: Extruded-polystyrene board insulation complying with ASTM C 578, Type VII, 60-psi (414-kPa) minimum compressive strength; unfaced; fabricated with shiplapped or channel edges and with one side having ribbed drainage channels.
1. Products: Subject to compliance with requirements, provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following:
a. DiversiFoam Products; CertiFoam Plaza Deck.
b. Dow Chemical Company (The); Styrofoam Ribbed Roofmate.
c. Owens Corning; [Foamular 404 RB] [Foamular 604 RB].

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work. Examine substrates, areas, and conditions, with Installer present and manufacturer's representative, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
2. Verify that substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
3. Substrate shall be smooth, free of voids, spalled areas laitance, honeycombs and sharp protrusions.

4. Verify openings and penetrations are in place and ready to receive waterproof membrane.

B. Verify substrate surfaces are free of frozen matter, dampness, loose particles, cracks, pits, projections, penetrations, or foreign matter detrimental to adhesion or application of waterproofing system.

C. Verify that substrate surfaces are smooth, free of honeycomb or pitting, and not detrimental to full contact bond of waterproofing materials.

D. Verify that items penetrating surfaces to receive waterproofing are securely installed.

E. Proceed with installation only after unsatisfactory conditions have been corrected.
   1. Application of membrane indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Protect adjacent surfaces from damage not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's written instructions. Vacuum substrate clean. Provide clean, dust-free, and dry substrate for waterproofing application.

C. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

D. Close off deck drains and other deck penetrations to prevent spillage and migration of waterproofing fluids.

E. Remove grease, oil, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
   1. Abrasive blast clean concrete surfaces uniformly to expose top surface of fine aggregate according to ASTM D4259 with a self-contained, recirculating, blast-cleaning apparatus. Remove material to provide a sound surface free of laitance, glaze, efflorescence, curing compounds, concrete hardeners, or form-release agents. Remove remaining loose material and clean surfaces according to ASTM D4258.

F. Remove fins, ridges, and other projections and fill honeycomb, aggregate pockets, and other voids.

G. Do not apply waterproofing to surfaces unacceptable to waterproofing manufacturer.

H. Fill non-moving joints and cracks with a filler compatible with waterproofing materials.

I. Install cant strips at inside corners.

3.03 INSTALLATION

A. Install waterproofing to specified minimum thickness in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.

B. Flashing Installation:
   1. Install elastomeric flashing sheets at terminations of waterproofing membrane according to manufacturer's written instructions.
   2. Prime substrate with asphalt primer.
   3. Install elastomeric flashing sheet and adhere to deck and wall substrates in a layer of hot rubberized asphalt.
   4. Extend elastomeric flashing sheet up walls or parapets a minimum of 8 inches above plaza deck and 6 inches onto deck to be waterproofed.
   5. Install termination bars and mechanically fasten to top of elastomeric flashing sheet at terminations and perimeter of roofing.

C. Apply primer or surface conditioner at a rate recommended by manufacturer, and protect conditioner from rain or frost until dry.

D. At joints and cracks less than 1/2 inch in width including joints between horizontal and vertical surfaces, apply 12 inch wide strip of joint cover sheet.

E. At joints from 1/2 inch to 1 inch in width, loop joint cover sheet down into joint between 1-1/4 inch to 1-3/4 inch, and extend sheet at least 6 inches on either side of expansion joint.

F. Center joint cover sheet over joints, roll sheet into 1/8 inch thick coating of waterproofing material and apply second coat over sheet extending at least 6 inches beyond sheet edges.

G. Extend membrane over cants and up intersecting surfaces at membrane perimeter minimum 6 inches above horizontal surface for first ply and 6 inches at subsequent plies laid in shingle fashion.

H. Apply extra thickness of waterproofing material at corners, intersections, and angles.

I. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.

J. Extend waterproofing material and flexible flashing into drain clamp flange, apply adequate coating of liquid membrane to assure clamp ring seal. Coordinate with drain installation as specified in Division 22.

K. Seal membrane and flashings to adjoining surfaces.

3.04 INSTALLATION - DRAINAGE PANEL AND PROTECTION BOARD

A. Immediately after cooling, dust membrane with tack-reducing surfacing at rate of approximately 10 lb/100 sq ft.

B. After membrane has cooled, but before it becomes dusty, apply separation sheet and lap joints to ensure complete coverage.

C. Place drainage panel directly against membrane, butt joints, place to encourage drainage downward, with geotextile facing away from wall or deck substrate according to manufacturer's written instructions. Scribe and cut boards around projections, penetrations, and interruptions. Use methods that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

D. Drainage Panel Installation:
   1. At base of substrate, install base drains oriented horizontally.
   2. Secure base drains to substrate with washer-head fasteners at 24 inches on center.
   3. Use couplers and corner fittings to form continuous drains.
   4. Install discharge outlet fittings to connect with discharge systems.
   5. Mechanically fasten drainage mat units with fabric placed against substrate.
   6. Shingle-lap filter fabric lap joints; adhere fabric with spray adhesive.
   7. Penetrations and Tie-Back Heads: Cut drainage composite units to fit; wrap extra filter fabric around open core edge.
   8. Top of Drainage Panel: Wrap filter fabric flaps behind top panel edge; secure panels and wrapped fabric to wall with termination bars fastened at 12 inches on center.
   9. Connect base fittings to discharge pipe and run to sump or daylight. Properly compact soil under drain pipe to prevent settling of drain pipe or disruption of proper drainage slope.

E. Place protection board directly against drainage panel; butt joints, and scribe and cut boards around projections, penetrations, and interruptions.

3.05 FIELD QUALITY CONTROL

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

B. Owner will provide testing services, and Contractor to provide temporary construction and materials for testing.

C. Provide daily on-site attendance of waterproofing and insulation manufacturer's representative during installation of this work.

D. Upon completion of horizontal membrane installation, dam installation area in preparation for flood testing.

E. Flood Testing: Flood test each deck area for leaks, according to recommendations in ASTM D 5957, after completing and protecting waterproofing but before overlaying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches with clean water. Maintain 2 inches of clearance from top of sheet flashings. After 48 hours, inspect for leaks.

F. If leaking is found, remove water, repair leaking areas with new waterproofing materials as directed by Architect; repeat flood test, and repair damage to building.

G. When area is proven watertight, drain water and remove dam.

3.06 PROTECTION

A. Do not permit traffic over unprotected or uncovered membrane during remainder of construction period.

B. Protect installed assembly from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where surface will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

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SECTION 07 16 16
CRYSTALLINE WATERPROOFING

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 SECTION INCLUDES

A. Crystalline waterproofing.
   1. Surface applied crystalline waterproofing.
   2. Admixture for crystalline waterproofing integrated into concrete mix.

1.03 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete to be waterproofed.

B. Section 07 13 00 - Sheet Waterproofing: Waterproofing between elevator pit walls and earth.

C. Section 07 14 00 - Fluid-Applied Waterproofing: Waterproofing between elevator pit walls and earth.

1.04 REFERENCE STANDARDS

A. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating.

B. ASTM D4259 - Standard Practice for Preparation of Concrete by Abrasion Prior to Coating Application.

C. ASTM D4260 - Standard Practice for Liquid and Gelled Acid Etching of Concrete.

D. COE CRD-C 48 - Handbook for Concrete and Cement Standard Test Method for Water Permeability of Concrete.

E. NSF 61 - Drinking Water System Components - Health Effects.

F. UL (DIR) - Online Certifications Directory.

1.05 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. Test data showing hydraulic permeability.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Installation methods.
   5. Details for waterproofing at joints, intersections, and other special conditions.

C. Manufacturer's qualification statement.

D. Installer's qualification statement.

E. Specimen warranty.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least five 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.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Take necessary precautions to keep cementitious materials dry.

1.08 FIELD CONDITIONS

A. Maintain environmental conditions, such as temperature, humidity, and ventilation within limits recommended by manufacturer for acceptable results; do not install products under environmental conditions outside the manufacturer's indicated limits.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Installer Warranty: Provide 2-year warranty commencing on the Date of Substantial Completion for correcting leaking waterproofing, unless leakage is caused by structural failure, structural movement, or other causes beyond the installer's control. Complete forms in Owner's name and register with installer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Crystalline Waterproofing (surface applied):
   1. Euclid Chemical Company; VANDEX SUPER/SUPER WHITE: www.euclidchemical.com.
   2. Koster American Corporation; NB-1 Grey: www.kosterusa.com.
   3. Kryton International Inc; Krystol T1 and T2 Waterproofing System: www.kryton.com.
   4. Penetron; PENETRON - Crystalline Waterproofing Coating: www.penetron.com.
   5. W.R. Meadows, Inc.; CEM-KOTE CW PLUS: www.wrmeadows.com.
   6. Xypex Chemical Corporation; XYPEX Concentrate: www.xypex.com.
   7. Substitutions: See Section 01 60 00 - Product Requirements.

B. Crystalline Waterproofing Admixture (mixed with concrete at batch plant):
   1. Euclid Chemical Company: www.euclidchemical.com.
   2. Koster American Corporation: www.kosterusa.com.
   3. Kryton International Inc: www.kryton.com.
   4. Penetron: www.penetron.com.
   5. W.R. Meadows, Inc.; ADI-CON CW PLUS: www.wrmeadows.com.
   6. Xypex Chemical Corporation: www.xypex.com.
   7. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ASSEMBLIES

A. Crystalline Waterproofing Admixture for concrete elements: Base Bid
   1. Elevator foundations, including footings, sump pits, and elevator walls.

B. Crystalline Waterproofing for Concrete Building Surfaces: Where concrete tickets for admixture cannot be verified.
   1. Negative (interior side) of elevator pits.
   2. Negative (interior side) of sump pits within elevator pits.

2.03 MATERIALS

A. Crystalline Waterproofing: Portland cement, quartz or silica sand, and other active chemicals that when applied to surface of concrete forms insoluble crystals in capillary pores preventing passage of liquids, while having no adverse effect on normal properties of concrete.
   1. Hydraulic Permeability: No measurable leakage or water flow at 200 psi pressure when tested in accordance with COE CRD-C 48, using minimum 2 inch thick sample and 20 days duration.
   2. Toxicity: Non-toxic.
      a. Potable Water and Drinking Water Safe: Provide UL (DIR) listed and labeled waterproofing; tested safe for use in potable drinking water applications in accordance with NSF 61.
   3. VOC Content: 0 g/L

B. Plugging Compound: Ready-mixed cementitious compound meeting requirements and approved by waterproofing manufacturer, resistant to water but vapor permeable for horizontal, vertical, and overhead surfaces not exposed to vehicular traffic and compatible with substrate.

C. Patching Compound: Ready-mixed cementitious mortar approved by waterproofing manufacturer for patching or filling tie holes, reveals, honeycombs, or other damaged cementitious surfaces and compatible with substrate.

D. Accessory Materials: Patching compounds, crack fillers, and other accessory materials as recommended or required by the waterproofing manufacturer to establish warranted application, using products from the waterproofing manufacturer to the extent available.

2.04 MIXES

A. Waterproofing to be factory pre-mixed for the addition of water only at job-site.

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. Examine batch tickets to verify that concrete includes waterproofing admixture.

3.02 PREPARATION

A. Coordinate with applicable provisions of Section 03 30 00 - Cast-in-Place Concrete for admixtures and mix designs.

B. Where new concrete with integral waterproofing is to be bonded to previously placed concrete, prepare surfaces to be treated in accordance with waterproofing manufacturer's instructions. Saturate cold joint surface with clean water, and remove excess water before application of coat of waterproofing admixture slurry. Apply slurry coat uniformly with semi-stiff bristle brush at rate recommended by waterproofing manufacturer.

C. Mixing of admixtures shall occur at the batching site. Do not mix containers, including bags, with the concrete batch.

3.03 PREPARATION FOR APPLIED CRYSTALLINE WATERPROOFING.

A. Remove loose or foreign material and projections and fill holes, honeycombs, and depressions. Remove standing water. Perform other preparation work as recommended in writing by the manufacturer.

B. Clean surfaces thoroughly prior to installation.
   1. Remove dust, dirt, mortar, efflorescence, grease, oils, paint, form-release agents, and curing compounds in accordance with ASTM D4258.
   2. Concrete substrate shall be structurally sound and free from deteriorated concrete, dust, dirt, paint, oil, efflorescence, laitance, and other contaminants. Blow clean using unoiled air.
   3. Thoroughly clean the surface using high-pressure wash with a minimum 34.5 MPa (5,000 psi), or 24.1 MPa (3,500 psi) with sand brought into the nozzle, unless otherwise noted or required by manufacturer.

C. Prepare surfaces using methods recommended in writing by manufacturer for achieving best result for substrate under project conditions by sand blasting, water blasting, acid etching, or as recommended by manufacturer.
   1. Troweled Finish: Prepare concrete surface by abrasive cleaning in accordance with ASTM D4259 before coating application.
   2. Etched Finish: Prepare concrete surface by acid etching in accordance with ASTM D4260 before coating application.
   3. Surface profile shall be CSP 2-5 per ICRI Guideline 310.2–1997 (formerly 03732) “Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays”.
   4. Use thin patching mortar to patch the “honeycombing” and air pockets

D. Concrete shall be minimum 7 days old.

E. Plug water leaks with hydraulic cement mortar.

F. Patch holes, construction joints, and cracks. Remove defective concrete. Use polymer modified structural repair mortar for patching in excess of 1/4 inch.

G. Obtain approval of manufacturer's field representative before beginning installation.

3.04 INSTALLATION

A. Mix or prepare product in strict accordance with manufacturer's written instructions.
   1. In the absence of mixing instructions from the manufacturer, mix the contents of the bag with water using a motorized mixer and paddle.

a. Adjust the water for brushable consistency or a stiffer consistency for trowel application.
b. Ensure that the crystalline waterproof coating is applied within 15 to 20 minutes after mixing, unless otherwise specifically stated in the manufacturer’s written instructions.

B. Install in accordance with manufacturer's written instructions, maintain environmental conditions required and recommended by manufacturer, and keep a copy of manufacturer's instructions on site.
1. Apply one or two coats of waterproofing mix to walls and floors to achieve recommended thickness. Application methods and curing shall be as recommended in writing by waterproofing manufacturer.

C. Coordinate waterproofing installation with installation of products that must penetrate waterproofed surfaces.

D. Treatment of Inside Corners:
1. Apply a thin coat of crystalline waterproofing coating in slurry consistency to the area.
2. Install a mortar cove over the inside corners if required by the manufacturer.

E. Prevent excessive drying of surface.
1. Cure waterproofing for at least three days, or length of time required by manufacturer, with water spray and adequate air circulation.
2. Do not use chemical curing agents unless explicitly approved in writing by waterproofing manufacturer.

F. Do not backfill, fill water or liquid holding structures, or apply finish coatings until time period recommended in writing by manufacturer has passed.

3.05 FIELD QUALITY CONTROL

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

B. Flood test waterproofing application by filling water holding structures to capacity and allowing to stand for not less than 24 hours.

C. Permeability Test: Test concrete with waterproofing admixture according to COE CRD-C 48.

D. If any leaks appear, notify Architect and drain.
1. Repair leaks at no additional cost to Owner.
2. Repeat flood test until any leakage is eliminated.

3.06 PROTECTION

A. Protect from damage by weather; do not cover with impermeable (plastic) sheeting unless air circulation is provided and only where approved in writing by manufacturer.

B. Touch-up, repair or replace damaged waterproofing after Date of Substantial Completion.

END OF SECTION

SECTION 07 19 00
WATER REPELLENTS

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 SECTION INCLUDES

A. Water repellents applied to exterior and interior exposed to public view, masonry and concrete surfaces.

1.03 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Substrate for the Work of this Section.

B. Section 03 35 00 - Concrete Finishing: Surfaces identified to receive the Work of this Section.

1.04 REFERENCE STANDARDS

A. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.

B. ASTM D5095 - Standard Test Method for Determination of the Nonvolatile Content in Silanes, Siloxanes and Silane-Siloxane Blends Used in Masonry Water Repellent Treatments.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordinate mix design and installation sequence with surfaces that will receive water repellants.

1.06 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 Field Reports: Report whether manufacturer's "best practices" are being followed; if not, state corrective recommendations. Email report to Architect the same day as inspection occurs; mail report on manufacturer's letterhead to Architect within 2 days after inspection.

D. Manufacturer's Qualification Statement.

E. Installer's Qualification Statement.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience

C. Owner reserves the right to provide continuous independent inspection of surface preparation and application of water repellent.

1.08 MOCK-UPS

A. Prepare representative surface 36 by 36 inches in size using specified materials and preparation and application methods on surfaces identical to those to be coated; approved mock-up constitutes standard for workmanship.

B. For proposed substitutions, prepare side-by-side mock-ups of specified and substitute products.

C. Mock-up may not remain as part of the Work.

1.09 FIELD CONDITIONS

A. Protect liquid materials from freezing.

B. Do not apply water repellent when ambient temperature is lower than 50 degrees F or higher than 100 degrees F.

PART 2 PRODUCTS

2.01 MATERIALS

A. Water Repellent: Non-glossy, colorless, penetrating, water-vapor-permeable, non-yellowing sealer, that dries invisibly leaving appearance of substrate unchanged.
   1. Applications: Vertical surfaces and non-traffic horizontal surfaces.
   2. Number of Coats: As required to meet performance specifications.
   3. VOC Content: Less than 50 g/L, when tested in accordance with ASTM D3960 or ASTM D5095.
   4. Maintains dry appearance when wetted.
   5. Water-based siloxane, silane, or blend that reacts chemically with concrete and masonry.
      a. Manufacturers:
         1) MAPEI Corporation; Planiseal WR 40: www.mapei.com.
         2) Pecora Corporation: www.pecora.com.
         3) PROSOCO, Inc.; Sure Klean® Weather Seal Siloxane PD (predilute): www.prosoco.com.
         4) Sherwin-Williams Company; Loxon 7 Percent Siloxane: www.sherwin-williams.com.
         5) Tnemec Company, Inc.; Prime-A-Pell H2O: www.tnemec.com.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify joint sealants are installed and cured.

C. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of water repellent.

3.02 PREPARATION

A. Coordinate with installation of cast-in-place concrete prior to any concrete placement.

B. Protection of Adjacent Work:
   1. Protect adjacent landscaping, property, vehicles, and in-place construction from drips and overspray.
   2. Protect adjacent surfaces not intended to receive water repellent.

C. Prepare surfaces to be coated as recommended by water repellent manufacturer for best results.
   1. Coordinate the surface preparation requirements based on the specific manufacturer approved.

D. Do not start work until concrete and masonry mortar substrate is cured a minimum of 60 days.

E. Remove loose particles and foreign matter.

F. Remove oil and foreign substances with a chemical solvent that will not affect water repellent.

G. Scrub and rinse surfaces with water and let dry.

H. Allow surfaces to dry completely to degree recommended by water repellent manufacturer before starting coating work.

3.03 APPLICATION

A. Apply water repellent in accordance with manufacturer's instructions, using procedures and application methods recommended as producing the best results.

B. Apply at rate and in number of coats as recommended in writing by manufacturer over the entire surface.

C. Remove water repellent from unintended surfaces immediately by a method instructed by water repellent manufacturer.

D. Provide manufacturer's field service representative to inspect preparation and application work for at least 3 hours on first day to ensure that manufacturer's "best practices" for preparation and application are being followed.

END OF SECTION

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SECTION 07 21 00
THERMAL INSULATION

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 SECTION INCLUDES

A. Board insulation at exterior wall behind fiber cement and masonry veneer wall finish.

B. Batt insulation in exterior wall construction.

C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

D. Sill Sealer.

E. Accessories.

1.03 RELATED REQUIREMENTS

A. Section 04 20 01 - Masonry Veneer: Masonry walls enclosing insulation.

B. Section 07 25 00 - Weather Barriers : Sheet-applied Weather Resistive Barriers.

C. Section 07 27 00 - Fluid-Applied Air Barriers: Separate air barrier materials.

D. Section 07 54 23 - Thermoplastic-Polyolefin (TPO) Membrane Roofing: Insulation specified as part of roofing system.

1.04 REFERENCE STANDARDS

A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

C. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

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

E. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

F. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C.

G. ICC-ES AC239 - Acceptance Criteria for Termite-Resistant Foam Plastic.

H. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components.

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.

1.06 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Surface-Burning Characteristics: ASTM E84.
2. Fire-Resistance Ratings: ASTM E119.
3. Combustion Characteristics: ASTM E136.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened containers with identification labels and testing agency markings intact and legible.

B. Store products in manufacturer's unopened packaging until ready for installation.
   1. Store at temperatures not less than 40 degrees F (or temperature required by manufacturer) 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.

1.08 FIELD CONDITIONS

A. Do not install insulation in wood framed walls that are not compliant with required moisture content ratings.

PART 2 PRODUCTS

2.01 FOAM BOARD INSULATION MATERIALS

A. Termite-Resistant Expanded Polystyrene (EPS) Board Insulation: Comply with ASTM C578.
   1. Locations: Foundation or underslab insulation as indicated on Drawings.
   2. Termite Resistance: Comply with ICC-ES AC239.
   3. Flame Spread Index (FSI): 25 or less, when tested in accordance with ASTM E84.
   4. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   5. Board Thickness: 1-1/2 inch.
   6. Products:
      a. AFM Corporation; Foam-Control® PLUS+® with Perform Guard®: www.foam-control.com.
      b. Cellofoam North America Inc.; PermaBG+™: www.cellofoam.com.
      c. Nisus Corporation; Bora-Foam: www.nisuscorp.com.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

B. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, comply with ASTM C1289.
   1. Locations: Exterior wall continuous insulation with foil facer(s) as indicated on Drawings.
   2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly Classifications:
      a. Type I: Faced with aluminum foil on both major surfaces of the core foam.
         1) Class 2 - Glass fiber reinforced or non-reinforced core foam.
         2) Compressive Strength: 16 psi, minimum.
         3) Thermal Resistance, R-value: At 1-1/2 inch thick; 9.0, minimum, at 75 degrees F.
   3. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   4. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   5. Comply 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.
   6. Board Size: 48 inch by 96 inch.
   7. Board Thickness: 1.5 inch.
   8. Board Edges: Square.
   9. Products with foil facers:
      a. Atlas Roofing Corporation; EnergyShield Pro Continuous Wall Insulation: www.atlasroofing.com.
      b. Carlisle Coatings & Waterproofing, Inc; R2+ Silver: www.carlisleccw.com.
      c. DuPont de Nemours, Inc; THERMAX XARMOR (ci): www.building.dupont.com.
      d. Hunter Panels; Xci Foil (Class A): www.hunterpanels.com.
      e. Johns Manville; AP Foil-Faced: www.jm.com.
      f. Substitutions: See Section 01 60 00 - Product Requirements.

C. Rigid Cellular Polyisocyanurate (ISO) Thermal Insulation Board with Facers Both Sides: Complying with ASTM C1289.
   1. Locations: Exterior wall continuous insulation with breathable facer on both sides.

2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
3. Classifications:
    a. Type I: Faced with aluminum foil on both major surfaces of core foam.
        1) Class 2 - Glass fiber reinforced or non-reinforced core foam.
        2) Compressive Strength: 16 psi, minimum.
        3) Thermal Resistance, R-value: At 1-1/2 inch thick; 9.0, minimum, at 75 degrees F.
    b. Type II: Faced with either cellulosic facers or glass fiber mat facers on both major surfaces of the core foam.
        1) Class 1 - Faced with glass fiber reinforced cellulosic facers on both major surfaces of core foam.
        2) Thermal Resistance, R-value: At 1-1/2 inch thick; Class 1, Grades 1-2-3 - 8.4 (1.48), minimum, at 75 degrees F.
4. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
5. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
6. Comply 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.
7. Board Size: 48 inch by 96 inch.
8. Thermal Resistance: R-value as shown on the Drawings.
9. Board Edges: Square.
10. Products with non-foil facers:
    a. Atlas Wall CI Board, division of Atlas Roofing Corporation; EnergyShield: www.atlasroofing.com.
    b. Carlisle Coatings & Waterproofing, Inc; R2+ Matte: www.carlisleccw.com.
    c. Dow Chemical Company: www.dow.com.
    d. Hunter Panels; Xci CG (Class A): www.hunterpanels.com.
    e. Johns Manville; CI Max: www.jm.com.
    f. Rmax Inc; Durasheath-3: www.rmax.com.
    g. Holcim Elevate; Resista Insulation; www.holcimelevate.com.
11. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MINERAL/GLASS FIBER BLANKET INSULATION MATERIALS

A. Flexible Glass Fiber Blanket Thermal Insulation: Preformed insulation, complying with ASTM C665; friction fit.
    1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
    2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
    3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
    4. Formaldehyde Content: Zero.
    5. Thermal Resistance: R-value as indicated on Drawings.
    6. Thickness: Insulation shall have a thickness based on the R-values in accordance with the UL Assemblies and project energy requirements identified on the Drawings.
    7. Facing: Insulation shall be faced or unfaced in accordance with the assemblies identified on the Drawings.
        a. Unfaced Batt Insulation Manufacturers:
            1) CertainTeed Corporation: www.certainteed.com.
            2) Johns Manville; Formaldehyde-free™ fiberglass insulation: www.jm.com.
            3) Knauf; EcoBatt® Insulation: www.knaufinsulation.us.
            4) Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation: www.ocbuildingspec.com.
            5) Substitutions: See Section 01 60 00 - Product Requirements.

B. Glass Fiber Batt Insulation at exterior wall within the floor/ceiling cavity and exterior wall within roof/ceiling cavity.
    1. Batt insulation Unfaced, flame spread rating not more than 25.ASTM C665
        a. Manufacturers:

1) CertainTeed Corporation; CertaPro™ Thermal: www.certainteed.com.
2) Johns Manville; Fiberglass Batts: www.jm.com.
3) Knauf; EcoBatt® Insulation: www.knaufinsulation.us.
4) Owens Corning Corporation; PINK Next Gen™ Fiberglas™ Flame Spread 25: www.ocbuildingspec.com.
5) Substitutions: See Section 01 60 00 - Product Requirements.

C. Mineral Wool Blanket Thermal Insulation: Flexible or semi-rigid preformed insulation, complying with ASTM C665.
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.

2.03 SILL SEALER

A. Sill Seal Insulation: Flexible, moisture-resistant, preformed polyethylene foam strip.
1. Formaldehyde Content: Zero.
2. Width: 3.5 inch wide strip.
3. Thickness: minimum 0.1875 inch.
4. Manufacturers:
a. Reflectix, Inc.: Reflectix® Sill Sealer; http://www.reflectixinc.com.
b. DuPont de Nemours, Inc.: STYROFOAM™ BRAND SILL SEAL ; www.dupont.com.
c. Owens Corning Corp: ProPink ComfortSeal™ Sill & Framing Gasket www.owenscorning.com.
5. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 ACCESSORIES

A. Air and Moisture Sealing Insulation Fasteners: Preassembled fastener units consisting of sealing washer, screw, and gasketing tube.
1. Length as required for thickness of insulation material and penetration of deck substrate.
2. Thread and tip types as required for substrate material.
3. Products:
a. TruFast Walls, a Division of Altenloh, Brinck & Co. US, Inc; Grip-Deck TubeSeal: www.trufastwalls.com/#sle.
b. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation Fasteners: Lengths of unfinished, 13-gauge, 0.072-inch high carbon spring steel with chisel or mitered tips, held in place by tension, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.

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. Nails or Staples: Steel wire; electroplated or galvanized; type and size to suit application of faced insulation flanges.

E. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

C. Prior to closing walls or ceilings, obtain Owner’s approval of insulation installation.

D. Verify adjacent materials are dry and ready to receive installation.

E. Verify mechanical and electrical services within walls have been installed and tested.

3.02 BOARD INSTALLATION AT EXTERIOR WALLS

A. Install boards horizontally on walls.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BATT INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Install in exterior wall spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. Exposed facings, including but not limited to those in concealed spaces, shall either meet Class A flame spread requirements or shall be in substantial contact with gypsum panels not less than 1/2 inches thick.

F. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

G. Coordinate work of this section with construction of air barrier seal, see Section 07 27 00.

3.04 FIELD QUALITY CONTROL

A. Installation shall meet Grade I or Grade II RESNET Standards.

B. See Section 01 40 00 - Quality Requirements for additional requirements.

3.05 SILL SEALER INSTALLATION

A. Install on top of slab and underneath the sill plate to fill the gap between the sill plate and foundation slab or wall for a tight, uniform fit.

3.06 MISCELLANEOUS VOIDS

A. Loose-Fill Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.

B. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.07 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

B. Touch-up, repair or replace damaged products before Substantial Completion

END OF SECTION

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SECTION 07 21 13.19
MINERAL BOARD INSULATION

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 SECTION INCLUDES

A. Perimeter Fire Containment Systems.

B. Building Insulation for Thermal and Acoustical Applications.

C. Fire Resistive Joint Systems.

D. Firestopping of Through Penetrations.

1.03 RELATED REQUIREMENTS

A. Section 07 21 00 - Thermal Insulation

B. Division 07 Sections: Various Sections for cladding where Mineral Board insulation is part of the cladding system.

C. Section 08 43 13 - Aluminum-Framed Storefronts: Window systems.

D. Section 08 44 13 - Glazed Aluminum Curtain Walls: Window systems.

E. Section 09 21 16 - Gypsum Board Assemblies: Insulation installed in conjunction with exterior wall sheathing.

1.04 REFERENCE STANDARDS

A. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

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

D. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

E. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C.

F. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.

G. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

H. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus.

I. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.

J. ASTM C 1104 – Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.

K. Federal Specification HH-I-521F: Insulation Blankets, Thermal (Mineral Fiber, For Ambient Temperatures).

L. Federal Specification HH-I-558B: Insulation, Blocks, Blankets, Felts, Sleeving (Pipe and Tube Covering), and Pipe fitting Covering, Thermal (Mineral Fiber, Industrial Type)

M. National Fire Protection Association (NFPA) Life Safety Code

N. Underwriters Laboratories (UL) - UL 2079 Standard test method for fire resistance of Building Joint Systems.

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.

C. 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.

D. Performance Data:
   1. Submit appropriate research reports or evaluation data for products listed in this section.
   2. Prior to project closeout, Contractor shall certify in accordance with section 01770 that all products installed pursuant to this section do not contain Asbestos or Polychlorinated Biphenyls (PCB).

E. Shop Drawings: Submit manufacturers shop Drawings describing the type and location of each product specified.

F. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Single manufacturer with a minimum of ten years experience manufacturing or marketing products in this section shall provide all products listed.

B. Installer Qualifications:
   1. Products listed in this section shall be installed by a single organization with at least two (2) years experience successfully installing insulation on projects of similar type and scope as specified in this section.
   2. If the installation of the curtain wall is the responsibility of a different installer, coordinate specified installations prior to commencement of work to ensure the complete system meets the specified ratings.
   3. Certification per FM 4991, Underwriters Laboratories, Intertek (OPL) Laboratories, or by the Firestop Contractors International Association (FCIA).

C. Fire- Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by Underwriters Laboratories (UL), Intertek (OPL) or another testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Identify materials appropriate markings of applicable testing and inspecting agency.
   2. Surface-Burning Characteristics: ASTM E84. Unfaced material will have a maximum flame spread 0 and smoke-developed of 0. Foil Faced material will have maximum flame spread 25 and smoke-developed of 0.
   3. Fire-Resistance Ratings:
   4. ASTM E2307 pertains to perimeter fire containment. ASTM E119 pertains to fire rated walls, floors and ceilings. ASTM E814 pertains to poke-throughs and penetration assemblies. ASTM E1966 pertains to fire resistive joint systems.
   5. Combustion Characteristics: Rated as non combustible as defined by NFPA standard 220 when tested in accordance with ASTM E136.

D. Manufacturer's identification tags or marks are not acceptable on surfaces where products are considered to be finish material.
   1. Evidence of patching after removal of tags or marks is not acceptable.

E. Field Inspection: Follow criteria outlined in ASTM E2393 Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.

F. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship is approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to the job site in original packages, containers, or bundles bearing the brand name and manufacturer's identification.

B. Storage: Store materials in dry locations with adequate ventilation, free from water, and in such a manner to permit easy access for inspection and handling.

C. Handling: Handle materials to avoid damage. When installing or otherwise handling these insulation products, wear a NIOSH approved dust mask or respirator, gloves and long sleeved, loose fitting clothing closed at the neck and wrists. Wear safety glasses when installing.

1.08 PROJECT CONDITIONS

A. Protect adjacent work of other trades from damage. Clean substrates of substances harmful to insulation or vapor retarders, including removal of projections which might puncture vapor retarders. In cold weather, during installation of smoke sealant material, temperatures within the building shall be maintained above 55 Degrees F. Provide adequate ventilation to carry-off excess moisture.

1.09 WARRANTY

A. At project closeout, provide to the owner or owners representative an executed copy of the manufacturer's warranty document outlining the terms, conditions, and exclusions of their Standard Limited Warranty against Manufacturing Defect.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer: Thermafiber, Inc.: 3711 Mill St.; Wabash, IN 46992; Toll Free Tel: 888-834-2371; Tel: 260-563-2111; Fax: 260-563-8979: www.thermafiber.com

B. Other acceptable Manufacturers:
   1. Rockwool: www.rockwool.com/north-america.

C. Substitutions: 01 60 00 - Product Requirements.

2.02 PERIMETER FIRE CONTAINMENT

A. General: Where indicated for gaps between the perimeter edge of fire-resistance-rated floor assemblies and non-fire-resistance-rated exterior curtain walls, provide a perimeter fire-containment system with the fire test response characteristics indicated, as determined by testing identical systems per the Underwriters Laboratories or Intertek (OPL) Laboratories, or another testing and inspecting agency accountable to authorities having jurisdiction. If no tested system exists, an engineering judgment as specified by the International Firestop Council must accompany the design.

B. Curtain Wall Insulation:
   1. Thickness as noted in tested and listed design.
   2. Type: Thermafiber FireSpan 90 Insulation.
      a. R-Value: 4.2 per inch.
      b. Facing: Unfaced.
      c. Density: 8.0 pcf (nominal).
      d. Surface-Burning Characteristics: ASTM E84. Unfaced material will have a maximum flame spread 0 and smoke-developed of 0. Foil Faced material will have maximum flame spread 25 and smoke-developed of 0.
   3. Type: Thermafiber FireSpan 40 Insulation.
      a. R-Value: 4.2 per inch.
      b. Facing: Unfaced.
      c. Density: 4.0 pcf (nominal).
      d. Surface-Burning Characteristics: ASTM E84. Unfaced material will have a maximum flame spread 0 and smoke-developed of 0. Foil Faced material will have maximum flame spread 25 and smoke-developed of 0.

C. Safing Insulation:
   1. Type: Thermafiber Safing Insulation.
      a. R-Value: 4.2 per inch.
      b. Facing: Unfaced.
      c. Facing: Foil Faced.
      d. Standard Density: 4.0 pcf (actual).

e. Surface-Burning Characteristics: ASTM E84. Unfaced material will have a maximum flame spread 0 and smoke-developed of 0. Foil Faced material will have maximum flame spread 25 and smoke-developed of 0.

D. Safing Clips: Z-Shaped galvanized steel clips formed from 1 inch (25mm) wide strips of 20 gauge galvanized steel. 3 inches (76mm) high with 2 inch (51mm) and 3 inch (76mm) upper and lower horizontal legs. See specific UL or OPL/Intertek design to verify if safing clips are required.

E. Hardware:
1. Thermafiber Impasse hardware for attaching curtain wall insulation.
2. Mechanical Fasteners as approved by the Architect and Manufacturer.

F. Mullion Covers:
1. 1 inch (25 mm) Thermafiber FireSpan 90 Insulation for protection of mullions.
2. 2 inch (51 mm) Thermafiber FireSpan 90 Insulation for protection of mullions.

G. Backer / Reinforcement Member: Thermafiber Impasse T-Bar or other light gauge steel channel or angle approved by the primary manufacturer. Place horizontally at the safe-off line to support the curtain wall insulation to prevent bowing of curtain wall insulation caused by compression fitting of the Safing insulation.

H. Smoke Barrier: Smoke sealant as listed in the appropriate fire tested assembly and approved by the Architect and Manufacturer.

I. Vapor Retarder Tape: Compatible with specified facer and comparable perm rating. For taping insulation joints and repairing tears.

2.03 THERMAL AND ACOUSTICAL INSULATION

A. Exterior Thermal / Acoustical Insulation:
1. Thickness: As noted on Drawings.
2. Type: Thermafiber FireSpan 90 Insulation.
a. R-Value: 4.2 per inch.
b. Facing: Unfaced.
c. Density: 8.0 pcf (nominal).
d. Surface-Burning Characteristics: ASTM E84. Unfaced material will have a maximum flame spread 0 and smoke-developed of 0. Foil Faced material will have maximum flame spread 25 and smoke-developed of 0.
3. Type: Thermafiber FireSpan 40 Insulation.
a. R-Value: 4.2 per inch.
b. Facing: Unfaced.
c. Density: 4.0 pcf (nominal).
d. Surface-Burning Characteristics: ASTM E84. Unfaced material will have a maximum flame spread 0 and smoke-developed of 0. Foil Faced material will have maximum flame spread 25 and smoke-developed of 0.
4. Type: Thermafiber FS 15 Insulation.
a. R-Value: 4.0 per inch for thickness of > 1”. R-Value of 4.2 per inch for thickness of 1”.
b. Facing: Unfaced only.
c. Density: 4 pcf (nominal) for 1” thick material.
d. Density: 3.0 pcf (nominal) for thicknesses greater than 1”.
e. Surface-Burning Characteristics: ASTM E84. Unfaced material will have a maximum flame spread 0 and smoke-developed of 0.
5. Type: Thermafiber Sound Attenuation Fire Blanket (SAFB).
a. Facing: Unfaced only.
b. Density: 4 pcf (nominal) for 1” thick material.
c. Density: 2.5 pcf (nominal) for thicknesses greater than 1”.
d. Surface-Burning Characteristics: ASTM E84. Unfaced material will have a maximum flame spread 0 and smoke-developed of 0.

B. Rain Screen / Cavity Wall Continuous Insulation
1. Description: Non-combustible, semi-rigid mineral wool insulation board that is water repellent and resists temperatures above 2,000° F, meets ASTM C612, IVA.

2. Thickness: As noted on Drawings.
3. Type: Thermafiber RainBarrier 45 Insulation
    a. R-value of 4.2 per inch.
    b. Facing: Unfaced.
    c. Density: 4.5 pcf.
    d. Surface Burning Characteristics: Unfaced- Flame Spread 0 and Smoke Developed 0
    e. Moisture Resistance: Absorbs less than 0.03% by volume, ASTM C1104
    f. Non-corrosive, ASTM C665.
4. Type: Thermafiber RainBarrier HD Insulation
    a. R-value of 4.2 per inch.
    b. Facing: Unfaced.
    c. Density: 6.0 pcf.
    d. Surface Burning Characteristics: Unfaced-Flame Spread 0 and Smoke Developed 0
    e. Moisture Resistance: Absorbs less than 0.03% by volume, ASTM C 1104.
    f. Non-corrosive, ASTM C665.
5. Hardware: RainBarrier Insulation Retaining Clip for securing RainBarrier continuous insulation to exterior substrate. This clip is recommended by manufacturer as it is compatible with multiple types of masonry and facade tie systems it is compatible with multiple types of masonry and facade tie systems.

C. Multi-Purpose Thermal and Acoustical Insulation Product Used Where Fire Rated Assembly is NOT REQUIRED:
1. Description: Non-combustible, semi-rigid mineral wool insulation board that is water repellent and resists temperatures above 2,000° F, meets ASTM C612, Type IA (VersaBoard 35), Type IA, IB, II, III, IVA (VersaBoard 40) and Type IA, IB, II, III, IVA (VersaBoard 60 & 80). VersaBoard provides fire resistive characteristics, sound control, thermal insulation, and energy conservation for various commercial applications. VersaBoard is ideal for parking garage under decking, mechanical rooms, and other areas where insulation is required.
2. Thickness: As noted on Drawings.
3. Type: Thermafiber VersaBoard 35:
    a. R-Value: 4.0 per inch.
    b. Facing: Available in unfaced, ASJ Facing, Black Mat Facing, and White Mat Facing.
    c. Density: 3.5 pcf (actual).
4. Type: Thermafiber VersaBoard 40:
    a. R-Value: 4.2 per inch.
    b. Facing: Available in unfaced, ASJ Facing, Black Mat Facing, and White Mat Facing.
    c. Density: 4.0 pcf (actual).
5. Type: Thermafiber VersaBoard 60:
    a. R-Value: 4.2 per inch.
    b. Facing: Available in unfaced, ASJ Facing, Black Mat Facing, and White Mat Facing.
    c. Density: 6.0 pcf (actual).
6. Type: Thermafiber VersaBoard 80:
    a. R-Value: 4.2 per inch.
    b. Facing: Available in unfaced, ASJ Facing, Black Mat Facing, and White Mat Facing.
    c. Density: 8.0 pcf (actual).
7. Physical Properties of VersaBoard 35, 40, 60 and 80:
    a. Surface Burning Characteristics: Unfaced- Flame Spread 0 and Smoke Developed 0, Foil Faced- Flame Spread 25 and Smoke Developed 0. ASJ Faced- Flame Spread 10 and Smoke Developed 5. Black and White Mat Faced: Surface Burning Characteristics unknown.
    b. Moisture Resistance: Absorbs less than 0.03% by volume, ASTM C 1104.
    c. Non-corrosive, ASTM C665.

D. Interior Partition Walls and Ceilings:
1. Thickness: As noted on Drawings.
2. Type: Thermafiber Sound Attenuation Fire Blanket (SAFB).

a. Facing: Unfaced only.
b. Density: 4.0 pcf (nominal) for 1” thick material.
c. Density: 2.5 pcf (nominal) for thicknesses greater than 1”.
d. Surface Burning Characteristics: Unfaced- Flame Spread 0 and Smoke Developed 0.
e. Minimum Recycle Content: 70% (Pre-Consumer).

3. Type: Thermafiber Creased Sound Attenuation Fire Blanket (SAFB).
a. Density: 2.5 pcf (nominal) Creased SAFB available in 2.5 pcf only.
b. Surface Burning Characteristics: Unfaced- Flame Spread 0 and Smoke Developed 0.
c. Minimum Recycle Content: 70% (Pre-Consumer).

2.04 FIRE RESISTIVE JOINT SYSTEMS IN RATED ASSEMBLIES

A. Insulation:
1. Type: Thermafiber Safing Insulation for construction joint application.
2. Type: Thermafiber Top-Stop Insulation for head of wall applications.
a. Thickness: As noted on Drawings.
b. Facing: Unfaced.
c. Surface Burning Characteristics: Unfaced- Flame Spread 0 and Smoke Developed 0.

B. Smoke Barrier: Smoke sealant as listed in the appropriate fire tested assembly and approved by the Architect and Manufacturer.

2.05 FIRESTOPPING OF THROUGH PENETRATIONS IN RATED ASSEMBLIES

A. Safing Insulation:
1. Type: Thermafiber Safing Insulation.
a. Thickness: As noted in tested designs.
b. Facing: Unfaced.
c. Standard Density: 4.0 pcf (actual).
d. Density: 6.0 pcf (actual).
e. Density: 8.0 pcf (actual).
f. Surface Burning Characteristics: Unfaced- Flame Spread 0 and Smoke Developed 0.

B. Smoke Barrier: Smoke sealant as listed in the appropriate fire tested assembly and approved by the Architect and Manufacturer.

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 for achieving the best result for the substrate under the project conditions.

3.03 BACKER REINFORCEMENT MEMBERS

A. Install backer reinforcement member in accordance with manufacturer's instructions.

B. Install Thermafiber Impasse T-Bar or an approved light steel angle or channels, placed horizontally at the safing line, attached to the vertical mullions either within the insulation at a horizontal splice, or behind the insulation and mechanically attached to vertical mullions. This detail prevents the bowing of the curtain wall insulation due to the compression fit of the safing insulation.

3.04 CURTAIN WALL INSULATION

A. Install curtain wall insulation in accordance with Underwriters Laboratories / Intertek (OPL) Laboratories listed system and manufacturer's instructions.

B. Install backer bar assembly in accordance with the tested design. Not applicable when the Thermafiber No Backer Bar™ system is specified.

C. Retain insulation in place with mechanical fasteners within the mullions and transoms (spandrel area), spaced at intervals recommended by tested assembly to hold insulation securely in place without touching the exterior wall. Maintain cavity width of dimension indicated between insulation and exterior wall.

3.05 SAFING INSULATION

A. Install safing insulation in accordance with manufacturer's instructions.

B. Install safing insulation of proper size in safe off area between curtain wall insulation and floor slab as prescribed by the listed and tested assembly.

C. Safing insulation direction and compression as well as the absence of safing Z-clips are prescribed by the listed and tested assembly.

D. Install Safing insulation of proper density and size into construction joints (head-of-wall, floor-to-floor, floor-to-wall, etc.) as prescribed by the listed and tested assembly.

E. Install Safing insulation of proper density and size into poke-throughs and penetrations as prescribed by the listed and tested assembly.

3.06 SMOKE BARRIER SYSTEM

A. Install smoke barrier system in accordance with manufacturer's instructions.

B. Utilize foil faced FireSpan curtain wall Insulation with Thermafiber safing Insulation. Apply approved smoke sealant in accordance with the tested assembly.

C. Install Safing insulation of proper density and size as prescribed by the tested assembly. Apply approved smoke sealant in accordance with the tested assembly.

D. Install Safing insulation of proper density and size into poke-throughs and penetrations as prescribed by the tested assembly. Apply approved smoke sealant in accordance with the tested assembly.

3.07 PROTECTION

A. Protect installed products until completion and project closeout.

B. Touch-up, repair or replace damaged products before Substantial Completion.

3.08 CLEAN-UP

A. Prior to project closeout, remove all related rubbish, excess material, scaffolding, tools and equipment from the site. Dispose of waste material in a manner approved by applicable jurisdictions.

END OF SECTION

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SECTION 07 21 29
NON-COMBUSTIBLE SPRAYED INSULATION

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 SECTION INCLUDES

A. Spray-applied fibrous insulation applied to the underside of structure.

1.03 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Substrate to which products listed in this Section will adhere.

1.04 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

B. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

C. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

D. ASTM C739 - Standard Specification for Cellulosic Fiber Loose-Fill Thermal Insulation.

E. ASTM C1014 - Standard Specification for Spray-Applied Mineral Fiber Thermal and Sound Absorbing Insulation.

F. ASTM D1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics.

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

H. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C.

I. ASTM E736/E736M - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.

J. ASTM E759/E759M - Standard Test Method for Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members.

K. ASTM E859/E859M - Standard Test Method for Air Erosion of Sprayed Fire-Resistive Materials (SFRMs) Applied to Structural Members.

L. ITS (DIR) - Directory of Listed Products.

M. UL (DIR) - Online Certifications Directory.

N. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.05 SUBMITTALS

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

B. Product Data: Provide data on materials, describing insulation properties.

C. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and weather related criteria.

D. Manufacturer's Qualification Statement.

E. Installer's Qualification Statement.

F. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

C. Products Specified by Flammability Criteria: Listed and classified by ITS (DIR), UL (DIR), or authorities having jurisdiction (AHJ).

D. Spray foam insulation is not an acceptable substitute for spray-applied insulation.

1.07 FIELD CONDITIONS

A. Do not install insulation, when ambient and surface temperatures are lower than required by manufacturer.

B. Maintain acceptable ambient and substrate surface temperatures prior to, during, and after installation of primer and insulation materials and overcoat.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Exposed Cellulosic Fiber Sprayed Insulation:
   1. International Cellulose Corp; Product K-13 Spray-On High R-Value System: www.spray-on.com. (Basis of Design)
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Glass Fiber Sprayed Insulation:
   1. Monoglass® Incorporated; Product Monoglass. (Basis of Design)
   2. Thermacoustic Industries International; TC-417.
   3. American Sprayed Fibers, Inc; Dendamix

C. Mineral Wool Fiber Sprayed Insulation:
   1. Rockwool International.
   2. Thermafiber, Inc.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Cellulose Fiber Insulation: ASTM C739; treated cellulose fiber.
   1. Spray applied and non-hygroscopic inorganic insulation.
   2. Thickness / R-Factor: Minimum values as indicated on Drawings.
   3. Color: As selected by Architect from manufacturer's full range.
   4. Bond strength shall be greater than 100 psf per ASTM E736/E736M.
   5. Bond Deflection per ASTM E759/E759M: 6” Deflection in 10’ Span – No Spalling or Delamination.
   6. Product shall be Class 1, Class A per ASTM E84/UL 723.
   7. Non-corrosive per ASTM C739.
   8. K factor: 0.22 K, when tested in accordance with ASTM C177.
   9. Density: 2 pcf, when tested in accordance with ASTM D1622.
   10. Flame Spread and Smoke Developed Index: 10/0, when tested in accordance with ASTM E84.
   11. Combustibility: Passing ASTM E136.

B. Glass Fiber: ASTM C1014.
   1. Spray-applied fiber conforming to ASTM E136 using MONOGLASS Liquid Bonding Adhesive manufactured by Monoglass Incorporated.
   2. Thickness / R-Factor: Minimum values as indicated on Drawings.
   3. Color: White.
   4. Thermal /acoustic insulation shall not contain asbestos, free crystalline silica or combustible fibers, and shall exhibit the following properties:
      a. Fire Hazard Classification; ASTM E84: Flame Spread = 0, Smoke Developed = 0, Fuel Contribution = 0.
      b. Non-Combustible; ASTM E136, ISO 1182-90 & CAN 4-S114-78.
      c. Air Erosion; ASTM E859/E859M, No Mass Loss.
      d. Smolder Resistance; CGSB 51-GP-36P, Passed: 0.4% mean weight loss.
      e. Vibration Resistance Type 1; CGSB 51GP-11M, Passed: 0.02% mass loss.

f. Dry Density; ASTM D1622/D1622M, 3.0 pounds/cubic foot.
g. Thermal Conductivity; ASTM C518, K-Factor .25, R-Value 4.00/inch.
h. Noise Reduction Coefficient:
1) ASTM C423; NRC = .85, 1.4" on solid backing.
2) ISO 354; NRC = .75 @ 25mm/1"* NRC = .95 @ 50mm/2"*.
i. Fire Gas Toxicity; University of Pittsburgh Protocol, Max CO2 3.5%, Max CO 0.3%.

5. Bonding Adhesive shall be mixed with fresh, clean water to the exact proportions recommended by the manufacturer.
6. K factor: 0.25 K, when tested in accordance with ASTM C518.
7. Density: 3.0 lb/cu ft. minimum.

C. Spray Applied Mineral Wool Insulation: Comply with manufacturer's written physical requirements.
1. Spray applied non-combustible, non-hygroscopic inorganic insulation.
2. Thickness / R-Factor: Minimum values as indicated on Drawings.
3. Color: White.
4. Product shall be Class 1, Class A per ASTM E84/UL 723
5. Non-Combustible; ASTM E136.
6. Air Erosion; ASTM E859/E859M, No Mass Loss.

2.03 ACCESSORIES

A. Primer: As required by insulation manufacturer.

B. Lathing, hardware and fasteners as required to achieve specified R-value.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are clean, dry, and free of matter that may inhibit adhesion.

B. Verify that ceiling hangers and supporting clips have been are installed correctly.

C. Verify other work on and within spaces to be insulated is complete prior to application.

3.02 PREPARATION

A. Mask and protect adjacent surfaces from overspray or damage.

B. Coordinate installation of the sprayed fiber insulation with work of other trades.

C. Apply primer in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. Install sprayed insulation in accordance with manufacturer's written instructions.
1. Install "Spray-On High R-Value System" in multiple passes as required by manufacturer, using manufacturer's recommended galvanized lath material and galvanized fasteners.
a. The first pass will be an average of 4" or 5" thick.
b. The color for the first pass will be tan.
c. Install the second pass of spray-applied insulation to total required R-Value.
d. Color to be Light Gray.
e. Use fans to keep air moving across the material and force moisture laden air outside. The material must be ventilated continuously until dry.
f. Remove and dispose of over-spray.

B. Install insulation to a uniform monolithic density without voids.

C. Install to achieve a thermal resistance R-Value as indicated on Drawings.

D. Tamp wet sprayed insulation surface to improve adhesion and to achieve a smooth surface.

3.04 FIELD QUALITY CONTROL

A. Independent agency field inspection will be provided under provisions of Section 01 40 00 - Quality Requirements.

B. Inspection will include verification of sprayed insulation and surface sealer thickness and density.

3.05 PROTECTION

A. Do not permit subsequent construction work to disturb applied sprayed insulation.

B. Ensure proper ventilation after the application is complete

END OF SECTION

SECTION 07 25 00
WEATHER BARRIERS

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 SECTION INCLUDES

A. Water-Resistive Barrier: Under exterior wall cladding, over sheathing or other substrate; not air tight or vapor retardant.

B. Self-adhering flexible flashing applied directly to exterior face of sheathing and underneath or over air or WRB.

C. Air Barriers: Materials that form a system to stop passage of air through exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls.

1.03 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Structural substrate.

B. Section 07 21 00 - Thermal Insulation: Vapor retarder installed in conjunction with batt insulation.

C. Section 07 21 13.19 - Mineral Board Insulation: Vapor retarder installed in conjunction with mineral wool insulation.

D. Section 07 46 46 - Fiber-Cement Siding: Exterior Cladding.

E. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with weather barriers.

F. Section 07 92 00 - Joint Sealants: Sealing the building envelope.

G. Division 08 - Openings: Various Sections for building fenestrations.

H. Section 09 21 16 - Gypsum Board Assemblies: Wall sheathing substrate for WRB.

1.04 DEFINITIONS

A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.

B. Air Barrier: Airtight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.

C. Water-Resistive Barrier: Water-shedding barrier made of material that is moisture resistant, to the degree specified, intended to be installed to shed water without sealed seams.

1.05 REFERENCE STANDARDS

A. AATCC Test Method 127 - Test Method for Water Resistance: Hydrostatic Pressure.

B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

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

D. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights.

E. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials.

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

G. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components.

1.06 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 and penetrations.

D. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

E. Warranty Documentation for Installation of Building Rainscreen Assembly: Submit installer warranty and ensure that forms have been completed in Owner's name and registered with installer.

1.07 QUALITY ASSURANCE

A. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

B. Source Limitations: For each type of material required to complete the work of this section provide products from a single manufacturer including, but not limited to, self-adhered jamb flashing, self-adhered window sill pan flashing, and seam sealers. Obtain secondary materials including, but not limited to, joint sealants self-adhering membrane flashing, and substrate repair materials specified in other sections from a source recommend by weather resistant barrier manufacturer.

1.08 COORDINATION

A. Material Compatibility: Coordinate the Work of this Section with other interfacing work in direct contact with the products listed herein. Consult with manufacturer for compatibility of materials specified in other Sections that will be in contact with the products listed in this Section.

B. Weather Barrier as a system: The WRB materials and products shall act and be installed as a warranted system. WRB materials, accessories, and transitions shall be fabricated from and approved in writing by the same manufacturer.

1.09 MOCK-UP

A. See Section 01 40 00 - Quality Requirements for mock-up quality requirements.

B. Coordinate with other materials required for mock-up and as indicated in Section 01 43 39 - Mock-Ups.

C. Provide materials of each type specified for use in mock-up.

D. Install water-resistive barrier materials in mock-up.

1.10 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

B. Install products specified in this section at a temperature and humidity range recommended by the materials manufacturers before, during and after installation.

1.11 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 building envelope and confirmation materials are installed in accordance with manufacturer's written requirements to achieve system warranty.

1. Coordinate with Field Quality Control requirements and adjust scope of observations required for a full system warranty.

PART 2 PRODUCTS

2.01 WEATHER BARRIER ASSEMBLIES

A. Water-Resistive Barrier: Provide on exterior walls under exterior cladding.

2.02 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)

A. Air Barrier Sheet, Mechanically Fastened, non-woven, non-perforated air and water resistive barrier:

1. Location: Framed exterior walls. Coordinate transitions to concrete masonry unit walls and concrete walls with self-adhered sheet or fluid applied system by same manufacturer as mechanically fastened sheet.
2. Air Permeance: 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.
3. Water Vapor Permeance: 5 perms, minimum, when tested in accordance with ASTM E96/E96M Procedure A (Desiccant Method) at 73.4 degrees F.
4. Water Penetration Resistance: Withstand a water head of 21 inches, minimum, for minimum of 5 hours, when tested in accordance with AATCC Test Method 127.
5. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for a minimum of 180 days of weather exposure.
6. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 50 or less, when tested in accordance with ASTM E84.
7. Complies with NFPA 285 wall assembly requirements.
8. Water Resistance: Comply with applicable water-resistive requirements of ICC-ES AC38.
9. Seam and Perimeter Tape: Polyethylene self-adhering type, mesh reinforced, 2 inches wide, compatible with weather barrier.
10. Acceptable Products for Type III Fire Retardant Treated (FRT) Wood Framed Construction.
    a. DuPont de Nemours, Inc; Tyvek Commercial Wrap with FlexWrap, StraightFlash, StraightFlash VF, and Tyvek Tape: www.dupont.com. (Basis of Design)
    b. DuPont de Nemours, Inc; Tyvek Commercial Wrap D with FlexWrap, StraightFlash, StraightFlash VF, and Tyvek Tape: www.dupont.com.
    c. Henry Building Systems Group; WeatherSmart Commercial: www.henry.com.
    d. VaproShield, LLC; WrapShield or WrapShield IT: www.vaproshield.com.
    e. Substitutions: Not permitted.
11. Acceptable Products: Drainable Wraps for Type III Fire Retardant Treated (FRT) Wood Framed Construction.
    a. DuPont de Nemours, Inc; Tyvek Commercial Wrap D with FlexWrap, StraightFlash, StraightFlash VF, and Tyvek Tape: www.dupont.com. (Basis of Design)
        1) Drainage Efficiency ASTM E2273: >98%
    b. Henry Building Systems Group; WeatherSmart Drainable: www.henry.com.
        1) Drainage Efficiency ASTM E2273: >95%
    c. Substitutions: Not permitted.

2.03 ACCESSORIES

A. Primers, Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified in Section 07 92 00 - Joint Sealants, unless otherwise required in writing by weather barrier manufacturer to achieve a fully warranted system.

B. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement is waived if not installed on a roof.
1. Width: 4 inches and 12 inches.
2. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 30 days of weather exposure.
3. Composition: As specified or as recommended by weather barrier manufacturer to achieve a fully warranted system.

C. Fasteners: DuPont de Nemours Tyvek® Wrap Cap or other "button cap" nails or screws approved in writing by weather barrier sheet manufacturer. Staples and button cap staples are not acceptable.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the work of this Section.

B. Verify that openings and penetrations are in place and ready to receive weather resistant barrier.

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Clean and prime substrate surfaces to receive adhesives in accordance with manufacturer's instructions.

C. Install self-adhered flashing over exterior sheathing full height at both outside and inside corners for 9 inches in both directions. Shingle lap discontinuous strips and provide continuous seal around each corner.
   1. Unless otherwise indicated on Drawings, provide coverage for corner trim and the end fasteners of adjacent cladding materials.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's written instructions and in accordance with Drawings.

B. Unless otherwise directed or approved by the Architect, install Air Barrier after sheathing is installed and before windows and doors are installed.
   1. If windows and/or doors are installed prior to installation of Air Barrier, follow manufacturer’s installation instructions and ASTM E2112 requirements for that condition.

C. Air Barriers: Install continuous airtight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

D. Mechanically Fastened Sheets - On Exterior:
   1. Install sheets shingle-fashion to shed water, with seams generally horizontal, and in a uniform and consistent layout.
   2. Overlap seams as recommended by manufacturer, but at least 6 inches.
   3. Overlap at outside and inside corners as recommended by manufacturer, but at least 12 inches.
   4. Attach to framed construction with manufacturer approved large metal or plastic cap fasteners extending through sheathing into framing. Space fasteners at 12 to 18 inches on center along each framing member supporting sheathing.
      a. Staples and button cap staples are not acceptable, even if otherwise accepted by the Air Barrier manufacturer.
      b. Staples are NOT acceptable for temporary fastening, even if otherwise accepted by the Air Barrier manufacturer.
   5. Seal seams, laps, penetrations, tears, transitions, and cuts with self-adhesive tape approved by manufacturer; use only large-headed, gasketed fasteners recommended in writing by the manufacturer.
   6. Install weather barrier UNDER jamb flashings.
   7. Install head flashings under weather barrier.
   8. At openings to be filled with frames having nailing flanges, wrap excess sheet into jamb and sill openings; at head, seal sheet over flange and flashing.

E. Self-Adhered Sheets:
   1. Prepare substrate in manner recommended by sheet manufacturer; fill and tape joints in substrate and between dissimilar materials.
   2. Lap sheets shingle-fashion to shed water and seal laps air tight.
   3. Once sheets are in place, press firmly into substrate with resilient hand roller; ensure that laps are firmly adhered with no gaps or fishmouths.
   4. Use same material, or other material approved by sheet manufacturer for the purpose, to seal to adjacent construction and as flashing.
   5. At wide joints, provide extra flexible membrane allowing joint movement.

F. Openings and Penetrations in Mechanically Fastened Sheets:
   1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto weather barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
   2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.

3. At openings to be filled with non-flanged frames, seal weather barrier to all sides of opening framing, using flashing at least 9 inches wide, covering entire depth of framing.
4. At head of openings, install flashing under weather barrier extending at least 2 inches beyond face of jambs; seal weather barrier to flashing.
5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Obtain approval of installation procedures by the weather barrier manufacturer based on a mock-up installed in place, prior to proceeding with installation.

C. Take digital photographs of each portion of the installation prior to covering up weather barrier.

3.05 PROTECTION

A. Protect weather barrier from damage and wear during remainder of construction period.

B. Do not leave materials exposed to weather longer than recommended in writing by manufacturer.

C. Examine weather barrier immediately prior to installation of building exterior finish material. Repair any damage as recommended in writing by the manufacturer.

END OF SECTION

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SECTION 07 27 00
FLUID-APPLIED AIR BARRIERS

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 SECTION INCLUDES

A. Fluid applied air barriers at concrete, CMU, and cold-formed metal framed exterior walls.

1.03 RELATED REQUIREMENTS

A. Section 04 20 00 - Unit Masonry: Structural substrate at exterior wall.

B. Section 04 26 13 - Masonry Veneer: Structural substrate at exterior wall: Exterior cladding.

C. Section 04 73 16 - Adhered Masonry Manufactured Stone Masonry Veneer: Exterior cladding.

D. Section 05 40 00 - Cold-Formed Metal Framing: Structural substrate at exterior wall.

E. Section 07 42 13 - Metal Wall Panels: Exterior cladding.

F. Section 07 42 13.23 - Metal Composite Material Wall Panels: Exterior cladding.

G. Section 07 54 23 - Thermoplastic-Polyolefin (TPO) Membrane Roofing: Membrane roofing overlapping top of exterior wall at parapet.

H. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with air barriers.

I. Section 08 43 13 - Aluminum-Framed Storefronts: Window systems.

J. Section 09 21 16 - Gypsum Board Assemblies: Sheathing over exterior structural substrate.

1.04 DEFINITIONS

A. Air Barrier: Airtight barrier made of material that is virtually air impermeable but water vapor permeable, both to amount as specified, with sealed seams and sealed joints to adjacent surfaces.

1.05 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension.

B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

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

D. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.

E. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights.

F. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials.

G. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components.

1.06 SUBMITTALS

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

B. Product Data: Provide data on material characteristics, performance criteria, limitations, and identify all project specific accessories.

C. Shop Drawings: Provide drawings of project specific details, special joint conditions, and all penetration types.

D. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

E. Warranty Documentation for Installation of Building Rainscreen Assembly: Submit installer warranty and ensure that forms have been completed in Owner's name and registered with installer.

1.07 QUALITY ASSURANCE

A. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer where required as part of warranty requirements.

C. Source Limitations: For each type of material required to complete the work of this section provide products from a single manufacturer including, but not limited to, self-adhered jamb flashing, self-adhered window sill pan flashing, and seam sealers. Obtain secondary materials including, but not limited to, joint sealants self-adhering membrane flashing, and substrate repair materials specified in other sections from a source recommend by weather resistant barrier manufacturer.

1.08 COORDINATION

A. Material Compatibility: Coordinate the Work of this Section with other interfacing work in direct contact with the products listed herein. Consult with manufacturer for compatibility of materials specified in other Sections that will be in contact with the products listed in this Section.

B. Weather Barrier as a system: The WRB materials and products shall act and be installed as a warranted system. WRB materials, accessories, and transitions shall be fabricated from and approved in writing by the same manufacturer.

1.09 MOCK-UPS

A. Coordinate with other materials required for mock-up and as indicated in Section 01 43 39 - Mock-Ups.

B. Provide materials of each type specified for use in mock-up.

C. Install air barrier materials in mock-up.

D. Locate where directed.

E. Mock-up may not remain as part of work.

1.10 FIELD CONDITIONS

A. Install products specified in this Section at temperature and humidity recommended in writing by materials manufacturers before, during, and after installation.

1.11 SPECIAL BUILDING ENCLOSURE WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Installation Warranty for Building Rainscreen Assembly: Installer of exterior rainscreen assembly (including air/vapor barrier and attachments, framing, and exterior panels) to provide 10-year warranty that includes coverage for defective materials and/or workmanship. This warranty will also clearly include materials, labor, necessary activity to access these areas, and removal of any materials to effect repairs and restore to watertight conditions. www.edacontractors.com/#sle

1.12 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 building envelope and confirmation materials are installed in accordance with manufacturer requirements to achieve system warranty.

1. Coordinate with Field Quality Control requirements and adjust scope of observations required for a full system warranty.

PART 2 PRODUCTS

2.01 AIR BARRIER MATERIALS (AIR IMPERMEABLE AND WATER VAPOR PERMEABLE)

A. Air Barrier, Fluid Applied: Vapor permeable, elastomeric waterproofing.

1. Air Barrier Membrane:
    a. Material: Water-based single component, vapor permeable elastomeric membrane.
    b. Dry Film Thickness (DFT): 37 mils, minimum, based on 70 mil wet film thickness application.
    c. Air Permeance: 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.
    d. Water Vapor Permeance: 5 perms, minimum, when tested in accordance with ASTM E96/E96M using Procedure B - Water Method, at 73.4 degrees F.
    e. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 180 days of weather exposure.
    f. Elongation: 250 percent, minimum, when tested in accordance with ASTM D412.
    g. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A when tested in accordance with ASTM E84.
    h. Nail Sealability: Pass, when tested in accordance with ASTM D1970/D1970M.
    i. VOC Content: 100 oz/gal maximum.
    j. Sealants, Tapes and Accessories: As recommended in writing by coating manufacturer.
    k. Products:
        1) GCP Applied Technologies; PERM-A-BARRIER® VPL: www.gcpat.com.
        2) Henry Company; Air-Bloc 17MR: www.henry.com. (Basis of Design)
        3) Sika Group; Sikagard 535: www.sika.usa.com.
        4) Sto Corp; Sto AirSeal: www.stocorp.com.
        5) Tremco Commercial Sealants & Waterproofing; ExoAir 230: www.tremcosealants.com.
        6) W.R. Meadows, Inc; Air-Shield LMP: www.wrmeadows.com.
        7) Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Air Barrier and Adjacent Substrates: As indicated or in compliance with air barrier manufacturer's written installation instructions.

B. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrate and air barrier materials.
    1. Application: Apply at nominal thickness required in writing by manufacturer to maintain installation warranty.

C. Primer: Liquid applied method using products and detailing as required in writing by material manufacturer to maintain warranty.
    1. Color: \Manufacturer's standard.

D. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement waived if not installed on roof.
    1. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 180 days of weather exposure.
    2. Products and detailing as required in writing by material manufacturer to maintain warranty.

E. Liquid Flashing: One-part, fast curing, nonsag, gun grade, trowelable. Products and detailing as required in writing by material manufacturer to maintain warranty.

F. Thinners and Cleaners: As recommended in writing by material manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready for work of this section.

B. Verify that openings and penetrations are in place and ready to receive weather resistant barrier.
    1. Verify that utility penetrations are in place, sealed and protected at rated conditions in accordance with required fire stopping assemblies, inspected, and approved to receive weather resistant barrier.

C. Where existing conditions are the responsibility of another installer, notify Architect of unsatisfactory conditions.

D. Do not proceed with this work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's written installation instructions.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's written installation instructions.

B. Air Barriers: Install continuous airtight barrier over above grade surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

C. Unless otherwise directed or approved by the Architect, install Air Barrier after sheathing is installed and before windows and doors are installed.
   1. If windows and/or doors are installed prior to installation of Air Barrier, follow manufacturer’s installation instructions and ASTM E2112 requirements for that condition.

D. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's written installation instructions. Consult manufacturer if temperature is outside of range limits.

E. Fluid-Applied Coatings or Membranes:
   1. Prepare substrate in accordance with manufacturer's written installation instructions; treat joints in substrate and between dissimilar materials as indicated.
   2. Where exterior masonry veneer is being installed, install masonry anchors before installing air barrier over masonry; provide airtight seal around anchors.
   3. Apply bead or trowel coat of mastic sealant with minimum thickness of 1/4 inch along coating seams, rough cuts, and as recommended in writing by manufacturer.
   4. Use flashing to seal to adjacent construction and to bridge joints in coating substrate.

F. Openings and Penetrations in Exterior Air Barriers:
   1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto air barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
   2. At openings with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
   3. At openings with nonflanged frames, seal air barrier to each side of framing at opening using flashing at least 9 inches wide and cover entire the depth of framing.
   4. At head of openings, install flashing under air barrier extending at least 2 inches beyond face of jambs; seal air barrier to flashing.
   5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
   6. Service and Other Penetrations: Form flashing around penetrating item and seal to air barrier surface.

3.04 FIELD QUALITY CONTROL

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

B. Owner will provide testing services, and Contractor to provide temporary construction and materials for testing.

C. Coordination of ABAA Tests and Inspections:
   1. Provide testing and inspection required by ABAA QAP.
   2. Notify ABAA in writing of schedule for air barrier work and allow adequate time for testing and inspection.
   3. Cooperate with ABAA testing agency.
   4. Allow access to air barrier work areas and staging.
   5. Do not cover air barrier work until tested, inspected, and accepted.

D. Do not cover installed air barriers until required inspections have been completed.

E. Obtain approval of installation procedures from air barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.

F. Take digital photographs of each portion of installation prior to covering up air barriers.

3.05 PROTECTION

A. Do not leave materials exposed to weather longer than recommended in writing by manufacturer.

END OF SECTION

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SECTION 07 42 13.23
METAL COMPOSITE MATERIAL WALL PANELS

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 SECTION INCLUDES

A. Exterior aluminum-faced composite panels with mounting system. Panel mounting system including formed metal composite material (MCM) sheet anchorages attached to solid fire retardant backup, secondary supports, furring, fasteners and anchors to structure, gaskets and sealants, related flashing adapters and masking for a complete installation.

B. Matching flashing and trim, parapet coping, column covers, soffits, sills, border, filler items, and as indicated on Drawings.

1.03 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Installation of anchors.

B. Section 04 20 00 - Unit Masonry: Installation of anchors.

C. Section 05 40 00 - Cold-Formed Metal Framing: Panel support framing.

D. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal flashing components integrated with this wall system.

E. Section 07 92 00 - Joint Sealants: Sealing joints between siding and adjacent construction and fixtures.

1.04 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).

B. AAMA-2605 Superior Performance of Organic Coating on Aluminum,

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

F. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes.

G. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.

H. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

I. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus

J. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.

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

L. ASTM D1781 - Standard Test Method for Climbing Drum Peel for Adhesives.

M. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics.

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

O. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

P. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

Q. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meeting: Convene one week before starting work of this section to verify project requirements, coordinate with installers of other work, establish condition and completeness of building substrate, and review manufacturers' installation instructions and warranty requirements.
   1. Require attendance by the installer and relevant sub-contractors.
   2. Include MCM sheet manufacturer’s representative and wall system manufacturer’s representative to review storage and handling procedures.
   3. Review in detail truck transportation, parking, vertical transportation, schedule, personnel, installation of adjacent materials and substrate.
   4. Review procedures for protection of work and other construction.

1.06 SUBMITTALS

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

B. Product Data - MCM Sheets: Manufacturer's data sheets on each product to be used, including thickness, physical characteristics, and finish, and:
   1. Finish manufacturer's data sheet showing physical and performance characteristics.
   2. Storage and handling requirements and recommendations.
   3. Fabrication instructions and recommendations.
   4. Specimen warranty for finish, as specified herein.

C. 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.
   4. Specimen warranty for wall system, as specified herein.

D. Shop Drawings: Show layout and elevations, dimensions and thickness of panels, connections, details and location of joints, sealants and gaskets, method of anchorage, support clips, fasteners, number of anchors, supports, reinforcement, trim, flashings, and accessories.
   1. Indicate panel numbering system.
   2. Differentiate between shop and field fabrication.
   3. Indicate substrates and adjacent work with which the wall system must be coordinated.
   4. Include large-scale details of anchorages and connecting elements.
   5. Include large-scale details or schematic, exploded or isometric diagrams to fully explain flashing at a scale of not less than 1-1/2 inches per 12 inches.
   6. Include design engineer's stamp or seal on shop drawings for attachments and anchors.
   7. Show location and type of aluminum-extruded stiffeners at typical panels and at corner panels.

E. Certificate: Certify that the work results of this section meet or exceed specified requirements.

F. Design Data: Submit structural calculations stamped by design engineer, for Architect's information and project record.

G. Test Report: Submit report of full-size mock-up tests for air infiltration, water penetration, and wind performance.

H. Test Report: Submit test report verifying compliance with NFPA 285 for previously-tested exterior wall assembly.

I. Certificate: Provide documents showing product compliance with the local building code, which may include evaluation reports, test reports, supporting document and drawings, and manufacturer’s data.

J. Manufacturer's Field Reports: Provide within 48 hours of field review. State what was observed and what changes, if any, were requested or required.

K. Installer's qualification statement.

L. Testing agency's qualification statement.

M. Maintenance Data: Care of finishes and warranty requirements.

N. Executed Warranty: Submit warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.07 QUALITY ASSURANCE

A. Field Measurements: Verify actual dimensions by field measurement before fabrication; show recorded measurements on shop drawings.

B. Design Engineer's Qualifications: Design structural supports and anchorages under direct supervision of a Structural Engineer experienced in design of this type of work and licensed in Louisiana.

C. Manufacturer Qualifications: Company specializing in manufacturing wall panel systems specified in this section.
   1. With not less than five years of documented experience.
   2. Approved by MCM sheet manufacturer.

D. Installer Qualifications: Company specializing in performing work of type specified in this section.
   1. With minimum five years of documented experience.
   2. Approved in writing by wall panel system manufacturer.

E. Testing Agency Qualifications: Independent agency experienced in testing assemblies of the type required for this project and having the necessary facilities for full-size mock-up testing of the type specified.

F. Fire Resistance Ratings: Provide evidence of compliance with the following standards.
   1. NFPA 285.
   2. ASTM E84.
   3. ASTM D635; soffit panels or panels in a horizontal position.
   4. ASTM D1929.

G. Metal composite material (MCM) must be manufactured in the USA.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.
   1. Protect finishes by applying heavy-duty removable plastic film during production.
   2. Package for protection against transportation damage.
   3. Provide markings to identify components consistently with drawings.
   4. Exercise care in unloading, storing, and installing panels to prevent bending, warping, twisting, and surface damage.

B. Store products protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
   1. Store in well-ventilated space out of direct sunlight.
   2. Protect from moisture and condensation with tarpaulins or other suitable weathertight covering installed to provide ventilation.
   3. Store at a slope to ensure positive drainage of accumulated water.
   4. Do not store in enclosed space where ambient temperature can exceed 120 degrees F.
   5. Avoid contact with other materials that might cause staining, denting, or other surface damage.

1.09 WARRANTY

A. Wall System Warranty: Provide joint written warranty by manufacturer and installer, agreeing to correct defects in manufacturing or installation within a two year period after Date of Substantial Completion.

B. MCM Sheet Manufacturer’s Finish Warranty: Provide manufacturer's written warranty stating that the finish will perform as follows for minimum of 20 years:
   1. Chalking: No more than that represented by a No. 8 rating based on ASTM D4214.

2. Color Retention: No fading or color change in excess of 5 Hunter color difference units, calculated in accordance with ASTM D2244.
3. Gloss Retention: Minimum of 30 percent gloss retention, when tested in accordance with ASTM D523.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Composite Material (MCM) Sheet Manufacturers:
1. Alcoa, Inc; Reynobond® FR Aluminum Composite Material (ACM): www.alcoa.com.
2. ALPOLIC Materials; ALPOLIC / fr (fire resistant core): www.alpolic-usa.com.
3. Pac-Clad by Petersen Aluminum Corporation; PAC-3000 CS; FR core: www.pac-clad.com.
4. Reynobond® FR Aluminum Composite Material (ACM) as manufactured by Alcoa, Inc.; FR core: www.alcoa.com. (Basis of Design)

2.02 WALL PANEL SYSTEM

A. Wall Panel System: Metal panels, fasteners, and anchors designed to be supported by framing or other substrate provided by others; provide installed panel system capable of maintaining specified performance without defects, damage, or failure.
1. Provide structural design by or under direct supervision of a Structural Engineer licensed in Louisiana.
2. Provide panel jointing and weatherseal using reveal joints and gaskets but no sealant.
3. Anchor panels to supporting framing without exposed fasteners.
4. Include shop-installed aluminum stiffeners on all panels of 20 square feet or larger. Minimum stiffener recommendation is one per 20 square feet of panel area.

2.03 PERFORMANCE REQUIREMENTS

A. Thermal Movement: Provide for free and noiseless vertical and horizontal thermal movement due to expansion and contraction under material temperature range of minus 20 degrees F to 180 degrees F without buckling, opening of joints, undue stress on fasteners, or other detrimental effects; allow for ambient temperature at time of fabrication, assembly, and erection procedures.

B. Wind Performance: Provide system tested in accordance with ASTM E330/E330M without permanent deformation or failures of structural members under the following conditions:
1. Design Wind Pressure: As specified in structural drawings and local building code, but no less than 20 pounds per square foot (psf) and 30 psf on parapet and corner panels.
2. Maximum deflection of perimeter framing member of L/175 normal to plane of the wall; maximum deflection of individual panels of L/60.
3. Maximum anchor deflection in any direction of 1/16 inch at connection points of framing members to anchors. At 1 1/2 times design pressure, permanent deflections of framing members shall not exceed l/100 of span length and components shall not experience failure or gross permanent distortion. At connection points of framing members to anchors, permanent set shall not exceed 1/16 inch.

C. Water Penetration: No water penetration under static pressure when tested in accordance with ASTM E331 at a differential of 10 percent of inward acting design load, 6.27 psf minimum, after 15 minutes.
1. Water penetration is defined as the appearance of uncontrolled water on the interior face of the wall.
2. Design to drain leakage and condensation to the exterior face of the wall.

D. Fire Performance: Tested in accordance with, and complying with the acceptance criteria of, NFPA 285; testing must be performed specifically for this project.

2.04 MATERIALS

A. Metal Composite Material (MCM) Sheet: Two sheets of aluminum sandwiching a solid core of extruded thermoplastic material formed in a continuous process with no glues or adhesives between dissimilar materials; core material free of voids and spaces; no foamed insulation material content. The bond between the core and the skins shall be a chemical bond.

1. Overall Sheet Thickness: 0.118 inch, minimum.
2. Panel Weight: (4 mm) = 1.1 lb/square foot, (6 mm) = 1.5 lb/ft
3. Alloy: Manufacturer's standard, selected for best appearance and finish durability.
4. Bond and Peel Strength: No adhesive failure of the bond between the core and the skin nor cohesive failure of the core itself below 40 inch-pound/inch with no degradation in bond performance, when tested in accordance with ASTM D1781, simulating resistance to panel delamination, after 8 hours of submersion in boiling water and after 21 days of immersion in water at 70 degrees F.
5. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84 - Passed Class A.
6. Flammability: Self-ignition temperature of 650 degrees F or greater when tested in accordance with ASTM D1929.

B. Metal Framing Members: Include sub-girts, zee-clips, base and sill angles and channels, hat-shaped and rigid channels, and furring channels required for complete installation.
   1. Provide material strength, dimensions, configuration as required to meet applied loads and in compliance with applicable building code.

2.05 FINISHES

A. Fluoropolymer Coil Coating System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, with at least 80 percent of coil coated metal surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch; color and gloss as selected by Architect from manufacturer’s standard line.
   1. Products:
      a. PPG Metal Coatings; Duranar: www.ppgmetalcoatings.com/.
      b. Valspar; Fluropon: www.valsparcoilextrusion.com/.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

B. Color/Texture: As selected by Architect from manufacturer's standard range; series one, two or three colors. Color and Gloss as indicated on Drawings.

2.06 ACCESSORIES

A. Flashing: Sheet aluminum; 0.040 inch thick, minimum; finish and color to match MCM sheet; see Section 07 62 00 for additional requirements.

B. Anchors, Clips, and Accessories: Use one of the following:
   1. Stainless steel complying with ASTM A276/A276M, ASTM A480/A480M, or ASTM A666/A666M.
   2. Steel complying with ASTM A36/A36M and hot-dip zinc coating to ASTM A153/A153M.
   3. Steel complying with ASTM A36/A36M and hot-dip galvanized to ASTM A123/A123M, with Coating Thickness Grade of 100.

C. Bituminous Coating: Cold-applied asphalt mastic, noncorrosive compound free of asbestos, sulfur, and other deleterious impurities; 15-mil dry film thickness per coat.

D. Joint Sealer: Provide color to match wall panels silicone sealant of type approved in writing by MCM sheet manufacturer, and in compliance with ASTM C920.

E. Provide panel system manufacturer's and installer's standard corrosion resistant accessories, including fasteners, clips, anchorage devices, and attachments.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine dimensions, tolerances, and interfaces with other work.

B. Examine substrate on-site to determine that conditions are acceptable for product installation in accordance with manufacturer's written instructions.

C. Surfaces to receive panels shall be even, smooth, sound, clean, dry and free from defects detrimental to work. Notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Protect adjacent work areas and finish surfaces from damage during installation.

B. Provide anchorage items to be cast into concrete or built into masonry to appropriate installer(s) together with setting templates.
   1. See Section 03 30 00 for additional cast-in-place concrete requirements.
   2. See Section 04 20 00 for additional unit masonry requirements.

3.03 INSTALLATION

A. Do not install products that are defective, including warped, bowed, dented, and broken members, and members with damaged finishes.

B. Comply with instructions and recommendations of MCM sheet manufacturer and wall system manufacturer, as well as with approved shop drawings.

C. Install wall system securely allowing for necessary thermal and structural movement; comply with wall system manufacturer's instructions for installation of concealed fasteners.

D. Do not handle or tool products during erection in manner that damages finish, decreases strength, or results in visual imperfection or failure in performance. Return component parts that require alteration to shop for refabrication, if possible, or for replacement with new parts.

E. Do not form panels in field unless required by wall system manufacturer and approved by the Architect and panel manufacturer in writing prior to field forming panels; comply with MCM sheet manufacturer's instructions and recommendations for field forming.

F. Separate dissimilar metals; use gasket fasteners, isolation shims, or isolation tape where needed to eliminate possibility of electrolytic action between metals.

G. Where joints are designed for field-applied sealant, seal joints completely with specified sealant.

H. Install flashings as indicated on shop drawings. At flashing butt joints, provide a lap strap under flashing and seal lapped surfaces with a full bed of non-hardening sealant.

I. Install square, plumb, straight, and true, accurately fitted, with tight joints and intersections maintaining the following installation tolerances:
   1. Variation From Plane or Location: 1/2 inch in 30 feet of length and up to 3/4 inch in 300 feet, maximum.
   2. Deviation of Vertical Member From True Line: 0.1 inch in 25 feet run, maximum.
   3. Deviation of Horizontal Member From True Line: 0.1 inch in 25 feet run, maximum.
   4. Offset From True Alignment Between Two Adjacent Members Abutting End To End, In Line: 0.03 inch, maximum.

J. Replace damaged products.
   1. Exception: Field repairs of minor damage to finishes are permitted.
   2. Field Repairs to Finishes: Using materials and methods sufficient that repairs are not discernible when viewed at distance of 10 feet under all typical light conditions experienced at the project.

3.04 FIELD QUALITY CONTROL

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

B. Wall System Manufacturer's Field Services: Provide field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with instructions.

3.05 CLEANING

A. Ensure weep holes and drainage channels are unobstructed and free of dirt and sealants.

B. Remove protective film after installation of joint sealers, after cleaning of adjacent materials, and immediately prior to completion of work.

C. Remove temporary coverings and protection of adjacent work areas.

D. Clean installed products in accordance with manufacturer's instructions.

3.06 PROTECTION

A. Protect installed panel system from damage until Date of Substantial Completion.

END OF SECTION

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SECTION 07 46 46
FIBER-CEMENT SIDING

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 SECTION INCLUDES

A. Fiber-cement lap siding.

B. Fiber cement siding panels and attachment system.

C. Exterior, panelized fiber cement cladding system and accessories to complete a drained and back-ventilated rainscreen.

D. Column wraps to use fiber cement trim material.

E. Fiber cement soffit panels and installation.

F. Soffit venting materials and installation.

G. Accessories.

1.03 RELATED REQUIREMENTS

A. Section 05 40 00 - Cold-Formed Metal Framing: Water-resistive barrier under siding.

B. Section 06 10 00 - Rough Carpentry: Structural substrate for wall sheathing.

C. Section 06 16 36 - Wood Panel Product Sheathing: Wall sheathing substrate.

D. Section 07 25 00 - Weather Barriers: Water-resistive barrier under siding.

E. Section 07 31 13 - Asphalt Shingles: Soffit vents installed in asphalt shingles as part of roof venting design.

F. Section 07 62 00 - Sheet Metal Flashing and Trim; Metal flashing.

G. Section 07 92 00 - Joint Sealants: Sealing joints between siding and adjacent construction and fixtures.

H. Division 08 - Openings: various Sections for building fenestrations.

I. Section 09 21 16 - Gypsum Board Assemblies: Siding substrate.

J. Section 09 91 13 - Exterior Painting: Field painting.

1.04 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.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

D. ASTM C1186 - Standard Specification for Flat Fiber-Cement Sheets.

E. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components.

1.05 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.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Installation methods, including nail patterns.

C. Test Report: Applicable model code authority evaluation report (e.g. ICC-ES).

D. Maintenance Instructions: Periodic inspection recommendations and maintenance procedures.

E. Warranty: Submit copy of manufacturer's warranty, made out in Owner's name, showing that it has been registered with manufacturer.

F. Warranty Documentation for Installation of Building Rainscreen Assembly: Submit installer warranty and ensure that forms have been completed in Owner's name and registered with installer.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this section with minimum five years of experience.

B. Source Qualifications: Provide single source manufacturer for all installation materials to assure compatibility and to be in compliance for a full system warranty.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store materials under dry and waterproof cover, well ventilated, and elevated above grade on a flat surface.

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. Provide multi-year manufacturer fully transferable material warranty as indicated under Siding article sub-heading

D. Installation Warranty for Building Rainscreen Assembly: Installer of exterior rainscreen assembly (including air/vapor barrier and attachments, framing, and exterior panels) to provide 10-year warranty that includes coverage for defective materials and/or workmanship. This warranty will also clearly include materials, labor, necessary activity to access these areas, and removal of any materials to effect repairs and restore to watertight conditions. www.edacontractors.com.

PART 2 PRODUCTS

2.01 FIBER-CEMENT SIDING

A. Panel Siding: Vertically oriented panels made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
   1. Texture: Smooth.
   2. Length (Height): 96 inches, nominal.
   3. Width: 48 inches.
   4. Thickness: 5/16 inch, nominal.
   5. Batten Strips: one inch by two inch profile, pre-primed fiber cement.
      a. Nominal size: 12'-0" Long x 2-1/2" wide, 3/4" thick.
      b. Finish: "Smooth."
   6. Finish: Factory applied stain.
   7. Color: As indicated on Drawings.
   8. Warranty: 25 year minimum limited; transferable.
   9. Products:
      a. Allura, a division of Plycem USA, Inc: www.allurausa.com.
      b. James Hardie Building Products, Inc: www.jameshardie.com.
      c. Nichiha USA, Inc: www.nichiha.com.
      d. Prevail Multifamily Siding: www.prevailsiding.com.
      e. Substitutions: Not permitted.

B. 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. Style: Ventilated at soffit, non-ventilated at rake.
      a. Free Area: minimum 5 square inches per linear foot of soffit.

2. Texture: Smooth.
3. Length: 96 inches, nominal.
4. Width: As indicated on Drawings. Provide custom or field cut lengths as required to achieve layout indicated on Drawings.
5. Thickness: 5/16 inch, nominal.
6. Finish: Factory applied primer.
7. Color: Custom, as indicated on Drawings.
8. Manufacturer: Same as siding.

2.02 TRIM

A. Same material as siding, of widths indicated on Drawings for trim and fascia.
   1. Smooth texture with factory applied primer . Panel Siding; 4/4 trim.

B. Provide and install plinth blocks behind and under wall mounted devices and fixtures, including but not limited to sprinkler heads, hose bibs, exhaust fans and caps, outlet covers, lighting, pull stations, and other low voltage devices.
   1. Fabricate solid trim plinth blocks from a single trim piece of sufficient width to neatly interface with Lap and Panel siding.

C. Manufactured Corners with 3-1/2 inch returns for each face profile matching texture and color of fiber cement trim boards.

D. Corner posts for interior corners, unless otherwise detailed on Drawings.

2.03 ACCESSORIES

A. Cladding Support Clips: Thermally-broken, galvanized steel or composite steel clips for support of cladding z-girts, angles, channels and other framing.
   1. Galvanized Steel Sheet: ASTM A653/A653M, with G90/Z275 galvanized coating.
   2. NFPA 285: Pass
   3. Products:
      a. Advanced Architectural Products (A2P): SMARTci GreenGirt Clips Composite Framing Support (CFS) System; www.smartcisystems.com.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

B. Cladding Furring Strips: Galvanized metal channels.
   1. Combustible furring strips are not acceptable.

C. Insect Barrier: Screening material or system at base of rainscreen furring strips.

D. Metal Trim: Extruded aluminum alloy 6063-T5 temper.
   1. Finish: Clear anodized, unless otherwse indicated on Drawings.

E. Fasteners: Corrosion resistant fasteners (stainless steel, aluminum, or hot-dipped galvanized); type, length and size as recommended by manufacturer as required to penetrate minimum 1--1/2 inch.

F. Manufacturer's recommended clips, corrosion resistant fasteners, hot-dipped galvanized nails and screws or stainless steel fasteners. Do not use aluminum fasteners, staples, clipped head nails or fasteners that are not rated or designed for intended use. See manufacturer’s detailed instructions for appropriate fasteners for construction method used.

G. Exterior Soffit Vents: One piece, perforated, ASTM B221 AA DAF-45 6063 alloy, T5 temper, aluminum, with 3/8 inch depth and manufactured especially for soffit application. Provide continuous vent.
   1. Refer to Drawings for free area and venting requirements.

H. Exterior Soffit Vents: Hat-shaped vents, perforated, solid vinyl or extruded PVC, with 3/8 inch depth and manufactured especially for soffit application. Provide ventilation area indicated on Drawings.
   1. Refer to Drawings for locations, free area requirements, and venting requirements.

I. Starter strips for horizontal lap siding.

J. Flashing:
   1. Material properties specified in Section 07 62 00 - Sheet Metal Flashing and Trim.

2. Shapes and profiles indicated on Drawings.
3. Lap siding butt joints: Pre-finished metal or 20-year minimum UV-resistant plastic. 6 inches wide and overlaps the course below by 1 inch.
    a. Pre-finished Coil Stock. Uncoated metal is unacceptable.
    b. Pre-finished, pre-bent metal equivalent to Tamlyn "Plank Flash."
    c. UV-resistant plastic equivalent to "Bearskin."
4. Coordinate with Drawing details and manufacturer requirements for a fully warranted system installation.

K. Sealant: Elastomeric, polyurethane or silyl-terminated polyether/polyurethane, and capable of being painted.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrate, clean and repair as required to eliminate conditions that would be detrimental to proper installation. Verify substrate conditions are within alignment tolerances for proper installation.
1. Allowable stud spacing: 16 inches on center maximum.
2. Tolerance
    a. Wall surface plane must be plumb and level within +/- 1/4 inch in 20 feet in any direction.
    b. One layer of fiber cement 5mm (~3/16 inch) spacer may be used as shim.

B. Verify that water-resistant barrier has been installed over substrate completely and correctly; see Section 05 40 00.

C. Do not begin until unacceptable conditions have been corrected.

D. Do not install panels or components that appear to be damaged or defective. Do not install wet panels.

E. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Protect surrounding areas and adjacent surfaces during execution of this work.

B. Install Sheet Metal Flashing:
1. Above door and window trim and casings.
2. Above horizontal trim in field of siding.
3. In other locations as indicated on Drawings.

C. Do not install boards or components that appear to be damaged or defective. Do not install wet boards.

3.03 INSTALLATION

A. Install in accordance with manufacturer's written 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. Install in accordance with code mandated wind pressure for components and cladding.
4. Install over sheathing and weather barrier.
5. Use trim details indicated on Drawings.
6. Touch up field cut edges before installing.
7. Pre-drill nail holes if necessary to prevent breakage.
8. Nail flush at each stud; do not countersink fasteners. Nail in accordance with manufacturer's written requirements.
9. Contractor is advised. Rain screens and furring strips are required when specifically required in writing by siding manufacturer, including but not limited to American Fiber Cement Siding Corporation, James Hardie, and Prevail.

B. Install Work plumb, level, true and straight without distortions.

C. Provide Work smooth, free from abrasion, tool marks, or similar defects on exposed surfaces.

D. Over Wood Studs without Sheathing: Install siding over weather-resistive barrier, fastened into studs.

E. Over Wood and Wood-Composite Sheathing: Fasten siding through sheathing into studs.

F. Over Foam Sheathing: Read and comply with sheathing manufacturer's written recommendations.
   1. For sheathing of less than 1 inch thickness, nail through sheathing into studs using correspondingly longer nails.
   2. For sheathing greater than 1 inch thickness, install furring strips over studs and fasten siding through furring and into studs.
   3. Coordinate fastener size, length and material with Components and Cladding requirements indicated on the Drawings.

G. Over Masonry Walls: Install furring strips of adequate thickness to accept full length of nails and spaced at 16 inches on center; leave space at top and bottom open; top may be behind soffit; at bottom install insect screen over opening by wrapping a strip of screen over bottom ends of vertical furring strips.

H. Allow space for thermal movement between both ends of siding panels that butt against trim; seal joint between panel and trim with specified sealant.

I. Joints in Vertical Siding: Install Z-flashing in horizontal joints between successive courses of vertical siding.

J. Lap siding butt joints: Install flashing at each joint between lap siding panels. Overlap course below by 1 inch. Stagger joints between successive courses. Do not caulk at field butt joints.

K. Maintain space between siding material and trim in accordance with manufacturer's written recommendations.

L. Do not install siding less than 6 inches from ground surface, or closer than 1 inch to roofs, patios, porches, and other surfaces where water may collect.

M. Weather cut horizontal joints in vertical trim boards

N. Clean siding and accessory items using neutral cleaner approved by siding manufacturer, and prepare for Finish Painting.

O. Exterior Soffit Vents: Install according to manufacturer's written instructions and in locations indicated on the Drawings. Provide vent area as indicated on Drawings.

P. After installation, seal joints except lap joints of lap siding; seal around penetrations, and paint exposed cut edges.

Q. Finish Painting: Specified in Section 09 91 13 - Exterior Painting.

R. Panel Cutting:
   1. Always cut fiber cement panels outside or in a well ventilated area. Do not cut the products in an enclosed area.
   2. Always wear safety glasses and NIOSH/OSHA approved respirator whenever cutting, drilling, sawing, sanding or abrading the products. Refer to manufacturer SDS for more information.
   3. Use a dust-reducing circular saw with a diamond-tipped or carbide-tipped blade.
      a. Recommended circular saw: Makita 7-1/4” Circular Saw with Dust Collector (#5057KB).
      b. Recommended blade: Tenryu Board-Pro Plus PCD Blade (#BP-18505).
      c. Shears (electric or pneumatic) or jig saw can be used for complicated cuttings, such as service openings, curves, radii and scrollwork.
   4. Silica Dust Warning: Fiber cement products may contain some amounts of crystalline silica, a naturally occurring, potentially hazardous mineral when airborne in dust form. Consult product SDS or visit https://www.osha.gov/dsg/topics/silicacrystalline/.
   5. Immediately clean dust from cut panels as it may bind to the finish.

3.04 CLEANING AND PAINTING

A. Clean siding and accessory items using neutral cleaner approved by manufacturer.

B. Siding surface shall be cleaned and prepared for painting as specified in 09 91 13 - Exterior Painting.

3.05 PROTECTION

A. Protect installed products until Date of Substantial Completion.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 07 54 23
THERMOPLASTIC-POLYOLEFIN (TPO) MEMBRANE ROOFING

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 SECTION INCLUDES

A. Fully Adhered TPO membrane roofing system for installation over concrete deck on new construction.
   1. Install polyester reinforced SBS Vapor Retarder with moisture cured adhesive (DynaSet 1K) to concrete deck.
   2. Adhere base layer of new ENRGY 3 polyiso insulation to SBS Vapor Retarder.
   3. Install new edge metal.
   4. Provide 20-year manufacturer system guarantee.

B. Fully Adhered TPO membrane roofing system for installation over plywood deck on new construction.
   1. Fasten base layer of new ENRGY 3 polyiso insulation to deck.
   2. Fully adhere subsequent layers of new ENRGY 3 polyiso insulation to base layer insulation
   3. Fully adhere insulation cover board to insulation.
   4. Install new edge metal.
   5. Provide 20-year manufacturer system guarantee.

1.03 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Roof and parapet sheathing, wood nailers, wood blocking, screws for parapet sheathing, and other fasteners associated with roofing.

B. Section 07 62 00 - Sheet Metal Flashing and Trim: Formed metal flashing and trim items associated with roofing.

C. Section 07 71 00 - Roof Specialties: Manufactured copings, fascia, gravel stops, and other flashing-related items.

D. Section 07 72 33 - Roof Hatches: Roof hatches, vents, and manufactured curbs.

1.04 PRICE AND PAYMENT PROCEDURES

1.05 DEFINITIONS

A. LTTR: Long Term Thermal Resistance, as defined by CAN-ULC-S770.

B. Roofing Terminology: Refer to ASTM D1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" NRCA (RM) and NRCA (WM) for definition of terms related to roofing work in this Section.

C. Design Uplift Pressure: The uplift pressure, calculated according to procedures in SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems," before multiplication by a safety factor.

D. Factored Design Uplift Pressure: The uplift pressure, calculated according to procedures in SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems," after multiplication by a safety factor.

E. NDL: No Dollar Limitation. Refer to Warranty paragraphs.

F. TPO: Thermoplastic polyolefin.

1.06 REFERENCE STANDARDS

A. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems.

B. ASCE 7-10 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

C. ASTM C473 - Standard Test Methods for Physical Testing of Gypsum Panel Products.

D. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

E. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

F. ASTM D1079 - Standard Terminology Relating to Roofing and Waterproofing.

G. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

H. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin-Based Sheet Roofing.

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

J. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.

K. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings.

L. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C.

M. CAN-ULC-S770 - Standard Test Method for Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams.

N. NRCA (RM) - The NRCA Roofing Manual.

O. NRCA (WM) - The NRCA Waterproofing Manual.

P. Sheet Metal Terminology and Techniques: SMACNA “Architectural Sheet Metal Manual.”

1.07 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference: Before start of roofing work, Contractor shall hold a meeting to discuss the proper installation of materials and requirements to achieve the warranty.

1.08 SUBMITTALS

A. WITH BID DOCUMENTS:
   1. Installer Certificates: Signed certification from manufacturer that Installer is approved, authorized, or licensed by manufacturer to install the specified roofing system.
   2. Guarantees: Provide manufacturer’s current guarantee specimen.

B. UPON AWARD BUT PRIOR TO FINAL CONTRACT:
   1. Product Data: Manufacturer’s data sheets for each product to be provided.
      a. Where UL requirements are specified, provide documentation that shows that the roofing system to be installed is UL-Classified; include data itemizing the components of the classified or approved system.
   2. Detail Drawings: Provide roofing system plans, elevations, sections, details, and details of attachment to other Work and customized for this project for relevant conditions, including:
      a. Base flashings and membrane terminations.
      b. Tapered insulation, including slopes.
      c. Crickets, saddles, and tapered edge strips, including slopes.
      d. Insulation fastening and adhesive patterns.
      e. Verification Samples: Provide for membrane and insulations specified.
   3. PRIOR TO BEGINNING WORK:
      a. Prior to roofing system installation, roofing sub-contractor shall provide a copy of the Guarantee Application Confirmation document issued by Johns Manville Roofing Systems indicating that the project has been reviewed for eligibility to receive the specified guarantee and registered.
   4. PRIOR TO FINAL PAYMENT:
      a. Maintenance Data: Refer to Johns Manville’s latest published documents on www.JM.com.
      b. Guarantees: Provide manufacturer’s final approved and executed guarantee.

1.09 SUBMITTALS FOR CLOSEOUT

A. Executed Warranty.

1.10 QUALITY ASSURANCE

A. Installer Qualifications: Qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive the specified manufacturer's guarantee.
   1. Manufacturer Qualifications: Qualified manufacturer that has been pre-approved prior to the initial bid date for this Project.

B. Source Limitations: Obtain all components from the single source roofing manufacturer guaranteeing the roofing system. All products used in the system must be labeled by the single source roofing manufacturer issuing the guarantee. The manufacturer must be the primary brand of the manufacturer. The manufacturer must be a separate entity from the installing roofing contractor.

C. Coordinate with other trades for securing vertical substrate surfaces (decks, overbuilds, parapets, etc.) to structural framing (roof trusses and/or parapets) with screws where those vertical surfaces receive roof membrane.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storage.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. All insulation and materials must be securely tarped upon delivery to the project site.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.12 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when current and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written instructions and guarantee requirements.

1.13 GUARANTEE

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer's system guarantee equal to Johns Manville's Peak Advantage No Dollar Limit Roofing System Guarantee.
   1. Single-Source special guarantee includes roofing membrane, base flashings, roofing membrane accessories, roof insulation, fasteners, adhesives, cover board, walkway products, manufacturer’s edge metal products, and other single-source components of roofing system marketed by the manufacturer.
   2. Guarantee Period: 20 years from date of Substantial Completion.
   3. Guarantee shall not exclude:
      a. Exposure to U.V. light, reflected light or any temperature.
      b. Improperly installed or unapproved details of the roofing membrane system.
      c. Guarantee shall be transferable.
      d. from date of Substantial Completion.

C. Installer’s Guarantee: Submit roofing Installer's guarantee, including all components of roofing system for the following guarantee period:
   1. Guarantee Period: Two years from date of Substantial Completion.
   2. Existing Guarantees: Guarantees on existing building elements should not be affected by scope of work.
      a. Installer is responsible for coordinating with building Owner’s representative to verify compliance.

PART 2 PRODUCTS

2.01 PERFORMANCE CRITERIA

A. General: Installed roofing membrane system shall remain watertight; and resist specified wind uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Roofing materials shall be compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.

C. Installer must comply with current code requirements based on authority having jurisdiction.
   1. Wind Uplift Performance: Roofing system shall be identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist wind uplift pressure calculated in accordance with ASCE 7-10.
      a. Edge Metal shall comply with ANSI/SPRI/FM 4435/ES-1.

D. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
   1. Exterior Fire-Test Exposure: Class A; ASTM E108, for application and roof slopes indicated.

2.02 THERMOPLASTIC POLYOLEFIN ROOFING MEMBRANE - TPO

A. Fabric-Reinforced Thermoplastic Polyolefin Sheet: ASTM D6878/D6878M, uniform, flexible sheet formed from a thermoplastic polyolefin, internally fabric or scrim reinforced designed for applications in high temperature and UV exposures.
   1. Membrane Thickness: 60 mils, nominal.
   2. Reinforcement: fabric or scrim placed in the center of the sheet such that the top layer maintains a minimum of 27 mils above the scrim.
   3. Exposed Face Color: White.

B. Basis of Design Manufacturer - Roofing System; Johns Manville; JM TPO

C. Roofing systems manufactured by the companies listed below are acceptable provided they are completely equivalent in materials and warranty conditions:
   1. Carlisle Roofing Systems, Inc; Sure-Weld TPO: www.carlisle-syntec.com.
   2. Elevate; UltraPly TPO: www.holcimelevate.com.
   3. Flex Membrane International Corporation; TPO Plus: www.flexroofingsystems.com.
   4. GAF; EverGuard TPO: www.gaf.com.
   5. Substitutions: See Section 01 60 00 - Product Requirements.
      a. Submit evidence that the proposed substitution complies with the specified requirements.

2.03 ROOFING SYSTEM DESCRIPTION

A. Roofing System: Thermoplastic polyolefin (TPO) single-ply membrane.
   1. Membrane Attachment: Fully cold-applied adhesive adhered.
   2. Warranty: Full system warranty; 20 year Limited Warranty covering membrane, roof insulation, and membrane accessories.
   3. Comply with applicable local building code requirements.
   4. Provide assembly having Underwriters Laboratories, Inc. (UL) Class A Fire Hazard Classification.

B. Roofing System Components: Listed in order from top of roof down:
   1. Roofing Membrane: Thickness as specified: Cold adhesive attached.
   2. Insulation Cover Board: Provide one of the following. provided that only a single type of cover board is used for the entire roof system.
      a. Insulation Cover Board: Gypsum-based board, 1/2 inch minimum thickness; cold adhesive attached; stagger all joints in stacked and adjacent layers.
   3. Insulation:

a. Maximum Board Thickness: 3 inches; use a minimum of two layers; stagger all joints in stacked and adjacent layers.
b. Tapered: Slope as indicated; provide minimum R-value at thinnest point; place tapered layer on bottom.
c. Total R-Value as indicated on Drawings, but not less than required by applicable Energy Code.
d. Top Layer: Polyisocyanurate foam board, non-composite; cold adhesive attached.
e. Intermediate Layer(s), If Any: Polyisocyanurate foam board, non-composite; cold adhesive attached.
f. Bottom Layer: Polyisocyanurate foam board, non-composite; mechanically fastened.
1) Minimum thickness 2 inches except at drains.
g. Crickets: Tapered insulation of same type as specified for top layer; slope as indicated.

4. Air Barrier: Material approved in writing by roof manufacturer complying with requirements of fire rating classification; compatible with roofing and insulation materials.
a. Locations: Membrane roofing at framed roof decking substrates and concrete substrates.
b. Vapor Permeability: 30 perm maximum, measured in accordance with ASTM E96/E96M.
c. Basis of Design; Vapro Shield SlopeShield Plus SA.
5. Vapor Retarder: One layer Polyester Reinforced SBS Vapor Retarder; cold adhesive attached in moisture cured adhesive (DynaSet 1K).
a. Locations: Membrane roofing at concrete substrates..
6. Roof Deck Substrate Board: None; Insulation Cover Board is applied over top layer of insulation and underneath the TPO membrane; stagger all joints in stacked and adjacent layers.

2.04 AUXILIARY ROOFING MATERIALS – SINGLE PLY

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.
2. Sheet Flashing: Manufacturer's internally reinforced or scrim reinforced, smooth backed membrane with same thickness and color as sheet membrane.
a. Basis of Design; JM TPO.
3. Bonding Adhesive: Manufacturer's standard solvent-based bonding adhesive for base flashings.
a. Basis of Design; JM Membrane Bonding Adhesive (TPO&EPDM).
4. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, with anchors.
a. Basis of Design; JM Termination Systems.
5. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
a. Basis of Design; High Load Fasteners and Plates.
6. Miscellaneous Accessories: Provide pourable sealers, primers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, cover strips, and other accessories required for full installation.

2.05 AUXILIARY ROOFING SYSTEM COMPONENTS

A. Metal Edge System: Manufacturer’s factory fabricated metal edge system used to terminate the roof at the perimeter of the structure. Provide product from single-source roofing system supplier that is included in the No Dollar Limit guarantee.
1. Basis of Design; Presto-Weld Drip Edge. Provide metal approved, tested and manufactured to meet or exceed ANSI/SPRI/FM 4435/ES-1 standards and included in the manufacturer’s roofing warranty.

2.06 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads sourced from membrane roofing system manufacturer.
   1. Basis of Design; JM TPO Walkpad.
   2. Unless indicated otherwise on the Drawings, space walkway pads no further than 6 inches apart.

2.07 ROOF INSULATION

A. General: Preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2 (20 psi).
   1. Basis of Design; ENRGY 3.
   2. Provide insulation R-values to meet requirements indicated on Drawings.

2.08 TAPERED INSULATION

A. Tapered Insulation: ASTM C1289, Type II, Class 1, Grade 2 (20 psi), provide factory-tapered insulation boards fabricated to install at a slope of not less than 3/8 inch per 12 inches (1/32) in the field and 1/4 inch per 12 inches (1:48) at crickets and across valleys with 1/2 inch start, unless otherwise indicated on Drawings.
   1. Basis of Design; Tapered ENRGY 3.

2.09 COVER BOARDS

A. Gypsum-Based Cover Board and Substrate Board: Non-combustible, water resistant gypsum core with embedded glass mat facers, complying with ASTM C1177/C1177M, and with the following additional characteristics:
   1. Insulation Cover Board: Gypsum board panel installed directly under the membrane and over the top layer of insulation.
   2. Roof Deck Substrate Board: Gypsum board panel installed directly over the roof decking for use as a thermal or fire resistive barrier.
   3. Size: 48 inches by 96 inches, nominal.
      a. Exception: Board to be attached using adhesive or asphalt may be no larger than 48 inches by 48 inches, nominal.
   4. Thickness: As indicated elsewhere.
   5. Surface Water Absorption: 2.5 g, maximum, when tested in accordance with ASTM C473.
   6. Spanning Capability: Recommended by manufacturer for following minimum flute spans:
      a. 1/2 inch Thickness: 5 inches, minimum.
   7. Surface Burning Characteristics: Flame spread index of 0 (zero), smoke developed index of 0 (zero), when tested in accordance with ASTM E84.
   8. Combustibility: Non-combustible, when tested in accordance with ASTM E136.
   9. UL Classified for use with UL "P" series roofing assemblies.
   10. Mold Growth Resistance: Zero growth (Mold Score of 10), when tested in accordance with ASTM D3273 for minimum of 4 weeks.

2.10 PARAPET MATERIALS

A. Provide and install parapet sheathing capable of meeting project requirements for fire-resistive design, structural design, and membrane roofing manufacturer's substrate requirements to provide a fully warranted system.

B. Provide and install blocking, backing strip, or approved membrane roofing manufacturer substrate to receive base flashing, mounted at a height to match manufactuer's minumum requiremetns to accept membrane termination at vertical return above roof deck or top of insulation.

C. Provide and install screws into parapet structural sheathing.

2.11 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

B. Provide factory preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.
   1. Basis of Design; Diamondback Pre-Cut Cricket, Diamondback Pre-Cut Miter, Tapered Fesco Edge Strip.

C. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and furnished by roofing system manufacturer.
   1. Basis of Design; UltraFast Fasteners and Plates.

D. Urethane Adhesive: Manufacturer's two component polyurethane adhesive formulated to adhere insulation to substrate.
   1. Basis of Design; JM Two-Part Urethane Insulation Adhesive (UIA).

E. Wood Nailer Strips: Comply with requirements in Division 06 Section "Miscellaneous Rough Carpentry."

2.12 SAFETY PRODUCTS

A. Provide installed ladder and hatch safety systems as a part of this roofing project at all roof top ladder egress and on all hatches.
   1. Basis of Design: Roof Top Anchors/Safe Pro 15' ladder roof rail systems and full enclosure hatch safety rail systems.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with the requirements affecting performance of roofing system.
   1. General:
      a. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
      b. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
      c. Parapet Sheathing: refer to Section 06 10 00 - Rough Carpentry for plywood sheathing and screws for attaching plywood to roof framing.

B. Examine roof and parapet substrates to verify that manufacturer requirements for substrate fastening are acceptable to roof membrane manufacturer and warrantable.

3.02 PREPARATION

A. Clean and remove from substrate sharp projections, dust, debris, moisture, and other substances detrimental to roofing installation in accordance with roofing system manufacturer's written instructions.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction.

C. If applicable, prime surface of deck with asphalt primer at a rate recommended by roofing manufacturer and allow primer to dry.

3.03 INSULATION INSTALLATION

A. Coordinate installation of roof system components so insulation and cover board is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system manufacturer's written instructions for installation of roof insulation and cover board.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install insulation boards with long joints in a continuous straight line. Joints should be staggered between rows, abutting edges and ends per manufacturer's written instructions. Fill gaps exceeding 1/4 inch (6 mm) with like material.

E. Install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.

F. Trim surface of insulation boards where necessary at roof drains so completed surface is flush and does not restrict flow of water.

G. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

3.04 ROOFING MEMBRANE INSTALLATION, GENERAL

A. Install roofing membrane in accordance with roofing system manufacturer's written instructions, applicable recommendations of the roofing manufacturer and requirements in this Section.

B. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.

C. Cooperate with testing and inspecting agencies engaged or required to perform services for installing roofing system.

D. Coordinate installing roofing system so components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is imminent.
   1. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation.
   2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
   3. Remove and discard temporary seals before beginning work on adjoining roofing.

3.05 ADHERED ROOFING MEMBRANE INSTALLATION

A. Install roofing membrane over area to receive roofing in accordance with membrane roofing system manufacturer's written instructions.
   1. Unroll roofing membrane and allow to relax before installing.
   2. Install sheet in accordance with roofing system manufacturer’s written instructions.
   3. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
   4. Bonding Adhesive: Apply solvent-based bonding adhesive to substrate and underside of roofing membrane at rate required by manufacturer and allow to partially dry before installing roofing membrane. Do not apply bonding adhesive to splice area of roofing membrane.
   5. Attach roofing membrane securely at terminations, penetrations, and perimeter of roofing.
   6. Apply roofing membrane with side laps shingled with roof slope, where possible.
   7. Seams: Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.
      a. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane.
      b. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
         1) Remove and repair any unsatisfactory sections before proceeding with installation.
      c. Repair tears, voids, and incorrectly lapped seams in roofing membrane that do not meet requirements.
   8. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.
   9. Install roofing membrane and auxiliary materials to tie into existing roofing.

3.06 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates per membrane roofing system manufacturer's written instructions.

B. Apply solvent-based bonding adhesive at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners per manufacturer’s installation instructions.

D. Clean seam areas and overlap and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.07 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Heat weld and adhere walkway products to substrate according to roofing system manufacturer's written instructions.

3.08 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.

C. Final Roof Inspection: Arrange for roofing system manufacturer's Registered Roof Observer (RRO) to inspect roofing installation on completion and submit report to Architect.
   1. Notify Architect or Owner 48 hours in advance of date and time of inspection.

D. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.09 PROTECTION AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

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SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

A. Sealants for joints within sheet metal fabrications.

1.03 RELATED REQUIREMENTS

A. Section 04 26 13 - Masonry Veneer: Flexible metal flashings embedded in masonry.

B. Section 07 71 23 - Manufactured Gutters and Downspouts.

1.04 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).

B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

C. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.

E. ASTM D2178/D2178M - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.

F. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free.

G. CDA A4050 - Copper in Architecture - Handbook.

H. SMACNA (ASMM) - Architectural Sheet Metal Manual.

1.05 SUBMITTALS

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

B. Samples: Submit two samples 8 x 8 inch in size illustrating metal finish color.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 3 years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Stainless Steel: ASTM A666/A666M, Type 304 alloy, soft temper, 28 gauge, 0.0156 inch thick; smooth No. 4 - Brushed finish.

2.02 PREFINISHED ALUMINUM SHEETS

A. Description: Factory-applied topcoat systems applied to aluminum flat sheet substrates prior to fabrication by coil coating; topcoat systems consist of primers and organic topcoats on exposed side and backing coats on unexposed side.

B. Aluminum Sheet Substrates: ASTM B209/B209M, alloy and temper as recommended by manufacturer for application.

C. High-Performance Organic Coating System: Comply with AAMA 2604 for aluminum preparation, pretreatment, primer and finish coat system; provide thermally cured, 50-percent PVDF or silicone-modified polyester systems; tested for weathering for 5 years with 5 delta units color change maximum.

2.03 FABRICATION

A. Sheet Metal Fabrication Standard: Fabricate sheet metal flashing and trim to comply with recommendations of SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of the item indicated.

B. Form sections true to shape, accurate in size, square, and free from distortion or defects.

C. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer.
   1. Size: As recommended by SMACNA manual or sheet metal manufacturer for application but never less than thickness of metal being secured.

D. Form pieces in longest possible lengths.

E. Hem exposed edges on underside 1/2 inch; miter and seam corners.

F. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

G. Fabricate corners from one piece with minimum 18-inch long legs; seam for rigidity, seal with sealant.

H. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

I. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.

2.04 ACCESSORIES

A. Underlayment: ASTM D2178/D2178M, glass fiber roofing felt.

B. Slip Sheet: Rosin-sized sheathing paper.

C. Primer Type: Zinc chromate.

D. Protective Backing Paint: Zinc molybdate alkyd.

E. Concealed Sealants: Non-curing butyl sealant.

F. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
   1. Products:
      a. As specified in Section 07 92 00 - Joint Sealants

G. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.

C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch.

3.03 INSTALLATION

A. 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. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

E. Seal metal joints watertight.

F. Secure gutters and downspouts in place using concealed bracket or strap type fasteners. Ferrules and spikes are not allowed.

3.04 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.

END OF SECTION

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SECTION 07 71 00
ROOF SPECIALTIES

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 SECTION INCLUDES

A. Manufactured roof specialties, including copings, fascias, and roof edge flashings.

B. Factory fabricated cornices.

1.03 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Roof sheathing.

B. Section 06 17 53 - Shop-Fabricated Wood Trusses: Roof framing.

C. Section 07 54 23 - Thermoplastic-Polyolefin Roofing (TPO); Membrane Roofing.

D. Section 07 92 00 - Joint Sealants.

1.04 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).

B. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems.

C. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

F. NRCA (RM) - The NRCA Roofing Manual.

G. SPRI ES-1 - Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.

1.05 SUBMITTALS

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

B. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.

C. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.

D. Manufacturer's Installation Instructions: Indicate special procedures, fasteners, supporting members, and perimeter conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Roof Edge Flashings and Copings:
   1. Architectural Products Co: www.archprod.com.
   2. ATAS International, Inc: www.atas.com.
   3. Metal-Era Inc: www.metalera.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Control and Expansion Joint Covers:
   1. EMSEAL Joint Systems, Ltd; Emseal RoofJoint: www.emseal.com.
   2. GAF: www.gaf.com.
   3. Johns Manville: www.jm.com.

4. MM Systems Corp: www.mmsystemscorp.com.
5. Substitutions: See Section 01 60 00 - Product Requirements.

C. Pipe and Penetration Flashings:
1. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 COMPONENTS

A. Roof Edge Flashings: Factory fabricated to sizes required; corners mitered; concealed fasteners.
1. Configuration: Fascia, cant, and edge securement for roof membrane.
2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test methods RE-1 and RE-2 to positive and negative design wind pressure as defined by applicable local building code.
3. Splice Plates: Concealed, of same material, finish, and shape as fascia cover
4. Material: Formed aluminum sheet, 0.063 inch thick, minimum.
5. Finish: 70 percent polyvinylidene fluoride (PVDF).
6. Finish: Mill finish.
7. Color: As indicated on Drawings.
8. Products:
   a. Cheney Flashing Company.
   b. Johns Manville.
   c. Merchant & Evans, Inc.
   d. MM Systems Corporation.
   e. Petersen Aluminum Corporation.
   f. W.P. Hickman Company.
   g. Substitutions: See Section 01 60 00 - Product Requirements.

B. Copings: Factory fabricated to sizes required; corners mitered; concealed fasteners.
1. Configuration: Concealed continuous hold down cleat at both legs; internal splice piece at joints of same material, thickness, and finish as cap; concealed stainless steel fasteners.
   a. Snap on cap fabricated from material as noted below.
   b. Soldered Corners
   c. Snap-on Coping Anchor Plates: Concealed, stainless steel sheet, with integral cleats.
   d. Face Leg Cleats: Concealed, continuous stainless steel.
2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-3 to positive and negative design wind pressure as defined by applicable local building code.
3. Splice Plates: Concealed, of same material, finish, and shape as fascia cover
4. Material: Formed aluminum sheet, 0.040 inch thick, minimum.
5. Finish: 70 percent polyvinylidene fluoride.
6. Color: As selected by Architect from manufacturer's standard range.
7. Products:
   a. SAF Perimeter Systems, a division of Southern Aluminum Finishing Co.; Model PLC4 / Model PLC6 / custom profiles as indicated on plans: www.saf.com.
   b. Petersen Aluminum Corp.; PAC-TITE: www.pac-clad.com.
   c. W.P. Hickman Company; PermaSnap 2 Coping: www.wph.com. (Basis of Design)
   d. Substitutions: See Section 01 60 00 - Product Requirements.

C. Factory Fabricated Cornices: Factory fabricated, assembled, and finished sheet metal architectural details, including profiles, returns, mitered corners, end caps, rakes, gables, etc.; finished unit mechanically fastened to structural support.
1. Material: Aluminum sheet, ASTM B209/B209M alloy 30003 or 5005.can
2. Sheet Thickness: 0.04 inch.
3. Section Length: 10 feet, maximum, between joints.
4. Joint Splice Plates: Same material as cornice sections, 6 inches wide, minimum, and formed to match inside surface of cornice profile.

5. Support Brackets: Factory fabricated from 1/8-inch by 1-inch extruded aluminum bar, ASTM B221 or ASTM B221M.
6. Fastener Holes: Elongated; factory punched or drilled.
7. Aluminum Finish: Manufacturer's standard factory applied PVDF coating.
8. Color: To be selected by Architect from manufacturer's full range.

D. Pipe and Penetration Flashing: Base of TPO, compatible with shingle roof system, and capable of accommodating pipes sized between 3/8 inch and 12 inch.
1. Caps: EPDM or as required by membrane manufacturer to maintain fully warranted roof system.

2.03 FINISHES

A. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system; color as indicated.

2.04 ACCESSORIES

A. Sealant for Joints in Linear Components: As recommended by component manufacturer.

B. Adhesive for Anchoring to Roof Membrane: Compatible with roof membrane and approved by roof membrane manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that deck, curbs, roof membrane, base flashing, and other items affecting work of this Section are in place and positioned correctly.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

B. Seal joints within components when required by component manufacturer.

C. Anchor components securely.

D. Comply with NRCA (RM) drawing details where Contract Documents do not reference a specific condition.

E. Coordinate installation of components of this section with installation of roofing membrane and base flashings.

F. Coordinate installation of sealants and roofing cement with work of this section to ensure water tightness.

G. Coordinate installation of flashing flanges into reglets.

END OF SECTION

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SECTION 07 71 23
MANUFACTURED GUTTERS AND DOWNSPOUTS

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 SECTION INCLUDES

A. Pre-finished aluminum scuppers and conductor heads.

B. Downspout boots.

1.03 RELATED REQUIREMENTS

A. Section 07 31 13 - Asphalt Shingles: Primary sloped roofing system.

B. Section 07 41 13 - Metal Roof Panels; Accent sloped roofing system.

C. Section 07 62 00 - Sheet Metal Flashing and Trim.

D. Section 09 91 13 - Exterior Painting: Field painting of metal surfaces.

1.04 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).

B. ASTM A48/A48M - Standard Specification for Gray Iron Castings.

C. ASTM B32 - Standard Specification for Solder Metal.

D. SMACNA (ASMM) - Architectural Sheet Metal Manual.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Comply with SMACNA (ASMM) for sizing components for rainfall intensity determined by a storm occurrence of 1 in 10 years.

B. Maintain one copy of each document on site.

1.06 SUBMITTALS

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

B. Product Data: Provide data on prefabricated components.

C. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope to drain.

B. Prevent contact with materials that could cause discoloration, staining, or damage.

PART 2 PRODUCTS

2.01 MATERIALS

A. Aluminum Sheet: ASTM B209 (ASTM B209M); 0.032 inch thick.
   1. Finish: Mill.
   2. Color: Clear.

B. Pre-Finished Aluminum Sheet: ASTM B209 (ASTM B209M); 0.032 inch thick.
   1. Finish: Plain, shop pre-coated with modified silicone coating.
   2. Color: As indicated.

C. Solder: ASTM B32; Sn50 (50/50) type.

2.02 SCUPPERS AND CONDUCTOR HEADS

A. Scuppers: Profile as indicated, unless otherwise indicated on Drawings.

1. Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4-inch-(100-mm-) wide wall flanges to interior, and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof. Fabricate from the following materials:
    a. Aluminum: 0.032 inch (0.81 mm) thick.

B. Conductor Heads: Profile as indicated on Drawings.
1. Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape required, complete with outlet tubes and exterior flange trim. Fabricate from the following materials:
    a. Aluminum: 0.032 inch (0.81 mm) thick.

C. Anchors and Supports: Profiled to suit scuppers and conductor heads.
1. Anchoring Devices: In accordance with SMACNA requirements.

D. Fasteners: Same material and finish as scuppers and conductor heads, with soft neoprene washers.

2.03 ACCESSORIES

A. Downspout Boots: Smooth interior without boxed corners or choke points; include integral lug slots and on-body cleanout and cover with neoprene gaskets.
1. Configuration: Angular.
2. Material: Cast iron; ASTM A48/A48M; casting thickness 3/8 inch (9.5 mm), minimum.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that surfaces are ready to receive work.

3.02 PREPARATION

A. Paint concealed sheet metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch.

3.03 INSTALLATION

A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.

B. Sheet Metal: Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts and accessories.

C. Slope gutters 1/2 inch per 10 feet.

D. Secure gutters and downspouts in place using concealed bracket or strap type fasteners. Ferrules and spikes are not allowed.

E. Connect downspouts to storm sewer system. Grout connection watertight.

END OF SECTION

SECTION 07 72 33
ROOF HATCHES

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 SECTION INCLUDES

A. Roof hatches , manual operation, with built-in curbs.

B. Safety Rails and ladder-up system.

1.03 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Substrate for equipment specified in this Section.

B. Section 06 10 00 - Rough Carpentry: Substrate for equipment specified in this Section.

C. Section 07 53 23 - EPDM Thermoset Single-Ply Roofing - Carlisle: Membrane roofing interfacing with hatches smoke vents, and safety rail systems.

1.04 REFERENCE STANDARDS

A. 29 CFR 1910.23 - Ladders.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

D. FM (AG) - FM Approval Guide.

E. UL (DIR) - Online Certifications Directory.

1.05 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.
   5. For smoke hatches, submit evidence of approval by evaluation agency specified.

C. Certificate: For smoke hatches, provide certificate of approval from authority having jurisdiction.

D. Warranty Documentation:
   1. Submit manufacturer warranty.
   2. Ensure that forms have been completed in Owner's name and registered with manufacturer.
   3. Submit documentation that roof accessories are acceptable to roofing manufacturer, and do not limit the roofing warranty.

1.06 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.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 ROOF HATCHES AND VENTS, MANUAL AND AUTOMATIC OPERATION

A. Roof Hatch Manufacturers:
   1. Babcock-Davis; Personnel II (Ladder Access): www.babcockdavis.com.

2. Best Access Doors; BA-ALRF-LA (Ladder Access, Aluminum): www.bestaccessdoors.com.
3. Bilco Company; Type E (ladder access, 3 ft square, solid cover): www.bilco.com.
4. Nystrom, Inc: www.nystrom.com.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Roof Hatches and Smoke Vents: Factory-assembled aluminum frame and cover, complete with operating and release hardware.
1. Style: Provide flat metal covers unless otherwise indicated.
2. Mounting: Provide frames and curbs suitable for mounting conditions as indicated on drawings.
3. Thermally Broken Hatches: Added insulation to frame and cover; available in each manufacturer's standard, single leaf sizes; special sizes available upon request
4. Size: As indicated on drawings; single-leaf style unless indicated as double-leaf.
5. For Ladder Access: Single leaf; 30 by 36 inches.
6. For Ships Ladder Access: Single leaf; 30 by 54 inches.
7. For Stair Access: Single leaf; 30 by 96 inches.
8. For Equipment Access: Double leaf; 48 by 48 inches.

C. Smoke and Heat Vents: Where "smoke" or "smoke/heat" operation is indicated, provide following additional features and omit manual operation for access.
1. Smoke Release Mechanism: Automatic opening on melting of replaceable UL (DIR) listed fusible link at 165 deg F.
2. UL (DIR) or FM (AG) listed as automatically operated smoke and heat vent.
3. Size: 24 by 24 inches.

D. 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 gage, 0.0907 inch thick.
2. Insulation: Manufacturer's standard; 1 inch rigid glass fiber, located on outside face of curb.

E. Metal Covers: Flush, insulated, hollow metal construction.
1. Capable of supporting 40 psf live load.
2. Material: Mill finished aluminum; outer cover 11 gage, 0.0907 inch thick, liner 0.04 inch thick.
3. Insulation: Manufacturer's standard 1 inch rigid glass fiber.
4. Gasket: Neoprene, continuous around cover perimeter.

F. Safety Railing System: Manufacturer's standard accessory safety rail system mounted directly to curb.
1. Comply with 29 CFR 1910.23, with a safety factor of two.
2. Posts and Rails: Aluminum tube.
3. Gate: Same material as railing; automatic closing with latch.
4. Finish: Manufacturer's standard, factory applied finish.
5. Gate Hinges and Post Guides: ASTM B221 (ASTM B221M), 6063 alloy, T5 temper aluminum.
6. Mounting Brackets: Hot dipped galvanized steel, 1/4 inch thick, minimum.
7. Fasteners: Stainless steel, Type 316.
8. Manufacturers:
    a. Best Access Doors; BA-RGRH: www.bestaccessdoors.com.
    b. BILCO Company; Bil-Guard 2.0: www.bilco.com.
    c. SafePro L.P.; SP series: www.safeprosafety.com.
    d. Substitutions: See Section 01 60 00 - Product Requirements.

G. 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. Smoke Hatches: Manual release operation not to disturb automatic release mechanisms; easy resetting by Owner's maintenance personnel; provide latch designed to prevent relatching unless automatic release mechanism has been properly reset for automatic operation.
7. Locking: Padlock hasp on interior.

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.

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

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SECTION 07 81 23
INTUMESCENT FIRE PROTECTION

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 SECTION INCLUDES

A. Thin-film intumescent fire-resistive coatings for interior exposed structural steel.

B. Protective and/or decorative topcoats.

1.03 RELATED REQUIREMENTS

A. Section 05 12 00 - Structural Steel Framing: Coordination of primer for steel to receive coatings in this Section.

B. Section 09 91 23 - Interior Painting: Field-applied colored topcoats matching intumescent fireproofing.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.

B. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness.

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

D. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

E. SSPC-PA 2 - Procedure for Determining Conformance to Dry Coating Thickness Requirements.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with UL Assembly selections indicated on Drawings.

B. Preinstallation Meeting: Convene one week before starting work of this section.

1.06 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. Certificates: Certify that intumescent fireproofing provided for this project meets or exceeds specified requirements in all respects.

F. Test Reports: Published fire resistive designs for structural elements of the types required for the project, indicating hourly ratings of each assembly.

G. Field Quality Control Submittals: Submit field test report.

H. Manufacturer's qualification statement.

I. Installer's qualification statement.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company that specializes in manufacturing the type of products specified, with minimum of ten years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

1.08 MOCK-UPS

A. Provide a mock-up for evaluation of surface preparation techniques and application workmanship; approved mock-up will serve as a standard of comparison for subsequent work of this section.

B. Finish at least 100 sq ft of surface in areas as designated by Architect.

C. Evaluate mock-up for compliance with specified requirements, including thickness and finish texture.

D. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.

E. Refinish mock-up area as required to produce acceptable work.

F. Approved mock-up may remain as part of the project.

1.09 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.

1.10 FIELD CONDITIONS

A. Protect areas of application from windblown dust and rain.

B. Maintain ambient field conditions, such as 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. Ensure that relative humidity is between 40 and 60 percent in areas of application.
   4. Provide ventilation in enclosed spaces during application and for not less than 72 hours afterward.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Intumescent Water Based Thin-Film Fire Protection for Metal:
   1. Albi Manufacturing Division of StanChem Inc; Albi Clad TF+: www.albi.com.
   2. Carboline Company; A/D Firefilm IV: www.carboline.com.
   3. Contego International, Inc; Contego Original Formula Reactive Fire Barrier (RFB) Intumescent with Contego High Solids Reactive Fire Barrier (HS RFB) Low VOC: www.contegointernational.com.
   4. FlameOFF Coatings, Inc; FlameOFF Fire Barrier Paint: www.flameoffcoatings.com.
   5. Hilti, Inc; Fire Finish Steel Protection Spray CFP-SP WB: www.us.hilti.com.
   6. Isolatek International Corp; CAFCO SprayFilm WB 5 / ISOLATEK Type WB 5: www.isolatek.com.
   7. Shield Industries, Inc; FireGuard E-84 Intumescent Coating: www.shieldindustries.com.
   8. The Sherwin Williams Company; FIRETEX®: www.sherwin-williams.com.
   9. Manufacturers indicated in tested assemblies indicated on Drawings.

10. Substitutions: See Section 01 60 00 - Product Requirements.
    a. Products other than those indicated on Drawings shall be submitted and approved to the Authorities Having Jurisdiction by the Contractor if approved by the Architect.

2.02 SYSTEM REQUIREMENTS

A. Fireproofing: Provide intumescent thin-film 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, ITS/WH, or FM and bearing listing agency label or mark.

B. Structural Steel Columns: Fire resistance rating of up to 2 hours; Design Number as indicated on Drawings.

C. Structural Steel Beams: Fire resistance rating of up to 2 hours; Design Number as indicated on Drawings.

D. Structural Steel Beams and Exposed Steel Deck: Fire resistance rating of up to 2 hours; Design Number as indicated on Drawings.

2.03 MATERIALS

A. Fire Resistive Coating System: Thin-film intumescent fire protection system for structural steel.
   1. Surface Burning Characteristics: Class A, flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
   2. For Interior Use:
      a. Use only epoxy or water based products.
      b. VOC Content: Less than 500 g per L when tested in accordance with 40 CFR 59, Subpart D (EPA Method 24).
      c. Hardness: 60 min. for topcoating, 65 min. fully cured, when tested in accordance with ASTM D2240, Type D durometer.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

B. Protective and Decorative Top Coating: Acceptable in writing by fireproofing manufacturer for exposure and substrate conditions.
   1. Color and Gloss: As indicated on Drawings.
   2. Texture: Smooth.
   3. Coordinate with paint for color and sheen to match intumescent fireproof coating and adjacent painted surfaces; see Section 09 91 23.

C. Sealers and Primer: As required by tested and listed assemblies, and recommended in writing by fireproofing manufacturer to suit specific substrate conditions and achieve compliance with specified UL assemblies. Coordinate with substrate requirements and primers as outlined in Section 05 12 00 - Structural Steel Framing.

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 PREPARATION

A. Thoroughly clean surfaces to receive fireproofing.

B. Repair substrates to remove surface imperfections that could affect uniformity of texture and thickness of fireproofing system, and remove minor projections and fill voids that could telegraph through finished work.

C. Cover or otherwise protect other work that might be damaged by fallout or overspray of fireproofing system, and provide temporary enclosures as necessary to confine operations and maintain required ambient field conditions.

3.03 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.

F. Achieve uniform finished appearance complying with approved mock-up.

3.04 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01 40 00 - Quality Requirements.

1. Arrange for testing of installed intumescent fire protection by an independent testing laboratory using magnetic pull-off dry film thickness gauge in accordance with SSPC-PA 2, and ensure it meets requirements of authorities having jurisdiction (AHJ).
2. Submit field test reports promptly to Contractor and Architect.

B. Repair or replace intumescent fire protection at locations where test results indicate fireproofing does not meet specified requirements.

3.05 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.

3.06 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 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 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated on Drawings or not, and other openings indicated.

1.03 RELATED REQUIREMENTS

A. Section 07 81 00 - Applied Fire Protection.

B. Section 09 21 16 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.04 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.

C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

D. 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.

E. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

F. FM (AG) - FM Approval Guide.

G. FM 4991 - Approval Standard of Firestop Contractors.

H. ITS (DIR) - Directory of Listed Products.

I. UL (DIR) - Online Certifications Directory.

J. UL (FRD) - Fire Resistance Directory.

K. UL 1479 - Standard for Fire Tests of Penetration Firestops.

L. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems.

1.05 SUBMITTALS

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

B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements and are compatible with piping materials used on this project.

E. Certificate from authority having jurisdiction indicating approval of materials used.

F. Manufacturer's qualification statement.

G. 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. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report, where accepted in writing by the local authority having jurisdiction.
3. Submission of signed and sealed test reports or a signed and sealed engineering judgement is required for assemblies for which none of the above substantiation exists, where accepted in writing by the local authority having jurisdiction.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and:
1. Trained by manufacturer.
2. Approved by Factory Mutual Research Corporation under FM 4991, or meeting any two of the following requirements:
3. Verification of minimum three years documented experience installing work of this type.
4. Verification of at least five satisfactorily completed projects of comparable size and type.
5. Licensed by local authorities having jurisdiction (AHJ).

1.07 COORDINATION

A. Material Compatibility: Contractor shall coordinate the Work of this Section with other interfacing work in direct contact with the products listed herein. Consult with manufacturer for compatibility of materials specified in other Sections that will be in contact with the products listed in this Section.

1.08 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Firestopping Manufacturers:
1. 3M Fire Protection Products: www.3m.com/firestop.
2. Hilti, Inc.www.us.hilti.com.
3. Specified Technologies Inc: www.stifirestop.com.
4. Manufacturers indicated in tested assemblies indicated on Drawings or one of the other manufacturers listed above.
5. Substitutions: See Section 01 60 00 - Product Requirements.
   a. Products other than those indicated on Drawings shall be submitted and approved to the Authorities Having Jurisdiction by the Contractor if approved by the Architect.

2.02 MATERIALS

A. Firestopping Materials: As defined in each tested firestopping assembly.

B. Mold and Mildew Resistance: Provide firestoppping materials with mold and mildew resistance rating of zero in accordance with ASTM G21.

C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

D. Fire Ratings: Refer to Drawings for required systems and ratings.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. 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.

B. 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. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

C. 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. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

2.04 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.

1. Fire Ratings: Use system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to prevent liquid material from leakage.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by authorities having jurisdiction.

C. Install labeling required by code.

3.04 FIELD QUALITY CONTROL

A. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.05 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.06 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

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SECTION 07 92 00
JOINT SEALANTS

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 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Self-leveling pourable joint sealants.

C. Joint backings and accessories.

1.03 RELATED REQUIREMENTS

A. Section 01 45 35 - Quality Assurance Program for Penetrations & Joints

B. Division 04 Sections for masonry finishes.

C. Division 07 Sections for various exterior finishes.

D. Section 09 21 16 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

1.04 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer.

B. ASTM C834 - Standard Specification for Latex Sealants.

C. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications.

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.

E. ASTM C1193 - Standard Guide for Use of Joint Sealants.

F. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants.

G. ASTM C1311 - Standard Specification for Solvent Release Sealants.

H. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.

I. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.

J. SCAQMD 1168 - Adhesive and Sealant Applications.

K. SWRI (VAL) - SWR Institute Validated Products Directory.

1.05 SUBMITTALS

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

B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   4. Substrates the product should not be used on.
   5. Substrates for which use of primer is required.
   6. SWRI Validation: Provide currently available sealant product validations as listed by SWRI (VAL) for specified sealants.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements and are compatible with piping materials used on this project.

D. 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.

E. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

F. Installation Plan: Submit at least four weeks prior to start of installation.

G. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.

H. 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.

I. Sealant schedule: Provide a complete schedule of all joints and locations, and corresponding products.

J. Installation Log: Submit filled-out log for each length or instance of sealant installed.

K. Executed warranty.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

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. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
      a. Test date.
      b. Copy of test method documents.
      c. Age of sealant upon date of testing.
      d. Test results, modeled after the sample form in the test method document.
      e. Indicate use of photographic record of test.

E. 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.

F. 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 before minimum elongation, take necessary measures to correct conditions and retest; record each modification to products or installation procedures.
4. Administer field adhesion test on mock-up panel.

G. Stain Testing

1.07 COORDINATION

A. Material Compatibility: Contractor shall coordinate the Work of this Section with other interfacing work in direct contact with the products listed herein. Consult with manufacturer for compatibility of materials specified in other Sections that will be in contact with the products listed in this Section.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 2-year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Owner's name and register with manufacturer.

C. Extended Correction Period: Correct defective work within 3-year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Nonsag Sealants:
1. Bostik Inc: www.bostik-us.com.
2. Dow Corning Corporation: www.dowcorning.com/construction.
3. GE Construction Sealants : www.siliconeforbuilding.com
4. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com.
5. Pecora Corporation: www.pecora.com.
6. Sika Corporation: www.usa-sika.com.
7. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
8. W.R. Meadows, Inc: www.wrmeadows.com.
9. Substitutions: See Section 01 60 00 - Product Requirements.

B. Self-Leveling Sealants:
1. Bostik Inc: www.bostik-us.com.
2. Dow Corning Corporation: www.dowcorning.com/construction.
3. GE Construction Sealants www.siliconeforbuilding.com
4. Pecora Corporation: www.pecora.com.
5. Sika Corporation: www.usa-sika.com.
6. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
7. W.R. Meadows, Inc: www.wrmeadows.com.
8. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 JOINT SEALANT APPLICATIONS

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Scope:
1. Exterior Joints:
   a. Seal open joints except open joints indicated on Drawings as not sealed.
2. Interior Joints:
   a. Seal open joints except specific open joints indicated on drawings as not sealed.
3. Do Not Seal:

a. Intentional weep holes in masonry.
b. Joints indicated to be covered with expansion joint cover assemblies.
c. Joints where sealant is specified to be furnished and installed by manufacturer of product to be sealed.
d. Joints where sealant installation is specified in other sections.
e. Joints between suspended ceilings and walls.

C. Exterior Joints: Use non-sag non-staining silicone sealant, Type S-8, unless as otherwise indicated in the following schedule.
1. Type S-5B - Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.
2. Type S-5A - Lap Joints between Manufactured Metal Panels: Butyl rubber, non-curing.
3. Type S-7 - Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.
4. Type S-8 - Expansion and control joints, precast concrete panel joints, perimeter caulking (windows, door, panels).
5. Type S-9 - for the following locations:
a. Premium performance weather sealing product specifically designed for general glazing and weather sealing in curtain wall and building facades.
b. On substrates such as aluminum, glass, steel, painted metal, plastic, stone, concrete and brick. Primerless adhesion to many common building materials.
c. Exterior door and window frame perimeter to adjacent materials.
d. Use double bead at sill or threshold of all exterior swinging or sliding doors, window frames and louver vents.
6. Type S-10 - for the following locations:
a. Expansion and control joints, precast concrete panel joints, curtainwall joints, mullion joints, stone pavers, and many other construction joints.
b. Exterior vertical working expansion and control joints.
7. Type S-11 - for the following locations:
a. Self-leveling, traffic-grade polyurethane, for continuous immersion; sidewalk expansion joints, parking deck expansion and control joints.

D. Type S-1 - Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
1. Type S-2 - Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.
2. Type S-6 - Wall and Ceiling Joints in Wet Areas: Non-sag polyurethane sealant for continuous liquid immersion.
3. Type S-3 - Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
4. Type S-4 - In Sound-Rated Assemblies: Acrylic emulsion latex sealant.

E. Sound-Rated Assemblies: Walls and ceilings identified as STC-rated, sound-rated, or acoustical.

2.03 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

2.04 NONSAG JOINT SEALANTS

A. Type S-8 - Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.
2. Nonstaining to Porous Stone: Nonstaining to light-colored natural stone when tested in accordance with ASTM C1248.
3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
4. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
5. Color: Match adjacent finished surfaces.
6. Service Temperature Range: Minus 20 to 180 degrees F.
7. Applications: Use for:
a. Perimeter caulking (windows, door, panels), expansion and control joints, and precast concrete panel joints.

8. Products:
    a. Dow Chemical Company; DOWSIL 790 Silicone Building Sealant: consumer.dow.com/en-us/industry/ind-building-construction.html.
    b. Pecora Corporation; 890: www.pecora.com.
    c. Sika Corporation; Sikasil WS-290: www.usa-sika.com.
    d. Tremco Commercial Sealants & Waterproofing; Spectrem 1: www.tremcosealants.com.
    e. Substitutions: See Section 01 60 00 - Product Requirements.

B. Type S-9 - Silicone Sealant: ASTM C920, Grade NS, Uses M, A, G, and O; not expected to withstand continuous water immersion or traffic.
    1. Movement Capability: Plus and minus 25 percent, minimum.
    2. Hardness Range: min. 40, Shore A, when tested in accordance with ASTM C661.
    3. Color: To be selected by Architect from manufacturer's full range.
    4. Cure Type: Mildew-resistant acetoxy-curing.
    5. Applications: Use for:
        a. Premium performance weather sealing product specifically designed for general glazing and weather sealing in curtain wall and building facades.
        b. On substrates such as aluminum, glass, steel, painted metal, plastic, stone, concrete and brick. Primerless adhesion to many common building materials.
        c. Exterior door and window frame perimeter to adjacent materials.
        d. Use double bead at sill or threshold of all exterior swinging or sliding doors, window frames and louver vents.
    6. Products:
        a. Dow Corning Corporation; #791 Silicone Perimeter Sealant: www.dowcorning.com.
        b. GE; Silpruf - SCS 2000: www.siliconeforbuilding.com.
        c. Pecora Corporation; #895: www.pecora.com.
        d. Tremco, Inc.; Spectrum 2: www.tremcosealants.com.

C. Type S-10 - Low Modulus - Single Component Silicone Sealant: ASTM C920 and ASTM C719, Type S, Grade NS, Class 100/50 movement capability, single component, neutral cure, low modulus, silicone building sealant.
    1. Color: As selected by Architect from manufacturer's full range.
    2. Applications: Use for:
        a. Expansion and control joints, precast concrete panel joints, curtainwall joints, mullion joints, stone pavers, and many other construction joints.
        b. Exterior vertical working expansion and control joints
    3. Products:
        a. Dow Corning Corporation; #790 Silicone Perimeter Sealant: www.dowcorning.com.
        b. GE; Silpruf - LM: www.siliconeforbuilding.com.
        c. Tremco, Inc.; Spectrem 1: http://www.tremcosealants.com.
        d. Tremco, Inc.; Spectrem 3: http://www.tremcosealants.com.
        e. Pecora Corporation; 890NST: www.pecora.com.

D. Type S-3 - Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
    1. Color: White.
    2. Applications: Use for:
        a. Joints between plumbing fixtures and floor and wall surfaces.
        b. Joints between kitchen and bath countertops and wall surfaces.
    3. Products:
        a. Custom Building Products; Commercial 100% Silicone Caulk: www.custombuildingproducts.com
        b. Dow Corning Corp.; #786 Mildew Resistant Silicone Sealant.
        c. GE Silicones; SCS1700 Sanitary.
        d. Pecora Corporation; 898NST Sanitary Silicone Sealant - Class 50: www.pecora.com.
        e. Sika Corporation; Sikasil GP: www.usa-sika.com.
        f. Tremco Global Sealants Tremsil 200 White/Clear: www.tremcosealants.com.

E. Type S-12 - Polymer Sealant: ASTM C920; single component, cured sealant is paintable and mold/mildew resistant, low odor and VOC, and ultraviolet (UV) resistant.
   1. For interior and exterior weatherization sealing applications. Adheres to most common building materials including; vinyl, aluminum, metal, fiber cement, masonry, wood, stucco and stone
   2. Adheres to wet surfaces.
   3. Color: White: paintable.
   4. Cure Type: Single-component, neutral moisture curing
   5. Service Temperature Range: as low as 20 degrees F.
   6. Products:
      a. DAP Products Inc; DYNAFLEX 800 Sealant: www.dapspecline.com. (Basis of Design)
      b. Other manufacturers that meet the performance requirements matching basis of design.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

F. Type S-13 - Hybrid Urethane 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. Color: To be selected by Architect from manufacturer's standard range.
   3. Service Temperature Range: Minus 75 to 300 degrees F.
   4. Products:
      a. Tremco Commercial Sealants and Waterproofing; Dymonic FC: www.tremcosealants.com.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

G. Type S-1 - Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 35 percent, minimum.
   2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
   3. Color: To be selected by Architect from manufacturer's full range.
   4. Service Temperature Range: Minus 20 to 170 degrees F.
   5. Applications: Use for:
      a. Control, expansion, and soft joints in masonry.
      b. Joints between concrete and other materials.
      c. Joints between metal frames and other materials.
      d. Other exterior joints for which no other sealant is indicated.
   6. Products:
      a. Sika Corporation; Sikaflex-1a: www.usa-sika.com.
      b. Sika Corporation; Sikaflex NP 1: usa.sika.com.

H. Type S-6 - Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface .
   1. Movement Capability: Plus and minus 35 percent, minimum.
   2. Products:
      a. Pecora Corporation; DynaTrol II General Purpose Two Part Polyurethane Sealant: www.pecora.com.
      b. Sika Corporation; Sikaflex-2c NS: www.usa-sika.com.
      c. Sika Corporation; Sikaflex NP 2: usa.sika.com/#sle.
      d. Tremco, Inc.; Dymeric 240/240 FC: www.tremco.com.

I. Type S-2 - Acrylic Emulsion Latex: Water-based; ASTM C834, single component, nonstaining, nonbleeding, nonsagging; not intended for exterior use.
   1. Color: Standard colors matching finished surfaces, Type OP (opaque).
   2. Applications: Use for:
      a. Interior wall and ceiling control joints.
      b. Joints between door and window frames and wall surfaces.
   3. Products:

a. Bostik Inc; Chem-Calk 600: www.bostik-us.com.
b. Pecora Corporation; AC-20 + Silicone Acrylic Latex Caulking Compound: www.pecora.com.
c. Tremco Global Sealants; Tremflex 834: www.tremcosealants.com..

J. Type S-4 - Acoustical Sealant for Concealed Locations:
1. Applications: Use for concealed locations only:
a. Sealant bead between top stud runner and structure and between bottom stud track and floor.
2. Products:
a. Hilti, Inc.; CP 506 Smoke and Acoustical Sealant: www.us.hilti.com.
b. Hilti, Inc.; CP 572 Smoke and Acoustical Spray Sealant: www.us.hilti.com.
c. Pecora Corporation; AIS-919 Acoustical and Insulation Latex Sealant: www.pecora.com.
d. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant: www.pecora.com.
e. Tremco Global Sealants; Acoustical/Curtainwall Sealant: www.tremcosealants.com.
f. USG Sheetrock Brand Acoustical Sealant: www.usg.com

K. Type S-5A - Butyl Sealant: Solvent-based; ASTM C1311; single component, nonsag; not expected to withstand continuous water immersion or traffic.
1. Color: Match adjacent finished surfaces.
2. Applications: Use for:
a. Various roofing applications such as chimney/flashing, valley details, general sheet metal work.
b. Between all types of masonry, steel, aluminum, glass, wood and other common construction materials. Also for sealing glass in channel glazing panels, caulking joints, mullions and flashings in curtain wall construction, and installation of insulated glass units in metal or wood frames.
c. Curtainwall joints, metal panel joining, bedding thresholds, secondary glazing seals, and areas where a seal is required against Tremco Neoprene or EPDM gaskets. .
3. Products:
a. Bostik Inc; Chem-Calk 300: www.bostik-us.com.
b. Pecora Corporation; BC-158: www.pecora.com.
c. Tremco Global Sealants; Tremco Butyl Sealant: www.tremcosealants.com.

L. Type S-5B - Non-Curing Butyl Sealant: Solvent-based; ASTM C1311; single component, non-sag, non-skinning, non-hardening, non-bleeding; vapor-impermeable; intended for fully concealed applications.

2.05 SELF-LEVELING JOINT SEALANTS

A. Type S-7 - Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion .
1. Movement Capability: Plus and minus 25 percent, minimum.
2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
3. Color: To be selected by Architect from manufacturer's full range.
4. Service Temperature Range: Minus 40 to 180 degrees F.

B. Type S-11 - Self-Leveling Polyurethane Sealant for Continuous Water Immersion: Polyurethane; ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure and continuous water immersion.
1. Movement Capability: Plus and minus 25 percent, minimum.
2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
3. Color: To be selected by Architect from manufacturer's full range.
4. Service Temperature Range: Minus 40 to 170 degrees F.
5. Applications: Use for:
a. Horizontal, traffic bearing surfaces.
6. Products:

a. Pecora Corporation; Dynatred Non-Sag Traffic Grade Sealant: www.pecora.com.
b. Sika Corporation; Sikaflex-2c SL: www.usa-sika.com.
c. Tremco Global Sealants; Vulkem 45SSL: www.tremcosealants.com.

2.06 ACCESSORIES

A. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

B. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

C. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.

D. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

E. Tooling agent: Agent recommended by sealant or caulk manufacturer to ensure contact of material with inner joint faces.

F. Divider strips: Synthetic rubber or closed cell synthetic foam not less than 1/16” thick and full depth of caulking material; approved by manufacturers of dissimilar materials as being compatible with each other.

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. Record each test on Preinstallation Adhesion Test Log as indicated.
4. If any sample fails, review products and installation procedures, consult manufacturer, or take other measures that are necessary to ensure adhesion; retest in a different location; if unable to obtain satisfactory adhesion, report to Architect.
5. After completion of tests, remove remaining sample material and prepare joints 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 instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

E. Protect elements surrounding the work of this section from damage or disfigurement.

F. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in an inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Provide joint sealant installations complying with ASTM C1193.

C. Install acoustical sealant application work in accordance with ASTM C919.

D. 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.

E. Install bond breaker backing tape where backer rod cannot be used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

G. 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.

H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

I. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

3.04 FIELD QUALITY CONTROL

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

B. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.

C. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

3.05 CLEANING

A. Clean adjacent soiled surfaces.

3.06 PROTECTION

A. Protect sealants until cured.

3.07 SCHEDULE

A. As indicated on Drawings.

3.08 POST-OCCUPANCY

A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width, i.e., at low temperature in thermal cycle. Report failures immediately and repair them.

END OF SECTION

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SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Hollow metal frames for wood doors.

C. Fire-rated hollow metal doors and frames.

D. Thermally insulated hollow metal doors with frames.

E. Hollow metal borrowed lites glazing frames.

1.03 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.

B. Section 08 71 00 - Door Hardware.

C. Section 08 80 00 - Glazing: Glass for doors and borrowed lites.

D. Section 09 91 13 - Exterior Painting: Field painting.

E. Section 09 91 23 - Interior Painting: Field painting.

F. Division 26 Electrical for Electromagnetic Door Locks.

1.04 ABBREVIATIONS AND ACRONYMS

A. ANSI: American National Standards Institute.

B. ASCE: American Society of Civil Engineers.

C. HMMA: Hollow Metal Manufacturers Association.

D. NAAMM: National Association of Architectural Metal Manufacturers.

E. NFPA: National Fire Protection Association.

F. SDI: Steel Door Institute.

G. UL: Underwriters Laboratories.

1.05 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design.

B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors.

C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100).

D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.

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

F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.

G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

H. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete.

I. ASTM C476 - Standard Specification for Grout for Masonry.

J. ASTM C1363 - Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus.

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

L. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.

M. ICC A117.1 - Accessible and Usable Buildings and Facilities.

N. ITS (DIR) - Directory of Listed Products.

O. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames.

P. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames.

Q. NAAMM HMMA 840 - Guide Specifications for Receipt, Storage and Installation of Hollow Metal Doors and Frames.

R. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames.

S. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.

T. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives.

U. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

V. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames.

W. UL (DIR) - Online Certifications Directory.

X. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.

Y. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.06 SUBMITTALS

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

B. Submit doors, frames, and door hardware as a single package for review.

C. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

B. Maintain at project site copies of reference standards relating to installation of products specified.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:
   1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com.
   2. Curries, an Assa Abloy Group company: www.assaabloydss.com.
   3. De La Fontaine Inc; Hollow Metal Frame Profile: www.delafontaine.com.
   4. Fleming Door Products, an Assa Abloy Group company: www.assaabloydss.com.
   5. Mesker, dormakaba Group; FDJ Series Drywall Frames: www.meskeropeningsgroup.com.
   6. Republic Doors, an Allegion brand: www.republicdoor.com.
   7. Steelcraft, an Allegion brand: www.allegion.com.
   8. Therma-Tru Corp.: www.thermatru.com
   9. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:
   1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
   2. Accessibility: Comply with ICC A117.1 and ADA Standards.
   3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
   4. Door Edge Profile: Manufacturers standard for application indicated.
   5. Typical Door Face Sheets: Refer to Door Schedule for additional information.
   6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on Drawings.
   7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
   8. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
      a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.

B. Hollow Metal Panels: Same construction, performance, and finish as doors.

C. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

A. Door Finish: Factory primed and field finished.

B. Type as scheduled on Drawings,Exterior Doors: Thermally insulated.
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 2 - Heavy-duty.
      b. Physical Performance Level B 500 000 cycles; in accordance with ANSI/SDI A250.4.
      c. Model 1 - Full Flush.
      d. Door Face Metal Thickness: 20 gage, 0.032 inch, minimum.
      e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
   2. Door Core Material: Polystyrene, 1 lbs/cu ft minimum density.
      a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.
   3. Door Core Thermal Resistance: R-Value of 6.0 minimum, for installed thickness of polystyrene.
   4. Door Assembly Thermal Resistance: For opaque, operable door assemblies; ASTM C1363:
      a. Climate Zones 1 through 4: U-Factor of 0.61 maximum.
   5. Door Thickness: 1-3/4 inches, nominal.
   6. Weatherstripping: Refer to Section 08 71 00.

C. Type as scheduled on Drawings,Interior Doors, Non-Fire Rated:
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 1 - Standard-duty.
      b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
      c. Model As scheduled on Drawings.
      d. Door Face Metal Thickness: 20 gauge, 0.032 inch, minimum.

2. Door Thickness: 1-3/4 inches, nominal.
3. Door Face Sheets: As scheduled on Drawings.

D. Type as scheduled on Drawings,Fire-Rated Doors:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
a. Level 1 - Standard-duty.
b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
c. Model As scheduled on Drawings.
d. Door Face Metal Thickness: 20 gauge, 0.032 inch, minimum.
2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
a. Temperature-Rise Rating (TRR) Across Door Thickness: In accordance with local building code and authorities having jurisdiction.
b. Provide units listed and labeled by UL (DIR) or ITS (DIR).
c. Attach fire rating label to each fire rated unit.
d. Smoke and Draft Control Doors: Self-closing or automatic closing doors in accordance with NFPA 80 and NFPA 105, with fire-resistance-rated wall construction rated the same or greater than the fire-rated doors, and the following;
1) Maximum Air Leakage: 3.0 cfm/sq ft of door opening at 0.10 inch w.g. pressure, when tested in accordance with UL 1784 at both ambient and elevated temperatures.
2) Gasketing: Provide gasketing or edge sealing as necessary to achieve leakage limit.
3) Label: Include the "S" label on fire-rating label of door.
3. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
4. Door Thickness: 1-3/4 inches, nominal.

2.04 METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Frame Finish: Factory primed and field finished.

C. Exterior Door Frames: Full profile/continuously welded type.
1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A60/ZF180 coating.
2. Frame Metal Thickness: 18 gauge, 0.042 inch, minimum.
3. Weatherstripping: Separate, see Section 08 71 00.

D. Interior Door Frames, Non-Fire Rated: Slip-on type at gypsum board walls, and knock-down type at masonry walls.
1. Frame Metal Thickness: 18 gauge, 0.042 inch, minimum.

E. Unit Interior, Entry Door Frames, Fire-Rated: Knock-down type (KD) prepared for application of field-applied door trim overlay.
1. Fire Rating: Same as door, labeled.
2. Construction: Kerfed frame, field-adjustable throat, without return or backbend, without casing retainer clips, and pre-drilled anchors for attachment through face of frame into rough opening.
3. Frame Metal Thickness: 20 gauge, 0.0375 inch, minimum.

F. Door Frames other than Unit Entry Doors, Fire-Rated: Knock-down type at gypsum walls and continuously welded for masonry/concrete walls.
1. Fire Rating: Same as door, labeled.
2. Frame Metal Thickness: 18 gauge, 0.042 inch, minimum.

G. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

H. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on Drawings.

I. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.

J. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

B. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15 mil, 0.015 inch dry film thickness (DFT) per coat; provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
   1. Fire-Rated Frames: Comply with fire rating requirements indicated.

2.06 ACCESSORIES

A. Louvers: Roll formed steel with concealed frame; finish same as door components; factory-installed.
   1. In Fire-Rated Doors: UL (DIR) or ITS (DIR) listed fusible link louver, same rating as door.
   2. Style: As indicated on Drawings.
   3. Louver Free Area: 50 percent.
   4. Fasteners: Concealed fasteners.

B. Glazing: Tempered, As specified in Section 08 80 00, factory installed.

C. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.

D. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.

E. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

F. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Install fire rated units in accordance with NFPA 80.

C. Coordinate frame anchor placement with wall construction.

D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

E. Install door hardware as specified in Section 08 71 00.

F. Coordinate installation of electrical connections to electrical hardware items.

G. Touch up damaged factory finishes to match appearance of factory finish.

3.04 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

3.06 SCHEDULE - SEE DRAWINGS

END OF SECTION

SECTION 08 14 16
FLUSH WOOD DOORS

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 SECTION INCLUDES

A. Solid core wood doors; flushface and molded face panels in configurations shown on Drawings; fire-rated and non-rated.

B. Hollow core wood doors; flushface and molded face panels in configurations shown on Drawings; non-rated.

1.03 RELATED REQUIREMENTS

A. Section 06 20 00 - Finish Carpentry: Wood door frames.

B. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.

C. Section 08 11 13 - Hollow Metal Doors and Frames.

D. Section 08 71 00 - Door Hardware.

E. Section 08 80 00 - Glazing.

F. Section 09 91 23 - Interior Painting: Field finishing of doors.

1.04 REFERENCE STANDARDS

A. ANSI A135.4 - Basic Hardboard.

B. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights.

C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition.

D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards.

E. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.

F. NFPA 101 - Life Safety Code.

G. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives.

H. WDMA I.S. 1A - Interior Architectural Wood Flush Doors.

1.05 SUBMITTALS

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

B. Submit doors, frames, and door hardware as a single package for review.

C. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

D. 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.

E. Warranty, executed in Owner's name.

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.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide manufacturer's warranty on interior doors for the life of the installation. Complete forms in Owner's name and register with manufacturer.

1. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. JELD-WEN, Inc.: www.jeld-wen.com.

B. Masonite Architectural: www.architectural.masonite.com.

C. Mastercraft: www.mastercraftdoors.com.

D. Simpson Door Company: www.simpsondoor.com.

E. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DOORS

A. Unit Entry Interior Doors, and other locations indicated on the door schedule: 1-3/4 inches thick unless otherwise indicated.
   1. Provide solid core doors at each location, with panel design as indicated on Drawings..
   2. Quality Standard: Premium Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS), AWMAC/WI (NAAWS) or WDMA I.S. 1A.
   3. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
   4. Wood veneer facing for field opaque finish as indicated on Drawings.

B. Unit Interior Doors: 1-3/8 inches thick unless otherwise indicated; Panel design as indicated on Drawings.
   1. Provide doors at each location scheduled on Drawings, with panel design as indicated on Drawings.
   2. Quality Standard: Premium Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS), AWMAC/WI (NAAWS) or WDMA I.S. 1A.
   3. Wood Veneer Faced Doors: 7-ply unless otherwise indicated.
   4. Faces: Any closed-grain hardwood of mill option, Hardboard, or MDF.
      a. Hardboard Faces: ANSI A135.4, Class 1 (tempered) or Class 2 (standard).
      b. MDF Faces: ANSI A208.2, Grade 150 or Grade 160.
   5. Exposed Vertical and Top Edges: Any closed-grain hardwood.
   6. Construction: Solid or hollow core as indicated on Door Schedule.
   7. Blocking: Provide wood blocking with minimum dimensions as follows:
      a. 5-by-18-inch (125-by-460-mm) lock blocks at both stiles.
      b. 5-inch (125-mm) top- and bottom-rail blocking.
      c. 2-1/2-inch (64-mm) mid-rail blocking.
   8. Wood veneer facing for field opaque finish as indicated on Drawings.
   9. Hardboard facing for field opaque finish as indicated on Drawings.

C. Unit Interior Mechanical Closet Doors: 1-3/4 inches thick unless otherwise indicated; Panel design as indicated on Drawings.
   1. Provide doors at each location scheduled on Drawings, with panel design as indicated on Drawings.
   2. Quality Standard: Premium Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS), AWMAC/WI (NAAWS) or WDMA I.S. 1A.
   3. Wood Veneer Faced Doors: 7-ply unless otherwise indicated.
   4. Faces: Any closed-grain hardwood of mill option, Hardboard, or MDF.
      a. Hardboard Faces: ANSI A135.4, Class 1 (tempered) or Class 2 (standard).
      b. MDF Faces: ANSI A208.2, Grade 150 or Grade 160.
   5. Exposed Vertical and Top Edges: Any closed-grain hardwood.
   6. Construction: Solid core as indicated on Door Schedule.
   7. Blocking: Provide wood blocking with minimum dimensions as follows:
      a. 5-by-18-inch (125-by-460-mm) lock blocks at both stiles.
      b. 5-inch (125-mm) top- and bottom-rail blocking.
      c. 2-1/2-inch (64-mm) mid-rail blocking.
   8. Wood veneer facing for field opaque finish as indicated on Drawings.
   9. Hardboard facing for field opaque finish as indicated on Drawings.

10. Provide intumescent coating on interior face.

2.03 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type staved lumber core (SLC), plies and faces as indicated.

B. Hollow Core Doors: Type - Standard (FSHC); plies and faces as indicated above.

2.04 DOOR FACINGS

A. Veneer Facing for Opaque Finish: Hardboard, in compliance with indicated quality standard.

B. Hardboard Facing for Opaque Finish: ANSI A135.4, Class 1 - Tempered, S2S (smooth two sides) hardboard, 1/8 inch thick.

C. Facing Adhesive: Type I - waterproof.

2.05 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:
   1. Provide solid blocks at lock edge and top of door for closer for hardware reinforcement.
   2. Provide solid blocking for other through bolted hardware.

C. Where supplementary protective edge trim is required, install trim after veneer facing has been applied full-width.

D. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.

E. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

F. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
   1. Exception: Doors to be field finished.

G. Provide edge clearances in accordance with the quality standard specified.

H. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.

I. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware

2.06 FINISHES - WOOD VENEER DOORS

A. Factory Priming:
   1. Doors for Opaque Finish: Factory prime faces, all four edges, edges of cutouts, and mortises with one coat of wood primer specified in [Section 099113 "Exterior Painting."] [Section 099123" Interior Painting."]

B. Finish work in accordance with WDMA I.S. 1A or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Opaque:
      a. As scheduled in Section 09 91 23 - Interior Painting.
      b. Color: As selected by Architect.
      c. Sheen: As scheduled.

2.07 ACCESSORIES

A. Wood Door Frames: See Section 06 20 00.

B. Hollow Metal Door Frames: See Section 08 11 13.

C. Metal Louvers:
   1. Louver Blade: Inverted V blade, sight proof, light proof.
   2. Louver Free Area: 50 percent.
   3. Frame: Metal style with tamper proof fasteners.

D. Glazing: See Section 08 80 00.

E. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.

F. Door Hardware: See Section 08 71 00.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.
   1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
   2. Reject doors with defects.

B. Verify existing conditions before starting work.

C. Verify that opening sizes and tolerances are acceptable.

D. 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 written instructions and specified quality standard.
   1. Install fire-rated doors in accordance with NFPA 80 requirements.
   2. Install smoke and draft control doors in accordance with NFPA 105 requirements.
   3. Install exterior doors in accordance with ASTM E2112.

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. Prime and paint all trimmed edges to match factory finish.

D. Use machine tools to cut or drill for hardware.

E. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

F. Install frames level, plumb, true, and straight.
   1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
   2. Anchor frames to anchors or blocking built in or directly attached to substrates.
      a. Secure with countersunk, concealed fasteners and blind nailing.
      b. Use fine finishing nails[or finishing screws] for exposed fastening, countersunk and filled flush with woodwork.
         1) For factory-finished items, use filler matching finish of items being installed.

G. Coordinate installation of doors with installation of frames and hardware.

H. Coordinate installation of glazing.

I. Install door louvers plumb and level.

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 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

C. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

D. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.05 ADJUSTING

A. Adjust doors for smooth and balanced door movement.
   1. Rehang or replace doors that do not swing or operate freely.

B. Adjust closers for full closure.

C. Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

3.06 SCHEDULE - SEE DRAWINGS

END OF SECTION

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SECTION 08 31 00
ACCESS DOORS AND PANELS

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 SECTION INCLUDES

A. Wall and ceiling access door and frame units for access to controls, fire dampers, smoke dampers and valves behind finished surfaces.

1.03 RELATED REQUIREMENTS

A. Section 06 17 53 - Shop-Fabricated Wood Trusses: Coordination of Roof Trusses for installation of Draftstop Doors.

B. Section 09 21 16 - Gypsum Board Assemblies: Substrate for products specified in this Section.

C. Section 09 91 13 - Exterior Painting: Field paint finish.

1.04 REFERENCE STANDARDS

A. ITS (DIR) - Directory of Listed Products.

B. UL (FRD) - Fire Resistance Directory.

1.05 SUBMITTALS

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

B. Product Data: Provide sizes, types, ratings, material descriptions, finishes, hardware, scheduled locations, and details of adjoining work.

C. Manufacturer's Installation Instructions: Indicate installation requirements.

D. Project Record Documents: Record actual dimensioned locations of all access units.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years documented experience.

1.07 COORDINATION

A. Coordinate the Work of this Section with other interfacing work in direct contact with the products listed herein, including but not limited to Section 06 17 53 - Shop-Fabricated Wood Trusses.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and accessories to Project site in original packages, containers, or bundles, labeled with manufacturer's name, product brand name, and lot number.

B. Store materials in accordance with manufacturer’s written instructions, inside, under cover, dry, protected from weather, direct sunlight, condensation, surface contamination, aging, corrosion, and damage from construction traffic and other causes.

1.09 WARRANTY

A. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

A. Wall and Ceiling-Mounted Units (non-rated):
   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 in Other Ceilings: 22 x 30 inches, unless otherwise indicated.

5. Door/Panel: Hinged, standard duty, square corner with concealed latch and no handle.

B. Fire-Rated Ceiling-Mounted Units:
   1. Ceiling Fire-Rating: As indicated on Drawings.
   2. Panel Material: Steel.
   3. Size: 22 x 30 inches, unless otherwise indicated.
   4. Door/Panel: Hinged, standard duty, square corner with keyed cam latch and no handle.

2.02 WALL & CEILING-MOUNTED UNITS

A. Manufacturers:
   1. ACUDOR Products Inc: www.acudor.com.
      a. Fire-Rated Ceiling-Mounted Units - 2 Hours or Less: ACUDOR FWC-5015.
      b. Units in Fire-Rated Walls Rated 2 Hours and Less: ACUDOR FW-5050.
      c. Wall- and Ceiling-Mounted Units (non-rated): ACUDOR DW-5058.
   2. Babcock-Davis: www.babcockdavis.com.
   3. Best Access Doors: www.bestaccessdoors.com.
      a. Universal Access Panel Drywall: Best Access Doors; Series BA-UAP.
      b. Recessed Access Panel: Best Access Doors; Series BA-RAD.
      c. Insulated Access Panel: Best Access Doors; Series BA-ALI.
      d. Aesthetic Access Door with Hidden Flange: Best Access Doors; Series BA-UHF.
      e. Large Opening Access Panel: Best Access Doors; Series BA-LO1D.
      f. Air Handler Access Door: Best Access Doors; Series BA-HVAC-MAH.
      g. Fire-Rated Insulated Access Panel for Drywall: Best Access Doors; Series BA-FRI.
      h. Glass-Fiber-Reinforced Gypsum Access Panel: Best Access Doors; Series BA-GRG-RC.
   4. Cendrex, Inc: www.cendrex.com.
      a. Wall- and Ceiling-Mounted Units (non-rated): Cendrex AHD-GYP, flush door; drywall bead frame, hinged.
      b. Fire-Rated Wall-Mounted Units; 2 Hours or less: Cendrex PFI series, insulated.
      c. Fire-Rated Ceiling-Mounted Units; 2 Hours or less: Cendrex PFI series, downward opening .
   5. Karp Associates, Inc: www.karpinc.com.
   6. Nystrom, Inc: www.nystrom.com.
      a. Wall- and Ceiling-Mounted Units; non-rated: Recessed Access Door, with drywall bead flange.
      b. Fire-Rated Wall-Mounted Units; 2 Hours or less: ITK.
      c. Fire-Rated Ceiling-Mounted Units - 2 Hours or Less: ITK, downward opening.
   7. Substitutions: See Section 01 60 00 - Product Requirements.

B. Wall and Ceiling Mounted Units: Factory fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
   1. Style: Exposed frame with door surface flush with frame surface.
   2. Door Style: Single thickness with rolled or turned in edges.
   3. Frames: 16-gauge, 0.0598-inch minimum thickness.
   4. Insulation: Non-combustible mineral wool or glass fiber.
   5. Units in Fire-Rated Assemblies: Fire rating as required by applicable code for fire-rated assembly that access doors are being installed.
      a. Provide products listed by ITS (DIR), UL (FRD), or Warnock Hersey (WHI) as suitable for purpose indicated.
   6. Steel Finish: Primed.
   7. Primed and Factory Finish: Polyester powder coat; color as selected by Architect from manufacturer's standard colors.
   8. Door/Panel Size: As indicated on Drawings.
   9. Hardware:
      a. Hardware for Fire-Rated Units: As required for listing; self-closing.
      b. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
      c. Latch/Lock: Tamperproof keyed cam latch.

d. Inside Latch Release: Mechanism that allows door/panel to be opened from inside.
e. Gasketing: Extruded neoprene, around perimeter of door panel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings are correctly sized and located.

B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to proceeding with this work.

B. Prepare surfaces using methods recommended in writing by manufacturer for applicable substrates in accordance with project conditions.

3.03 INSTALLATION

A. Install units in accordance with manufacturer's written instructions.

B. Install frames plumb and level in openings, and secure units rigidly in place.

C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

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SECTION 08 33 23.13
HIGH SPEED OVERHEAD COILING DOORS

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 SECTION INCLUDES

A. High Speed Overhead coiling doors, operating hardware, exterior, electric operation.

B. Wiring from electric circuit disconnect to operator to control station.

1.03 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Support framing, embeds, plates, guides, and other miscellaneous metal required for a complete installation. Coordinate with manufacturer for components provided with door assembly.

B. Section 08 71 00 - Door Hardware: Cylinder cores and keys.

C. Section 09 91 13 - Exterior Painting: Field paint finish on components not provided by door manufacturer.

D. Division 26 Sections for electrical circuits connecting operator and control station.

1.04 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

C. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts.

D. NEMA MG 00001 - Motors and Generators.

E. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.

1.05 SUBMITTALS

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

B. Product Data: Provide general construction, component connections and details, electrical equipment, and wiring diagrams.

C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.

D. Manufacturer's Installation Instructions: Indicate installation sequence and procedures, adjustment and alignment procedures.

E. Maintenance Data: Indicate lubrication requirements and frequency and periodic adjustments required, manufacturer data sheets, scheduled maintenance suggested, and equipment inter-connection diagrams.

F. Manufacturer's Qualification Statement: On Corporate letterhead, certifying manufacturer and product meets Quality Assurance requirements.

1.06 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.
   1. Electrical components shall be UL listed.
   2. Electrical control panel shall be NEMA approved.

B. Single Source Responsibility: Furnish high-speed roll doors and all components and accessories by a single manufacturer.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

D. Provide references upon request.

E. Material Qualifications: Specific door model used must have a proven track record of successful installations in similar applications of no less than 3 years.

F. Coordinate the work with installation of electric power and locations and sizes of conduit.

1.07 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 mechanical components.

C. Correct defective Work within a two year period after Date of Substantial Completion for electrical components.

D. Provide one year manufacturer warranty for parts and labor, from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Overhead Coiling Doors:
   1. Rytec Corporation; Spiral
      ® LH
      ®-FV
      ® (
      full vision): www.rytecdoors.com. (Basis of Design)
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE CRITERIA

A. Motor type: AC drive, and variable speed with soft acceleration and braking. Mechanical release lever on side column allows door to be easily opened in the event of a power failure.

2.03 COILING DOORS

A. System Description: Motor type: AC drive, and variable speed with soft acceleration and braking. Mechanical release lever on side column allows door to be easily opened in the event of a power failure.

B. Exterior Coiling Doors: Aluminum slat frames with clear LEXAN™ sheets with Margard™ coating.
   1. Capable of withstanding positive and negative wind loads as indicated on Structural Drawings for components and cladding, without undue deflection or damage to components.
   2. Finish: No. 4.
   3. Guides: Angles; aluminum.
   4. Hood Enclosure: Manufacturer's standard; aluminum.
   5. Electric operation with manual hand chain lift override in case of power failure.
   6. Mounting: As indicated on Drawings.

2.04 MATERIALS

A. Curtain Construction: Interlocking slats.
   1. Door Panel: Aluminum slat frames with vision panels; 9 inches high x thickness ranges from 1.2” – 2.4”, based on overall door size. Integral rubber weather seal between each slat. Door slats connected by hinge system to provide additional rigidity and security to door panel. Door curtain does not require a tensioning system for additional wind/pressure resistance. Doors which require the use of a tensioning system for additional wind/pressure resistance will not be accepted.
   2. Side Frames: Powder coated steel side frames with full height weatherseal on both sides to seal against door panel. “Intelligent” Advanced3 Light Curtain System mounted directly in doorline (to 6’-0” above finished floor). Doors using an external coil cord will not be accepted.
   3. Curtain Bottom: Extruded aluminum bottom bar with electric, reversing edge that reverses the door upon contacting an object.

4. Weatherstripping: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and where curtain enters hood enclosure of exterior doors.

B. Aluminum Slats: ASTM B221, aluminum alloy Type 6063.

C. Door Track: Spiral roll-up design features no metal-to-metal contact which results in ultra-quiet, low maintenance operation and eliminates wear on panel slats. Doors that roll up on a barrel or whose track design allows metal-to-metal contact will not be accepted.

D. Hood Enclosure: Internally reinforced to maintain rigidity and shape.
1. Factory finished to match door panel.

E. Coordinate electrical and low voltage requirements with Owner's Consultant.

F. Counterbalance: Up to six extension springs in each side column, depending on the size of the door. Springs assist the motor in opening the door. Mechanical release lever on side column allows door to be easily opened in the event of a power failure. Doors using torsion springs for counterbalance or doors with springs located within a barrel will not be accepted.

G. Finish: All door components provided by manufacturer shall be factory finished in color as selected by Architect from Manufacturer's standard selection.

2.05 ELECTRIC OPERATION

A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by a testing agency acceptable to authorities having jurisdiction.

B. Electric Operators:
1. Mounting: As indicated on Drawings.
2. Motor Enclosure:
a. Exterior Doors: NEMA MG 00001, Type 4; open drip proof.
3. Motor Rating: Minimum 2 hp motor with variable speed AC drive which allows for soft acceleration and braking. Doors using a motor with a clutch or pump will not be accepted
4. Motor Voltage as indicated on Electrical Drawings.
5. Provide rotary encoder to regulate door travel limits. Limits to be self-adjusting, without the use of tools, from floor level at the control panel.
a. Mechanical limits switches or doors that require tools to set the limits will not be accepted.
6. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
7. Controller Enclosure: UL listed, NEMA EN 10250, Type 4X with factory set parameters.
a. Parameter changes and all door configurations can be made from the face of the control box, no exposure to high voltage. Control panels that require opening of the control box and reaching inside to make parameter changes will not be accepted.
b. Controls include a variable speed AC drive system capable of infinitely variable speed control in both directions.
c. Programmable inputs and outputs accommodate special control applications (traffic lights, horns, actuation devices, timing sequences, etc.) without the need for additional electrical components.
d. Self-diagnostic scrolling two-line vacuum fluorescent display with expanded informational messages for straightforward installation, control adjustments and error reporting.
e. Complete history of door, at least two years, is logged and encrypted onto a USB flash drive. All errors have a time and date stamp for reference. Control panels not logging up to two years of door history will not be accepted.
8. Opening Speed: Opening at 100 inches per second and close at 24 inches per second.
9. Brake: Adjustable friction clutch type, activated by motor controller.
10. Manual override in case of power failure.

C. Control Station: Standard three button (OPEN-STOP-CLOSE) momentary control for each operator.
1. 24 volt circuit.

D. Safety Edge: Located at bottom of curtain, full width, electro-mechanical sensitized type, wired to stop operator upon striking object, hollow neoprene covered.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that opening sizes, tolerances and conditions are acceptable.

B. Verify field measurements are as indicated on and coordinated with shop drawings.

C. Coordinate the work with installation of electric power and locations and sizes of conduit.

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 Sections.

F. Complete wiring from disconnect to unit components.

G. Install perimeter trim, closures, and weatherstripping.

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 ft straight edge.

3.04 ADJUSTING

A. Adjust operating assemblies for smooth and noiseless operation.

B. Field Test and adjust doors for proper operation.

3.05 CLEANING

A. Clean all installed components.

B. Remove labels and visible markings.

C. Protect all finishes from subsequent construction operations.

END OF SECTION

SECTION 08 33 23
OVERHEAD COILING DOORS

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 SECTION INCLUDES

A. Exterior coiling doors.

B. Fire-rated coiling doors.

1.03 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Support framing, embeds, plates, guides, and other miscellaneous metal required for a complete installation. Coordinate with manufacturer for components provided with door assembly.

B. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.

C. Section 08 71 00 - Door Hardware: Cylinder cores and keys.

D. Section 09 91 13 - Exterior Painting: Field paint finish.

E. Division 26 Sections for electrical service and connections for powered operators and accessories.

1.04 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

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

E. ASTM E1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.

F. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.

G. ITS (DIR) - Directory of Listed Products.

H. UL (DIR) - Online Certifications Directory.

1.05 SUBMITTALS

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

B. Product Data: Provide general construction, electrical equipment, component connections and details, and adjacent construction.

C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

D. Manufacturer's qualification statement.

E. Maintenance Data: Indicate lubrication requirements and frequency, periodic adjustments required, and special tools.

1.06 QUALITY ASSURANCE

A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.

1. Obtain operators and controls from overhead coiling door manufacturer.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.

C. Installer Qualifications: Company specializing in performing work of type specified and with at least five years documented experience.

D. 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.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Include written instructions for all preventative maintenance and service requirements necessary to maintain warranty.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Structural Performance, Exterior Doors: Exterior overhead coiling doors shall withstand the wind loads, the effects of gravity loads, and loads and stresses within limits and under conditions indicated according to ASCE 7.
   1. Wind Loads: As indicated on Drawings.
   2. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.

B. Windborne-Debris-Impact-Resistance Performance: At exterior locations, provide overhead coiling doors that pass missile-impact and cyclic-pressure tests when tested according to ASTM E1886 and ASTM E1996 .
   1. Large Missile Test: For overhead coiling doors located within 30 feet (9.144 m) of grade.

C. Cycle Life:
   1. Design doors and components for high cycle use of up to 200,000 cycles for the life of the product.
   2. Design doors of construction for high speed operation to achieve operational speed up to 24 inches per second open and up to 12 inches per second close.

2.02 MANUFACTURERS

A. Overhead Coiling Metal Doors:
   1. Alpine Overhead Doors, Inc: www.alpinedoors.com.
   2. C.H.I. Overhead Doors: www.chiohd.com.
   3. Clopay Building Products: www.clopaydoor.com.
   4. Overhead Door Corp.: www.overheaddoor.com
   5. Raynor Garage Doors: www.raynor.com.
   6. The Cookson Company: www.cooksondoor.com.
   7. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 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. Single Thickness Slats: Manufacturer's standard.
   3. Nominal Slat Size: 2 inches wide by required length.
   4. Guide, Angles: Primed steel for field painting; color as selected by Architect.
   5. Hood Enclosure: Manufacturer's standard; primed steel for field painting.
      a. Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face.
      b. Galvanized Steel: Nominal 0.028-inch thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A653/A653M.

c. Include intermediate support brackets as required to prevent sagging.
6. Manual hand chain lift operation.
7. Mounting: Surface mounted, as detailed on Drawings.

2.04 MATERIALS

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.
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: Manufacturer's standard for door type and model; ASTM A653/A653M galvanized steel sheet.
a. Galvanizing: Minimum G90 coating.

B. Guide Construction: Continuous, of profile to retain door in place with snap-on trim, mounting brackets of same metal.

C. Guides - Angle: ASTM A36/A36M metal angles, size as indicated.
1. Hot-dip galvanized in compliance with ASTM A123/A123M.
2. Prime painted.

D. Hood Enclosure and Trim: Internally reinforced to maintain rigidity and shape.

E. Lock Hardware:
1. For motor operated units, additional lock or latching mechanisms are not required.
2. Latching Mechanism: Inside mounted, adjustable keeper, spring activated latch bar feature to keep in locked or retracted position.
3. Latch Handle: Manufacturer's standard.
4. Slide Bolt: Provide on single-jamb side, extending into slot in guides, with padlock on one side.
5. Manual Chain Lift: Provide padlockable chain keeper on guide.

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.

F. Examine locations of electrical connections.

G. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of work by installer is acceptance of substrate.

3.02 INSTALLATION

A. Install units, operating equipment, and accesories in accordance with manufacturer's written 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. Install enclosure and perimeter trim.

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. Engage a factory-authorized service representative to perform startup service;
   1. Test and adjust controls and safeties.
   2. Train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

B. Adjust operating assemblies for smooth and noiseless operation, free from warp, twist, or distortion. Lubricate bearings and sliding parts as recommended by manufacturer

C. Adjust seals to provide weathertight fit around entire perimeter.

3.05 CLEANING

A. Clean installed components in accordance with manufacturer written requirements to maintain warranty.

B. Remove labels and visible markings.

END OF SECTION

SECTION 08 43 13
ALUMINUM-FRAMED STOREFRONTS

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 SECTION INCLUDES

A. Aluminum-framed, exterior drainable storefront and "window wall" with vision glass.

B. Infill panels of metal and glass.

C. Aluminum doors and frames.

D. Weatherstripping.

E. Door hardware.

1.03 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete; Structural substrate.

B. Section 05 12 00 - Structural Steel Framing: Steel attachment members.

C. Section 05 50 00 - Metal Fabrications: Steel attachment devices.

D. Section 07 27 26 - Fluid Applied Membrane Air Barriers (STO AirSeal): Air/WRB under exterior cladding.

E. Section 07 92 00 - Joint Sealants: Perimeter sealant and back-up materials.

F. Section 08 80 00 - Glazing: Glass and glazing accessories.

G. Section 08 91 00 - Louvers: Louvers integrated into Aluminum-Framed Window Wall systems.

1.04 REFERENCE STANDARDS

A. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum.

B. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.

C. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

D. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site.

E. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights.

F. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

I. 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.

J. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

K. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

L. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.

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.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.06 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, internal drainage details, glass and infill, door hardware,and joint conditions at adjacent construction.

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. Include design engineer's stamp or seal on shop drawings for attachments and anchors.

D. Design Data: Provide framing member structural and physical characteristics and engineering calculations, and identify dimensional limitations; include load calculations at points of attachment to building structure.

E. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

F. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

G. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

1.07 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 Louisiana.

B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience.

C. Installer Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience.

1.08 MOCK-UP

A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-ups.

B. Provide 8 x 6 feet mock-up including all components occurring on project. Assemble to illustrate component assembly including glazing materials, weep drainage system, attachments, anchors, and perimeter sealant.

C. Locate on-site where directed by Owner or Architect. Mock-up may not remain as part of the Work.

D. See Drawings for size, shape, and configuration of mock-up.

1.09 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.

1.10 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.11 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a ten year period after Date of Substantial Completion.

C. 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.

D. Provide ten year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

E. Windows shall meet specified performance levels for air infiltration and water penetration resistance throughout the manufacturer warranty period.

F. Provide two (2) year labor warranty, for any defective part(s) or product(s) cost of labor included only within two (2) years of the date of sale by Manufacturer or its authorized dealer.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior railings by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: Design system to accommodate without deformation anticipated thermal movement over ambient temperature range of 120 degrees F, ambient; 180 degrees F material surfaces.

2.02 MANUFACTURERS

A. Aluminum-Framed Storefronts Manufacturers:

1. Boyd Aluminum: www.boydaluminum.com.
2. Coral Architectural Products, a division of Coral Industries, Inc: www.coralap.com.
3. C.R. Laurence Company, Inc; U.S. Aluminum: www.crl-arch.com.
4. Kawneer North America: www.kawneer.com.
5. Linear Rossa: linearossadesign.com.
6. Manko Window Systems, Inc: www.mankowindows.com.
7. Oldcastle BuildingEnvelope: www.oldcastlebe.com.
8. Tubelite, Inc: www.tubeliteinc.com.
9. Trulite Glass & Aluminum Solutions, LLC: www.trulite.com.
10. YKK: www.ykk.com
11. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 ALUMINUM-FRAMED STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.

1. Unitized, shop assembly.
2. Glazing Rabbet: For 1 inch insulating glazing.
3. Glazing Position: Centered (front to back).
4. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
5. Finish Color: As selected by Architect.
6. 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.
7. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
8. 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.
9. 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.

10. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
11. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
12. Maintain continuous air barrier and/or vapor retarder seal throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel, and heel bead of glazing compound.

B. Performance Requirements
1. 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.
   a. Design Pressure (DP): In accordance with applicable codes and design loads indicated on Structural Drawings for Components and Cladding.
   b. Design Wind Loads: Comply with requirements of ASCE 7.
   c. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
2. 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.
3. Air Leakage: 0.06 cfm/sq ft maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 6.27 psf pressure difference.
4. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.
5. Overall U-value Including Glazing: 0.45 Btu/(hr sq ft deg F), maximum.

2.04 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
1. Framing members for interior applications need not be thermally broken.
2. Glazing Stops: Flush.

B. Sill Receptors: Manufacturer's standard fabricated aluminum profiles/shapes.

C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

E. Infill Panels: 1 inch thick Glass Spandrel Panels Type GL-3, where indicated on Drawings.

F. Infill Panels: Insulated, aluminum sheet face and back, with edges formed to fit glazing channel and sealed, where indicated on Drawings.
1. Face Sheet: 0.063 inch thick.
2. Core: Fire-retardant core.
3. Back Sheet: 0.063 inch thick.
4. Finish: Same as storefront framing system.

G. Swing Doors: Glazed aluminum.
1. Thermally broken with insulating glass.
2. Thickness: 1-3/4 inches.
3. Vertical Stiles: Narrow
4. Bottom Rail: Not less than10 inches face profile dimension..
5. Glazing Stops: Square.
6. Finish: Same as storefront.

2.05 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Structural Supporting Sections and Anchors: See Section 05 12 00.

C. Fasteners: Stainless steel.

D. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

E. Glazing Accessories: See Section 08 80 00.

F. Shop and Touch-Up Primer for Steel Components: Zinc oxide, alkyd, linseed oil primer appropriate for use over hand cleaned steel.

2.06 FINISHES

A. Fluoroethylene Vinyl Ether (FEVE) Coating: Superior performing resin-based organic powder coatings system complying with AAMA 2605; single coat applications when applied to aluminum with dry film thickness (DFT) of 2 to 3 mil, 0.002 to 0.003 inch; color and gloss as indicated on Drawings.
   1. Apply coating to exposed metal surfaces with proper preparation and pretreatment in accordance with resin manufacturer's instructions.
   2. Products:
      a. IFS Coatings, Inc; IFS 500FP: www.ifscoatings.com.
      b. PPG; Coraflon Platinum: www.ppgindustrialcoatings.com.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

B. Superior Performing Organic Coatings System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent 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.
   1. Manufacturers:
      a. PPG Metal Coatings; Duranar: www.ppgmetalcoatings.com.
      b. Valspar; Fluropon: www.valsparcoilextrusion.com.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

C. Color: As selected by Architect from manufacturer's custom range.

D. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.07 HARDWARE

A. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.

B. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.

C. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all doors.

D. Hinges: Butt type, swing clear; top, intermediate, and bottom.
   1. Provide on all doors.

E. Push/Pull Set: Custom configuration push/pull handles.

F. Exit Devices: Panic or Electronic Egress as required to meet function and security requirements indicated on Life Safety Drawings.

G. Door Closers: Exposed overhead with narrow profile and cover plate not to exceed thickness of door top rail.

H. Handle Latch: As indicated on Drawings.
   1. Provide on doors as indicated.

I. Locks: To be coordinated with Low Voltage and Building Access Controls / Security Systems.

J. Other hardware as required by door function to comply with life safety, means of egress, and security requirements indicated on Drawings.

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 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. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

J. Set thresholds in full bed of sealant with end dams and secure to floor with mechanical anchors.

K. Install hardware using templates provided.

L. Install glass and infill panels using glazing method required to achieve performance criteria; see Section 08 80 00.

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. Provide services of storefront manufacturer's field representative to observe for proper installation of system and submit report.

B. Coordinate with Owner for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.

C. Provide field testing of installed storefront system by independent laboratory in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 during construction process and before installation of interior finishes.
   1. Test windows on mock-up and coordinate with Section 01 43 39 - Mock-Ups.
   2. Test windows in quantity and frequency during construction in accordnace with written direction from Architect and Building Envelope Consultant.
   3. Perform a minimum of two tests in the storefront system.
   4. Conduct tests in each area prior to 10 percent and 35 percent completion of this work.
   5. Field test for water penetration in accordance with ASTM E1105 with uniform static air pressure difference (Procedure A) not less than 6.67 psf.
      a. The AAMA definition of water leakage shall not be used. Water penetration shall be defined as any water penetration to the interior of the storefront system, including accumulation of any wanter on the interior face of glass and frame.
   6. Field test for air leakage in accordance with ASTM E783 with uniform static air pressure difference of 6.20 psf.
      a. Maximum allowable rate of air leakage is 0.09 cfm/sq ft (1.5 times specified rate).

D. Repair or replace storefront components that have failed designated field testing, and retest to verify performance complies with specified requirements.
   1. In the event of a test failure, diagnose, repair and or replace necessary components or materials and retest the failed specimen and test two like conditions to be selected by

Architect. If the cause of failure is deemed to be a systemic deficiency, make like repairs at all like conditions.

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. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.

C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

D. Remove excess sealant by method acceptable to sealant manufacturer.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

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SECTION 08 53 13
VINYL WINDOWS

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 SECTION INCLUDES

A. Vinyl-framed, factory-glazed windows with fixed sash and operating sash.

B. Operating hardware.

C. Insect screens.

1.03 RELATED REQUIREMENTS

A. Section 07 25 00 - Weather Barriers: Sealing frames to water-resistive barrier installed on adjacent construction.

B. Section 07 92 00 - Joint Sealants: Perimeter sealant and back-up materials. Sealing joints between frames and adjacent construction.

1.04 REFERENCE STANDARDS

A. AAMA 303 - Voluntary Specification for Rigid Polyvinyl Chloride (PVC) Exterior Profiles.

B. AAMA 812 - Voluntary Practice for Assessment of Frame Deflection When Using One Component Polyurethane Foams for Air-Sealing Rough Openings of Fenestration Installations.

C. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights.

D. ADA Standards - 2010 ADA Standards for Accessible Design.

E. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

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

G. ASTM D4726 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Exterior-Profile Extrusions Used for Assembled Windows and Doors.

H. ASTM E547 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference.

I. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.

J. 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.

K. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights.

L. ASTM F588 - Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact.

M. ASTM F2090 - Standard Specification for Window Fall Prevention Devices with Emergency Escape (Egress) Release Mechanisms.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Obtain hardware templates from hardware manufacturer prior to starting fabrication.

B. Preinstallation Meeting: Convene one week before starting work of this section.

1.06 SUBMITTALS

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

B. Product Data: Provide component dimensions, anchors, fasteners, glass, internal drainage, and window opening control devices.

C. Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related work, installation requirements, and operating hardware, including window opening control devices.

D. 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.

E. Test Reports: Prior to submitting shop drawings or starting fabrication, submit test report(s) by independent testing agency showing compliance with performance requirements in excess of those prescribed by specified grade.

F. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.07 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 installation of window types specified and with at least five years documented experience.

C. Field test agency accredited by the Fenestration and Glazing Industry Alliance (FGIA) under the Field Test Agency (FTA) Accreditation Program in accordance with FGIA LAP-3, with current accreditation in effect at the time of testing. Submit current accreditation certificate prior to mobilization. Testing shall be performed in accordance with ASTM E783.

1.08 MOCK-UP

A. See Section 01 40 00 - Quality Requirements for mock-up quality requirements.

B. Coordinate with other materials required for mock-up and as indicated in Section 01 43 39 - Mock-Ups.

C. Provide material of each type specified in this section for use in Mock-up.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

B. Protect finished surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.

C. Store materials in original packaging, under cover, protected from exposure to harmful weather conditions and from direct contact with water.
   1. Store at temperature and humidity conditions recommended by manufacturer.
   2. Do not use nonvented plastic or canvas shelters.
   3. Immediately remove wet wrappers.

D. Jig, brace, and box the window frame assemblies for transport to minimize flexing of members or joints.

1.10 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F.

B. Maintain this minimum temperature during and after installation of sealants.

1.11 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Provide ten year transferable manufacturer warranty for insulated glass units from seal failure, interpane dusting or misting, and replacement of same. Include coverage for degradation of color finish.

C. Provide transferable ten (10) year manufacturer warranty for all nonglass components for windows and doors, shall be free of manufacturing defects in material or workmanship that significantly impair their proper operation and function for ten (10) years from the date of sale by Manufacturer or its authorized dealer.

D. Provide transferable twenty (20) year manufacturer warranty for all Non- laminated glass products which shall be free from premature failure or permanent material obstruction of vision due to a failure of the glass seal for twenty (20) years from the date of sale by Manufacturer or its authorized dealer.

E. Windows shall meet specified performance levels for air infiltration and water penetration resistance throughout the manufacturer warranty period.

F. Provide two (2) year labor warranty, for any defective part(s) or product(s) cost of labor included only within two (2) years of the date of sale by Manufacturer or its authorized dealer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Vinyl Windows:
   1. Jeld-Wen, Inc.; Builders Vinyl (V-2500): www.jeld-wen.com
   2. Pella Corporation; 250 Series: www.pellacommercial.com.
   3. YKK AP : StyleView®: ykkap.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DESCRIPTION

A. Vinyl Windows: Factory-fabricated frame and sash members of extruded, hollow, ultraviolet-resistant, glass-fiber reinforced polyvinyl chloride (PVC) with integral color; with factory-installed glazing, hardware, related flashings, anchorage and attachment devices.
   1. Configuration: As indicated on Drawings.
      a. Product Type: FW - Fixed window and H - Hung window, vertically sliding in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
   2. Color: Exterior color as scheduled, Interior color as scheduled.
   3. Exterior Color: As selected by Architect from manufacturer's full line of colors.
   4. Size to fit openings with minimum clearance around perimeter of assembly providing necessary space for perimeter seals.
   5. Framing Members: Fusion welded corners and joints, with internal reinforcement where required for structural rigidity; concealed fasteners.
   6. 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.
   7. Glazing Stops, Trim, Flashings, and Accessory Pieces: Formed of rigid PVC, fitting tightly into frame assembly.
   8. Mounting Flange: Integral to frame assembly, providing weather stop at entire perimeter of frame. Provide channel filler where manufacturer does not include a closed back frame profile.
   9. Balance System; "Block and Tackle" or "constant force coil balances."
   10. Insect Screens: Tight fitting for operating sash location.

2.03 PERFORMANCE REQUIREMENTS

A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific window type:
   1. Performance Class (PC): LC.
   2. Performance Grade (PG): Equivalent to or greater than specified Design Pressure (DP).
   3. Performance Validation: Windows shall comply with AAMA/WDMA/CSA 101/I.S.2/A440 performance requirements as indicated by having AAMA, WDMA, or CSA certified label, or an independent test report for indicated products itemizing compliance and acceptable by authorities having jurisdiction
   4. Performance based on factory-mulled window when multiple lites provided.

B. Design Pressure: In accordance with applicable codes and Component and Cladding requirements indicated on Drawings.

C. Water Leakage: No water penetration beyond interior plane of glass at pressure of 7.5 PSF per ASTM E547.

D. Air Infiltration: Maximum air infiltration of 0.30 cfm/sq ft @ 1.57 psf test pressure per ASTM E783.

E. Overall Thermal Transmittance (U-value): 0.45, maximum, including glazing, measured on window sizes required for this project.

F. Solar Heat Gain Coefficient (SHGC): 0.25, maximum.
   1. Single Hung (SHGC): 0.25.
   2. Fixed Window (SHGC): 0.25.

G. Forced Entry Resistance (FER): Tested to comply with ASTM F588 requirements having at least Grade 10 performance for each required window assembly.

2.04 COMPONENTS

A. Glazing: Insulated double pane, annealed glass, clear, low-E coated, krypton filled, bird-friendly, with thermoplastic warm-edge spacer, with glass thicknesses as recommended by manufacturer for specified wind conditions and acoustic rating indicated.
   1. Provide glazing for vinyl window units in accordance whole-window and gateway performance levels established by the performance class indicated above and as indicated below
      a. Provide factory glazed vinyl window units in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
      b. Provide insulating units to comply with thermal performance indicated, but no less than 3/4 inch total thickness.

B. Vinyl Extrusions: Rigid (unplasticized) hollow PVC extrusions, formulated and extruded for exterior applications, complying with ASTM D4726 and AAMA 303 and the following:
   1. Recycled PVC contains unknown properties.
   2. PVC Resins: 100 percent virgin resin.
   3. PVC Formulation: High impacts, low heat buildup, lead free, cadmium free, non-chalking, and color and UV stabilized.
   4. Extrusion Wall Thickness: Not less than required to meet gateway structural pressure testing for the window unit indicated or 0.060 inch.
   5. Multichamber Extrusions: Profile designed with multiple chambers between interior and exterior faces of the extrusions.
   6. Integral Nail Fin not less than 1 1/4 inch wide.
   7. Fusion-Welded Sloped Sill & Projected Sill Nose:
   8. Fusion-Welded Frame and Sash.

C. Reinforcing Members: Aluminum, or nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated

D. Profile Shape/Design: As indicated on Drawings for basis of design product.

E. Frame Depth: Manufacturer's standard for basis of design product.

F. Insect Screens: Aluminum, extruded or roll-formed frame with mitered and reinforced corners; apply screen mesh taut to frame; secure to window with hardware to allow easy removal.
   1. Hardware: Manufacturer's standard; quantity as required per screen.
   2. Screen Mesh: Vinyl coated fiberglass, window manufacturer's standard mesh.
   3. Frame Finish: Manufacturer's standard, color to match window frame and sash color.

G. Tilt-In Sash.

H. Fasteners: Stainless steel or other materials warranted by manufacturer to be noncorrosive and compatible with vinyl window members, cladding, trim, hardware, anchors, and other components.

I. Accessories: Provide related flashings, anchorage and attachment devices as necessary for full assembly.

1. Double Weather Stripping.
2. Flush-Mounted Tilt Latches.
3. Constant-Force Stainless Steel Balance.

J. Sealants for Setting Window Sill Pan Flashing: Provide butyl tape, non-hardening butyl, polyurethane, or silicone sealant; in compliance with ASTM E2112 installation practices.

K. Interior Foam Sealant: Complying with AAMA 812 .

2.05 HARDWARE

A. Sash lock: Lever handle and keeper with cam lock, provide one, minimum, for each operating sash.
1. Comply with ADA Standards for operating hardware.

B. Finish of Exposed Hardware: Baked enamel, match interior sash and frame color.

C. Counterbalancing Mechanism: Comply with AAMA 902.

D. Accessible Units: Provide hardware with accessible reach range or supplemental hardware meeting applicable ADA/ANSI requirements.

E. Window Opening Control Device (WOCD): Provide operable window sash hardware to limit the opening of the venting sash to less than four inches and prevent the passage of a 4 inch diameter rigid sphere when the sash is first opened. Device shall automatically reset once the sash is returned to its fully closed position.
1. The device is to be easily releaseable to fully open without use of keys, tools, or special knowledge.
2. WOCD shall be located within the accessible reach range and meet ASTM F20ASTM F2090 .
3. Install on both sides of each operable sash.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify wall openings and adjoining water-resistive barrier seal materials are ready to receive this work.

3.02 INSTALLATION

A. Protect window and frame surfaces from contact with lime, mortar, cement, acids, harmful surfaces, and careless handling.

B. Install windows in accordance with building code requirements, manufacturer's written instructions, product data and approved shop drawings plumb, level, and true to line, within specified tolerances.
1. Provide anchoring to maintain window position and integrity of windows.
2. Coordinate fastener type with rough opening wood buck treatment. Provide stainless steel fasteners for windows framed in wood openings.

C. Flash opening and install windows in accordance with ASTM E2112 requirements and as indicated on Drawings.

D. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

E. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities as necessary.

F. Align window plumb and level, free of warp or twist, and maintain dimensional tolerances and alignment with adjacent work.

G. Install sill.

H. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Coordinate attachment and seal of perimeter air and vapor barrier materials.

J. Install operating hardware not pre-installed by manufacturer.

K. Fill voids between the perimeter of the window unit and adjacent construction, with a non-expanding closed-cell polyurethane foam specially formulated for the application meeting AAMA 812 .
   1. Coordinate with window manufacturer for compliance with warranty requirements and manufacturer's written installation instructions.

L. Install perimeter sealant and backing materials in accordance with Section 07 92 00.

M. Touch-up, repair or replace units with damage to finish or operable parts.

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 field testing and inspection requirements, and requirements for monitoring quality of specified product installations.

B. Provide field testing of installed vinyl windows by independent laboratory in accordance with testing criteria below and AAMA/WDMA/CSA 101/I.S.2/A440 during mock-up review and during construction process and before installation of interior finishes.
   1. Test windows on mock-up and coordinate with Section 01 43 39 - Mock-Ups.
   2. Test windows in quantity and frequency during construction in accordnace with written direction from Architect and Building Envelope Consultant.
   3. Perform tests on three individual windows in designated locations as directed by Architect.
   4. Conduct tests on individual windows prior to 5 percent and 35 percent completion of this work.
   5. Field test for water penetration in accordance with ASTM E1105 using Procedure B - cyclic static air pressure difference; test pressure shall not be less than 5 psf.
   6. Field test for air leakage in accordance with ASTM E783 with uniform static air pressure difference of 1.57 psf.
      a. Maximum allowable rate of air leakage is 1.5 times specified rate of 0.30 cfm/sq ft as indicated in AAMA/WDMA/CSA 101/I.S.2/A440.

C. Test windows on mock-up and coordinate with Section 01 43 39 - Mock-Ups.

D. Test windows in quantity and frequency during construction in accordance with written direction from Architect and Building Envelope Consultant.Architect

E. Repair or replace windows and interfaces that fail to meet performance requirements. Implement like repairs for all like conditions. Test repaired/replaced window and two like units in locations selected by Architect.Architect

3.05 ADJUSTING

A. Lubricate, test, and adjust windows to operate easily without sticking or binding, free from warp, twist or distortion, and to fit watertight for entire perimeter.

B. Adjust hardware for smooth operation and secure weathertight closure. Lubricate hardware and moving parts.

3.06 CLEANING

A. Remove protective material from pre-finished surfaces.

B. Clean weep holes in window unit to ensure proper drainage of installed unit. Replace wind baffles if missing or damaged.

C. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.

D. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to window and sealant manufacturer.

3.07 PROTECTION

A. Protect window surfaces from contact with contaminating substances resulting from construction operations.

B. Monitor surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants.

C. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations

END OF SECTION

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PART 1 - GENERAL

GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

DESCRIPTION OF WORK

B. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. HINGES AND PIVOTS
2. MORTISE LOCKSETS AND MORTISE DEADBOLTS
3. CYLINDRICAL LOCKSETS AND DEADBOLTS
4. EXIT DEVICES
5. DOOR CLOSERS
6. LOW ENERGY OPERATORS
7. ANSI A156.23 ELECTROMAGNETIC LOCKING DEVICES
8. ANSI A156.24 ELECTROMAGNETIC DELAYED EGRESS LOCKSETS
9. ANSI A156.25 MAGNETIC HOLD OPENS & POWER SUPPLIES
10. ANSI A156.29 EXIT LOCKS, EXIT ALARMS, ALARMS FOR EXIT
11. ANSI A156.31 ELECTRIC STRIKES
12. ELECTRIFIED HARDWARE BACKBOX PATHWAY KIT
13. ACCESS CONTROL DEVICES AND ACCESSORIES
14. ANSI A156.6 ARCHITECTURAL DOOR TRIM
15. ANSI A156.8 OVERHEAD STOPS
16. ANSI A156.21 & 22 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, GASETING, WEATHERSTRIP
17. ANSI A156.14 SLIDING DOOR HARDWARE KITS MEETING ANSI A156.14

C. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 081110 - HOLLOW METAL DOORS AND FRAMES for astragals provided as part of a fire-rated labeled assembly and for door silencers provided as part of the frame.
2. Section 081400 - FLUSH WOOD DOORS for astragals provided as part of a fire-rated labeled assembly.
3. Section 083310 - OVERHEAD COILING DOORS for overhead coiling door hardware, except cylinders.
4. Section 083320 - OVERHEAD COILING GRILLES for overhead coiling grille hardware, except cylinders.
5. Section 083610 - SECTIONAL DOORS for sectional door hardware, except cylinders.
6. Section 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS for entrance door hardware, except cylinders.
7. Section 102210 - WIRE MESH PARTITIONS for wire mesh partition door hardware, except cylinders.
8. Division 26 - ELECTRICAL for power for electrified door hardware and interface with building control and security systems.

REFERENCE STANDARDS

Comply with the following reference standards and publications as applicable to the project.

D. American National Standards Institute (ANSI):

1. ANSI A117.1 Accessible and Usable Buildings and Facilities.

E. Builders Hardware Manufacturers Association (BHMA):

1. ANSI/BHMA A156.1 Butts and Hinges
2. ANSI/BHMA A156.2 Bored and Preassembled Locks and Latches
3. ANSI/BHMA A156.3 Exit Devices
4. ANSI/BHMA A156.4 Door Controls - Closers
5. ANSI/BHMA A156.5 Auxiliary Locks and Associated Products
6. ANSI/BHMA A156.6 Architectural Door Trim
7. ANSI/BHMA A156.7 Template Hinge Dimensions
8. ANSI/BHMA A156.8 Door Controls - Overhead Stops and Holders
9. ANSI/BNMA A156.12 Interconnected Locks & Latches
10. ANSI/BHMA A156.13 Mortise Locks and Latches
11. ANSI/BHMA A156.14 Sliding and Folding Door Hardware
12. ANSI/BNMA A156.15 Closer Holder Release Devices
13. ANSI/BHMA A156.16 Auxiliary Hardware
14. ANSI/BHMA A156.17 Self-Closing Hinges and Pivots
15. ANSI/BHMA A156.18 Materials & Finishes
16. ANSI/BNMA A156.19 Power Assist & Low Energy Power Operated Doors
17. ANSI/BNMA A156.21 Thresholds
18. ANSI/BNMA A156.22 Door Gasketing Systems
19. ANSI/BNMA A156.23 Electromagnetic Locks
20. ANSI/BNMA A156.24 Delayed Egress Locks
21. ANSI/BHMA A156.25 Electrified Locking Devices
22. ANSI/BNMA A156.26 Continuous Hinges
23. ANSI/BHMA A156.28 Recommended Practices for Mechanical Keying Systems
24. ANSI/BHMA A156.29 Exit Locks, Exit Alarms, Alarms for Exit
25. ANSI/BHMA A156.30 High Security Cylinders
26. ANSI/BNMA A156.31 Electric Strikes
27. ANSI/BNMA A156.32 Integrated Door Assemblies
28. ANSI/BHMA A156.115 Hardware Preparation in Steel Doors with Steel Frames
29. ANSI/BHMA A156.115W Hardware Preparation in Wood Doors with Wood or Steel Frames
30. ANSI/BNMA A250.13 testing and Rating of Severe Windstorm Resistant Components

F. International Building Code (IBC).

1. ICC/ANSI A117.1 Standards for Accessible and Usable Buildings and Facilities
2. American with Disabilities Act Accessibility Guidelines

G. National Fire Protection Association (NFPA):

1. NFPA 70 Electrical Code
2. NFPA 80 Fire Doors and Fire Windows.
3. NFPA 101 Life Safety Code
4. NFPA 105 Standard for the Installation of Smoke Door Assembles
5. NFPA 252 Fire Tests of Door Assemblies.

H. Underwriters Laboratories Inc. (UL):

1. UL 10C Positive Pressure Fire Tests Of Door Assemblies.
2. UL 305 Panic Hardware.
3. UL 437 Drill and Pick Resistant Key Cylinders.
4. UL 1034 Burglary-Resistant Electric Locking Mechanisms.

SUBMITTALS

I. Product Data: Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.

J. Shop Drawings: Details of electrified door hardware, indicating the following:

1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring. Include the following:

   a. System schematic.
   b. Point-to-point wiring diagram.
   c. Riser diagram.
   d. Elevation of each door.

2. Detail interface between electrified door hardware and fire alarm access control and building control and security systems.

K. 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 Industry standards.
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening.

   a. Organize door hardware sets in same order as in the Door Hardware Schedule at the end of Part 3.

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 each 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. Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.
   i. Sequence of Operation: Include description of component functions that occur in the following situations: authorized person wants to enter; authorized person wants to exit; unauthorized person wants to enter; unauthorized person wants to exit.

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.

L. Keying Schedule: Prepared by or under the supervision of supplier, detailing the Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

M. Product Certificates: Signed by manufacturers of electrified door hardware certifying that products furnished comply with requirements.

1. Certify that door hardware approved for use on types and sizes of labeled fire doors complies with listed fire door assemblies.

N. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

1. Include lists of completed projects with project names and addresses of architects and owners, and other information specified.

O. Maintenance Data: For each type of door hardware to include in maintenance manuals specified in Division 01.

P. Warranties: Special warranties specified in this Section.

QUALITY ASSURANCE

Q. Installer Qualifications: An experienced installer who has completed 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.

R. Supplier Qualifications: Door hardware supplier with warehousing facilities in Project's vicinity and who is or employs a qualified product consultant available during the course of the Work to consult with Contractor, Designer, and the Owner about door hardware and keying.

1. Electrified Door Hardware Supplier Qualifications: An experienced door hardware supplier who has completed projects with electrified door hardware similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance, and who is acceptable to manufacturer of primary materials.

Engineering Responsibility: Prepare data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

2. Scheduling Responsibility: Preparation of door hardware and keying schedules.

S. Specifier & Product Consultants Qualifications: A person who is currently certified by the SPC Alliance and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

1. Electrified Door Hardware Qualifications: Experienced in providing consulting services for electrified door hardware installations.

T. Source Limitations:

1. Provide door hardware from manufacturers regularly engaged in producing the specified products. Where compatibility or interface between components is required, provide components from a single manufacturer or provide written documentation confirming compatibility, required listings, and proper interface among manufacturers.
2. Electrified door hardware shall be coordinated with mechanical hardware and building systems to ensure proper function, code compliance, monitoring, and serviceability.

U. Regulatory Requirements: Comply with provisions of the following:

1. Where indicated to comply with accessibility requirements, comply with the Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," as follows:

a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy

to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.

b. Door Closers: Comply with the following maximum opening-force requirements indicated:

1) Interior Hinged Doors: 5 lbf' applied perpendicular to door.
2) Sliding or Folding Doors: 5 lbf. applied parallel to door at latch.
3) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

c. Thresholds: Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.

2. NFPA 101: Comply with the following for means of egress doors:

a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
b. Delayed-Egress Locks: Lock releases within 15 seconds after applying a force not more than 15 lbf for not more than 3 seconds.
c. Door Closers: Not more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.
d. Thresholds: Not more than 1/2 inch high.

3. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

V. Fire-Rated Door Assemblies: Provide door hardware for 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 NFPA 252.

1. Test Pressure: Test at atmospheric pressure.

W. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
2. Preliminary key system schematic diagram.
3. Requirements for key control system.
4. Address for delivery of keys.

X. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to electrified door hardware including, but not limited to, the following:

1. Inspect and discuss electrical roughing-in and other preparatory work performed by other trades.
2. Review sequence of operation for each type of electrified door hardware.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review required testing, inspecting, and certifying procedures.

Y. Delivery: Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site. 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.

Z. Keys: Deliver keys to manufacturer of key control system.

COORDINATION

AA. Coordination: Coordinate layout and installation of recessed pivots and closers with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Section 033000 - CAST-IN-PLACE CONCRETE.

BB. Templates: Obtain and distribute to the parties' involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

CC. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm system and detection devices, access control and building control system.

DD. General Warranty: Special warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

EE. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of operators and door hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

FF. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.

GG. Warranty Period for Manual Closers: Ten years from date of Substantial Completion.

MAINTENANCE SERVICE

HH. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for the Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

OPEN SPECIFICATION INTENT

II. This Section is written to establish performance, quality, and coordination requirements and is not intended to limit competition. Products meeting the requirements of this Section may be provided by any qualified manufacturer, subject to compliance with the Contract Documents.

PART 2 - PRODUCTS MANUFACTURE

A. **Manufacturer Qualifications:** Acceptable manufacturers shall regularly engage in the manufacture of architectural door hardware products of the types specified herein and shall demonstrate documented compliance with applicable ANSI/BHMA standards, required listings and labeling, published warranty terms, and availability of field service support.

Participation in professional or industry organizations is permitted but shall not be used as the sole basis for acceptance.

B. **Substitutions:** Substitutions shall comply with Division 01 requirements. Post-award substitution requests shall include a side-by-side comparison identifying impacts to performance, listings, templates/wiring, system interface, warranty/service, cost, and schedule. Substitutions shall not be incorporated without written approval by the Designer and Owner.

C. **Definition of Equal:** An "equal" product shall meet or exceed the specified product in applicable ANSI/BHMA grade and cycle testing, required listings and labeling, material and finish quality, warranty duration, field serviceability, and compatibility with scheduled hardware and building systems.
Differences in configuration, installation, wiring/templates, maintenance, or lifecycle performance shall be clearly identified.

D. Basis-of-Design Manufacturer:

E. Listing of acceptable manufacturers:

1. Accurate Lock and Hardware
2. Architectural Builders Hardware Mfg.
3. Camden Door Controls
4. Command Access
5. Detex Mfg.
6. Don-Jo Mfg.
7. Frascio
8. Hawa
9. Legacy
10. National Guard Products
11. PBB Inc
12. PDQ Mfg.
13. Select Products Limited
14. Standard Metal Hardware
15. TownSteel Mfg.
16. Unison (Inox) Hardware Inc.

2.1 HINGES AND PIVOTS

A. ANSI A156.1 Hinges mortise Type

1. ANSI A156.1, full mortise template type complying with following general requirements unless otherwise scheduled.
2. Widths: Sufficient to clear trim projection when door swings 180 degrees.
3. Number: Furnish minimum three hinges to 90 inches (2 286 mm) high, four hinges to 120 inches (3 048 mm) high for each door leaf
4. Doors Over 40 inches (1 016 mm) Wide: Extra heavy weight ball or oilite bearing hinges.
5. Doors 1-3/8-inch (35 mm) Thick: 3-1/2-inch (89 mm) size.
6. Doors 2 inch (50 mm) Thick: 5 inch (125 mm) extra heavy weight ball or oilite bearing.
7. Doors Over 48 inches (1 220 mm) Wide: 5 inch (125 mm) extra heavy weight ball

Pins: Furnish nonferrous hinges with non-removable pins (NRP) at exterior and locked out-swinging doors, non-rising pins at interior doors.

8. Tips: Furnish with matching plug.
9. Material: Steel - Satin and plated
10. Material: Stainless Steel - Satin finished.

Acceptable mfg.:		PBB	Inox	Don Jo	PDQ
a.	Ball bearing hvy wgt steel	4B81	HG8111	HWBB74545	35 ST HB
b.	Bearing std wgt stainless steel	BB51	HG5112	BB94545	35 SS BB
c.	Ball bearing std wgt steel	BB81	HG8112	BB74545	35 ST BB

B. ANSI A15626 Continuous Hinges – Geared

1. Provide aluminum geared continuous hinges conforming to ANSI A156.25, Grade 1, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
2. Provide split polymer bearings at each hinge knuckle for quiet, smooth, self-lubricating operation. Provide hinge with no less than 32 bearings.
3. Hinges shall be capable of supporting door weights up to 600 pounds, and shall be successfully tested for 1,500,000 cycles.
4. On fire-rated doors, provide aluminum geared continuous hinges classified for use on rated doors by a testing agency acceptable to the authority having jurisdiction.
5. Install hinges with fasteners supplied by manufacturer.
6. Warranty: Hinges shall carry manufacturers lifetime warranty. Hinges must be stamped with manufacturers name for warranty purposes.

Acceptable mfg.:		ABH	Select	PBB	NGP
a.	Heavy Duty Bevel Edge	A111HD	SL18HD		HD1800

C. ANSI A156.17 Offset Pivot Hinges

1. Center-Hung and Offset Pivots: BHMA A156.4. Certified floor closers provided either center hung or 3/4-inch offset hung type complete with top and intermediate pivots (offset closers only) in quantity according to manufacturer's recommendation. Floor closers available with options for labeled, lead lined and regular doors. Provide independent and adjustable valves for closing speed, latch speed, and backcheck with built-in dead stop and hold open features as specified. Provided finish cover plates or thresholds as indicated in door Hardware Sets.
2. Pivots BHMA A156.4, Grade 1, certified pivots provided either center hung or 3/4-inch offset type complete with top, bottom, and intermediate pivots (offset pivots only) in quantity according to manufacturer's recommendations. Space intermediate pivots equally not less than 25 inches on center apart or not more than 35 inches on center for doors over 121 inches high. Pivot hinges to have oil impregnated bronze bearing in the top pivot and a radial roller and thrust bearing in the bottom pivot with the bottom pivot designed to carry the full weight of the door. Pivots to be UL listed for windstorm where applicable.

Acceptable mfg.:		ABH	Townsteel	Don Jo
a.	¾” Offset Pivots – 300 lbs.	0117	TSP	TP34

Electrified pivots-Intermediate (*wired - gauge - amp)

Acceptable mfg.:	ABH	Command

Electrified pivots-Intermediate for latch retraction (*wired - gauge - amp)

b. ¾" offset 2 - 18 - ETH2WH

D. Closer Hinges

1. Hinges: ANSI A156.7, full mortise template type complying with following general requirements unless otherwise scheduled. Material: Stainless Steel - Polished finished.
2. Closer hinges are adjustable for force required to open door and swing closing speed. Closers hinges contain torsion sprigs and disk springs. Grade 1 tested to a million cycles. UL certified to 3-hour fire rated.
3. Widths: 4.5 X 4.5 Inches. Sufficient to clear trim projection when door swings 180 degrees.
4. Number: Furnish minimum three hinges to 90 inches (2 286 mm) high, four hinges to 120 inches (3 048 mm) high for each door leaf.

   Fire Rated Doors To 86 inches (2 184 mm) High: Minimum three ball bearing hinges.

5. Pins: Furnish nonferrous hinges with non-removable pins (NRP) at exterior and locked out-swinging doors, non-rising pins at interior doors.
6. Tips: Furnish with matching plug.
7. Material: Steel - Polished and plated.
8. Acceptable manufacturers: Waterson Hinge K51M Series
9. Spring hinges are not acceptable.

Acceptable mfg.: PBB Waterson Hinge

Cont, Gear Hinge Prep For Ept — ABH A120HD X EPT LENGTH REQUIRED
Cont, Gear Hinge — ABH A120HD X LENGTH REQUIRED

Closer Hinges AX-L/R-30-4.5

2.2 MORTISE LOCKSETS AND MORTISE DEADBOLTS

A. ANSI A156.1 Mortise Locks

1. Mortise locks shall be certified as ANSI A156.13, Grade 1 Operational, Grade 1 Security, and shall be manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance. Lock case shall be multi-function and field reversible for handing without opening the case.
2. Locks are to have a standard 2 3/4" backset with a full 3/4" throw 2-piece stainless steel mechanical anti-friction latch bolt. Deadbolt shall be a full 1" throw, constructed of stainless steel.
3. Lever trim shall be solid brass, bronze, or stainless steel, cast or forged in the design specified, with wrought roses and external lever spring cages. Levers shall be thru-bolted to assure proper alignment, and shall have a 2-piece spindle. Lever trim on the secure side of doors serving rooms considered by the authority having jurisdiction to be hazardous shall have a tactile warning.
4. Lever design to be:_____

Acceptable mfg.:	Series
Storeroom Mortise Latch Retraction — CAC LPM193EU X 17	
Storeroom Mortise Lock — FRS MODULO 745 - SM- M507	

B. ANSI A156.25 Narrow Style Mortise Deadbolt

1. Maintain sleek lines with prominent narrow stile doors, ideal for aluminum storefronts.
2. Specify 1600 flip deadbolts for swinging doors and 1600SDL hook deadbolts for sliding doors.
3. 1", 1-1/8" standard narrow backsets. (1-1/4", 1-1/2" custom narrow backsets available.)
4. Pair with rigid 7200P or custom architectural pulls in a variety of finishes or custom sizes.
5. Available in a variety of deadbolt functions.
6. Can be used with standard mortise cylinders or thumb turn cylinders (by others).
7. Retrofit for popular Adams Rite Series locks.
8. Heavy gauge, stainless steel case.
9. Brass, bronze, aluminum, or stainless steel armor front, finished as required.
10. Faceplate options: flat (default), radius or beveled.
11. 4-7/8" strike.
12. Laminated stainless steel deadbolt with anti-lift feature, 1-1/2" throw.
13. Brass, stainless steel, or oil-rubbed bronze dust box.

Basis of Design:	Accurate
Comparable products by other manufacturers meeting the requirements of this Section, including performance, durability, adjustability, warranty, and finish, may be submitted as approved equals.	
a. Narrow Style Mortise Deadbolt	1600

C. Fire rated exit device control

1. Withstands 2200 lbs. outside pull force
2. Battery Alarmed
3. Rugged dead bolt 1" throw, saw resistant,
4. Photo-luminescent signage
5. 100 Decibel alarm for secondary exits
6. Corrosion resistant alloy lock body
7. Non handed
8. Resetting alarm is accomplished by a control key

Basis of Design:	Detex
Rated Passage Exit Device	F1014D-W-FSB1035

D. Mortise & Rim Cylinders

1. Solid brass construction.
2. Prepped for Small Format Interchangeable Core (SFIC) or Large Format Interchangeable Core (LFIC).
3. Provide screw fastened, interchangeable cams or tail piece, as required, to operate each keyed operating function.
4. Provide solid machined cylinder rings with tension spring to resist wrenching of cylinder. Length, finish and size as required.
5. Warranty: Three (3) years from date of installation.

E. Cores and Keys - Small Format Interchangeable Cores

1. Nickel-Silver Keys
2. Cores 6 or 7-pin solid brass construction
3. Individually capped
4. Stainless Steel C-clip assembled
5. Standard, Premium or Restricted keyways

2.3 CYLINDRICAL LOCKSETS AND DEADBOLTS

A. ANSI A156.2 Decorative Tubular ANSI Conformance - Grade 2

1. Solid steel reinforced strike plate.
2. Adjustable 2-3/4-inch (70 mm) to 2-3/8-inch (60 mm) backset 1 inch (25.5 mm) throw dead bolt with hardened steel roller.
3. Lock Cylinder:
4. Latch Bolt: 1 inch (25.5 mm) Throw Latch Bolt:
5. 1-1/8-inch (28.5 mm) by 2-1/4-inch (57 mm) front 1 inch (25.5 mm) diameter, 1 inch (25.5 mm) throw dead bolt with adjustable 2-3/8-inch (60 mm) to 2-3/4-inch (70 mm) backset. Square corner. Finish: As shown on schedules.

	Acceptable Mfg.:	Frascio	Townsteel	Inox	PDQ
a.	Decorative Tubular	T600/T700	TL	RA, SE, GA	TJ

B. Large Message Indicator Bored Lock

1. ANSI / BHMA A156.2 Constructed to meet Grade 1 certification.
2. UL10C Certified UL10(C) 3-hour fire rating.
3. ADA compliant, meeting the requirements of the Americans with Disabilities Act.
4. Fast and easy upgrade, designed to perfectly fit into existing cylindrical 161 door preps, making installation fast and easy.
5. High visibility status indicator, with a large message indicator on both sides of the opening, allows occupants or personnel in the hallway to identify a lock's status in an instant.
6. Indicator labels available: OCCUPIED / VACANT, LOCKED / UNLOCKED.
7. Heavy-duty stainless steel trim, cast and machined, provides a barrier to most adverse conditions.
8. Cylinder configurations are available with a cylinder on the outside and a thumb turn on the inside or in a double cylinder configuration.

Basis of Design: Frascio

Privacy With Indicator — FRS MODULO 745 - SM - H41 -M527

C. Smart Locks – Battery Powered

1. Battery-powered electronic tubular lockset with integrated credential reader; fits standard cylindrical door preparation with no additional drilling.
2. Door thickness 1-3/8" to 3-1/2"; backset 2-3/8" or 2-3/4" as required by the door preparation.
3. Power: three AAA batteries.
4. Credentials: data-on-card RFID, mobile key by Bluetooth / NFC, and wireless online operation, compatible with the Owner's access control platform.
5. Audit trail stored in the lock: not less than 1,450 events.
6. Mechanical key override.
7. Lever trim to match the lever design of the Project locksets.
8. Fire rated: UL 10C listed for 45-minute doors.
9. Interior use only.

Basis of Design:	Salto
Apt Entry Smart Lock - XS4 Mini W/ Key Override	SAL XS4 MINI - KEY OVERRIDE - FRS 745 LEVER

2.4 EXIT DEVICES

A. ANSI A156.3 Exit Devices – Heavy Duty

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1, and UL listed for Panic Exit and/or Fire Exit Hardware. .
2. Provide touchpad type exit devices, stainless steel. No aluminum rails are acceptable.
3. Touchpad shall extend a minimum of one half of the door width, but not the full length of the exit device rail. End-cap will have two-point attachment to door. Touch-pad shall match in material as well as finish.
4. Devices to incorporate a dead-latching feature for security and/or for future addition of alarm kits and/or other electrical requirements.
5. Vertical rod devices shall be capable of being field modified to less bottom rod devices by removal of bottom rod and adding firing pin(s), if required at fire rated openings.
6. Provide manufacturer's standard strikes.
7. Provide exit devices cut to door width and height. Locate exit devices at a height recommended by the exit device manufacturer, allowable by governing building codes, and approved by the Architect.
8. Mechanism case shall sit flush on the face of all flush doors, or spacers shall be furnished to fill gaps behind devices. Where glass trim or molding projects off the face of the door, provide glass bead kits.
9. Non-fire-rated exit devices shall have cylinder dogging
10. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant

levers that will travel to a 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.
11. Lever style will match the lever style of the locksets.
12. Lever trim on doors serving rooms considered by the authority having jurisdiction to be hazardous shall have a tactile warning.
13. Exit devices for fire rated openings shall be UL labeled fire exit hardware.
14. Provide electrical options as scheduled.

Acceptable mfg. :

Wide Style

	Detex	Townsteel	Inox	PDQ
Exit Device W/Latch Retraction — DET 1008D-W-ER-FSB1035 Top Rod Svr Rod Exit Device — DET 2103-W-FSB1035 Exit Device — DET 1008D-W-CD-FSB1035				

Narrow Style

	Detex	Townsteel	Inox	PDQ

B. ANSI A156.3 Exit Devices Storefront exit devices

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1, and UL listed for Panic Exit and/or Fire Exit Hardware.
2. Provide touchpad type exit devices.
3. Aluminum rails.
4. Touchpad shall extend 3" from face of door. End-cap will have two-point attachment to door. Touch-pad shall match in material as well as finish.
5. Devices to incorporate a 1" steel latch bolt ½" throw engaging astainless steel roller strike for locking
6. Vertical rod devices use a 3/8" steel vertical rods with steel latch bolts engaging a stainless-steel roller strike for locking
7. Provide manufacturer's standard strikes.
8. Provide exit devices cut to door width and height. Locate exit devices at a height recommended by the exit device manufacturer, allowable by governing building codes, and approved by the Architect.
9. Mechanism case shall sit flush on the face of all flush doors, or spacers shall be furnished to fill gaps behind devices. Where glass trim or molding projects off the face of the door, provide glass bead kits.
10. Non-fire-rated exit devices shall have cylinder dogging
11. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers that will travel to a 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.
12. Lever style will match the lever style of the locksets.
13. Lever trim on doors serving rooms considered by the authority having jurisdiction to

be hazardous shall have a tactile warning.
14. Exit devices for fire rated openings shall be UL labeled fire exit hardware.
15. Provide electrical options as scheduled.

Narrow Style

Narrow Style Cvr Exit Device — DET 6008DNS-W-1079

Narrow Style Cvr Exit Device — DET F6008DNS-W-1079

Narrow Style Rim Exit Device — DET 4008DNS-ER-W-1079

Narrow Style Cvr Exit Device — DET 6008DNS-1079-W

Concealed Vert Rod Latch Retraction — DET 6008DNV-W-ER-1079

Concealed Vert Rod Latch Retraction — DET F6008DNV-W-ER-1079

C. EZ Connect Harness (10) 22 Ga. And 2 (18) Ga. Wires, used to connect the locking device to the Power Transfer/Hinge/Pivot, Standard Sizes 3”-362”.

Basis of Design: ABH Mfg.

Comparable products by other manufacturers meeting the requirements of this Section, including performance, durability, adjustability, warranty, and finish, may be submitted as approved equals.

2.5 DOOR CLOSERS

A. ANSI A156.4 Rack and Pinon heavy duty door closers.

1. Exterior applications feature adjustable spring sizes from 1 to 6 and meets ANSI A117.1 and ADA for barrier-free accessibility.
2. Compliant with UL10C for positive pressure.
3. Certified to 1 million cycles by a recognized test lab. Non-handed.
4. Featuring full range spring power adjustment and backcheck, with a narrow projection full cover and flat form style arm.
5. Door control also features a backcheck positioning adjustment for parallel arm applications, to maintain an ANSI backcheck range similar to regular and top jamb applications.
6. Independent sweep and latch non-critical closing speed adjustment.
7. Standard Finish:

Acceptable Mfg.:	Townsteel	Detex/Ryobi	Inox	PDQ
a. Hvy duty surface door closers	TDC40	D-4550	DC90	7100

B. ANSI A156.4 Rack and Pinon medium duty door closers.

1. ANSI A156.4, Grade 1, surface door closer.

2. Model 8616 for interior and exterior applications and meets ANSI A117.1 and ADA for barrier-free accessibility.
3. Compliant with UL10C for positive pressure.
4. Non-handed.
5. Door control also features a backcheck positioning adjustment for parallel arm applications, to maintain an ANSI backcheck range similar to regular and top jamb applications.
6. Independent sweep and latch non-critical closing speed adjustment.
7. Painted Finish:

	Acceptable Mfg.:	Townsteel	Detex/Ryobi	Inox	PDQ
a.	Medium duty surface closers	TDC70	D-3550	DC61	5500

C. ANSI A156.4 Concealed Overhead Closers frame

D. ANSI A156.4 Concealed in Door Closer

E. ANSI A156.4 Floor closers

2.6 LOW ENERGY OPERATORS

A. ANSI A156.19 Surface mounted low energy operators ADA

1. ANSI A156.19, Grade 1, surface applied power assist and low energy power operated doors.
2. Closer with latch, sweep and backcheck intensity valves.
3. Compliant with UL10C for positive pressure.
4. Non-handed.
5. Receiver: 800 RFR Hard wired receiver mounted separately.
6. Power requirements: 120 VAC, 50/60 Hz, 2 amp.
7. Custom Paint Finish: Optional Special color as selected by the Architect

Acceptable Mfg.:	Detex	Command
Ada Low Energy Operator — CAC CATHDO100		

2.7 ANSI A156.25 MAGNETIC HOLD OPENS & POWER SUPPLIES

A. Power Supplies

1. Provide power supplies, recommended and approved by the manufacturer of the electrified locking component, for the operation of electrified locks, electrified exit devices, magnetic locks, electric strikes, and other components requiring a power supply.
2. Provide the appropriate quantity of power supplies necessary for the proper operation of the electrified locking component and/or components as recommended by the manufacturer of the electrified locking components with consideration for each electrified component utilizing the power supply, the location of the power supply, and the approved wiring diagrams. Locate the power supplies as directed by the Architect.
3. Provide a power supply that is regulated and filtered 24 VDC, or as required, and UL class 2 listed. Coordinate voltage with Owner prior to submitting.
4. Provide power supplies with the following features:
   a. 12/24 VDC Output, field selectable.

b. Class 2 Rated power limited output.
c. Universal 120-240 VAC input.
d. Low voltage DC, regulated and filtered.
e. Polarized connector for distribution boards.
f. Fused primary input.
g. AC input and DC output monitoring circuit w/LED indicators.
h. Cover mounted AC input indication.
i. Tested and certified to meet UL294.
j. NEMA 1 enclosure.
k. Hinged cover w/lock down screws.
l. High voltage protective cover.

Acceptable Mfg.: Inox Detex Command

Power Supply — CAC PS440B

2.8 ANSI A156.31 ELECTRIC STRIKES

A. Electric Strikes - Universal low & Standard Profile

1. Compatible with center line cylindrical and mortise locksets
2. Field selectable fail secure/failsafe
3. Dual voltage 12/24V, AC or DC.
4. Adjustable Strike body
5. 3 faceplates provided.
6. Continuous Duty operation.
7. Non-handed
8. Easy fit connections
9. Grade 1
10. 5 Year warranty
11. Static hold force 1500 lbs.,
12. UL Verified 250000 cycles.

Acceptable Mfg.: Camden Inox

Frame Frog Electric Boxes By Tadpole — FRF WPK1LS-001

2.9 ANSI A156.6 ARCHITECTURAL DOOR TRIM

A. Push and Pull Plates

1. Provide push plates 4 inches wide by 16 inches high by .050 inch thick and beveled 4 edges. Where width of door stile prevents use of 4" wide plate, adjust width to fit.
2. Provide push bars of solid bar stock, diameter and length as scheduled. Provide push bars of sufficient length to span from center to center of each stile. Where required, mount back-to-back with pull.
3. Provide offset pulls of solid bar stock, diameter and length as scheduled. Where required, mount back-to-back with push bar.
4. Provide pulls of solid bar stock, diameter and length as scheduled. Where required, mount back-to-back with push bar.
5. Provide pull plates 4" wide by 16" high by .050" thick, beveled 4 edges, and prepped for pull. Where width of door stile prevents use of 4" wide plate, adjust width to fit.
6. Provide wire pulls of solid bar stock, diameter and length as scheduled.
7. Provide decorative pulls as scheduled. Where required, mount back-to-back with

pull.

Acceptable mfg.:	Inox	Don Jo	PDQ	SMH
Push Plate .125		76-4" X 16"		
Pull Plate .125		7816-4" X 16"		

B. Protection Plates

1. Provide kick plates, and mop plates minimum of 0.050 inch thick as scheduled. Furnish with machine or wood screws, finished to match plates. Sizes of plates shall be as follows:
   a. Kick Plates - 8 inches high x 2 inches less width of door on single doors, 1 inch less width of door on pairs
   b. Mop Plates - 4 inches high x 2 inches less width of door on single doors, 1 inch less width of door on pairs

Acceptable mfg.:	Inox	Don Jo	PDQ	SMH
Kickplate 10" High		90 - 10" X LENGTH MINUS 2"		

C. Flush bolts

1. Automatic flush bolts shall have forged bronze or stainless-steel face plates with extruded brass levers and with wrought brass guides and strikes. Flush bolts for hollow metal doors shall be extension rod type, and wood doors shall have corner-wrap type. Hollow metal doors up to 7'-6" in height shall have 12" steel or brass rods. Manual flush bolts for doors over 7'-6" in height shall be increased by 6" for each additional 6" of door height. Provide dust-proof strikes at each bottom flush bolt.

Acceptable mfg.:	ABH Mfg.	Inox	Don-jo	PDQ	SMH

2. Manual flush bolts with forged bronze or stainless-steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

Acceptable mfg.:	ABH	Inox	Don-jo	PDQ	SMH
a. Manual flush bolts metal doors	1855S	FB197M	1555	93170	F65UL

D. Coordinators

1. Where pairs of doors are equipped with automatic flush bolts, an astragal, or other hardware that requires synchronized closing of the doors, provide a bar-type

coordinating device, surface applied to the underside of the stop at the frame head.

2. Provide a filler bar of the correct length for the unit to span the entire width of the opening, and appropriate brackets for parallel arm door closers and surface vertical rod exit device strikes or other stop mounted hardware. Factory-prep coordinators for vertical rod devices if required.

Acceptable mfg.:	ABH	Inox	Don-jo	PDQ	SMH
Door Coordinator			2011		

E. Door Stops and Holders

1. Wall stops shall be used wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used. Where a wall stop cannot be used, provide universal floor stops for low- or high-rise options.
2. At any opening where a wall or floor stop cannot be used, a heavy-duty overhead stop must be used.

Acceptable mfg.:	Inox	Don-Jo	ABH	PDQ	SMH
a. Wall stops – Concave-wrought	DS401	1407		102	S123
b. Hinge stop		1500			

F. Door Guards

1. Flip guard for multi-family projects and hotels
2. ANSI L33042
3. Length: 3" Width: 2-3/4" Height: 2-1/4"

Acceptable mfg.:	Inox	Don-Jo	PDQ
a. Door Flip Guard		1606	579

G. Door Viewers

1. Door viewers ANSI L23221
2. UL10C Fire rated
3. Solid Brass

Acceptable mfg.:	Inox	Don-Jo	PDQ	SMH
a. UL rated 160-degree ½”		ULDV90	906	
Door Viewer		UDLV90		

H. Roller latches

Acceptable mfg.:	Inox	Don-Jo	PDQ	SMH
Roller Latch		1702		F75 / F76

2.10 ANSI A156.21 & 22 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, GASETING, WEATHERSTRIP

A. Automatic Door Bottoms Heavy Duty

1. Heavy Duty;- Closed cell sponge neoprene
2. *BHM*A certified to ANSI/BHMA A156.22, 1,000,000 cycle test-grade 1
3. BHMA certified to ANSI/BHMA A156.22 performance tests for heat and cold
4. Aluminum alloy 6063, T5 temper
5. Synthetic rubber polymer blend: PVC, Nitrile rubber (NBR), and Chloroprene closed cell advanced elastomeric foam
6. Flame resistant &Moisture resistant
7. Temperature range -20°F to 200°F
8. Specify exact net length required to avoid field sizing
9. 36" and longer may be cut up to 4" in the field, under 36" should not be cut in the field, order net length
10. Minimum length 11", maximum length 60"
11. Door bottom is handed. Right hand supplied unless specified.
12. 7/8" max drop
13. Silicone is grey
14. Neoprene is black
15. Anodized aluminum

Acceptable Mfg.:	Legacy	NGP
a. Mortise mounted Neoprene wood door	7063	335NA
Auto Door Bottom	7463	522N

B. Door Sweeps Surface Mounted

1. Aluminum alloy 6063, T5 temper
2. Synthetic rubber polymer blend: Chloroprene and EPDM
3. Flame resistant & Moisture resistant
4. Temperature range -20°F to 200°F
5. BHMA certified to ANSI/BHMA A156.22 performance tests for heat and cold
6. #6 x 3/4" stainless steel sheet metal screws furnished
7. Screw holes slotted for adjustment
8. Nylon Brush is black
9. Silicone is gery
10. Neoprene is black
11. Anodized aluminum

Acceptable Mfg.	Legacy	NGP
Door Sweep		200N X LENGTH REQUIRED
Exterior Door Sweep		101V X LENGTH REQUIRED

C. Aluminum Thresholds – Flat

1. Aluminum alloy 6063, T5 temper
2. Fluted top
3. BHMA certified to ANSI/BHMA A156.21 1,000 lb. load test
4. Typical wall thickness .125"
5. 3/16" x 1-3/4" FH HiLo-Tapping Thread, Grey Phillips Drive, Concrete Screws, Salt Spray: ASTM B117 Approved
6. #10 x 1-1/2" FH zinc plated wood screws included

Acceptable Mfg.:	Legacy	NGP
a. ½" High - 5" wide	3556	425E
3" Wide X 1/2" High Saddle Threshold	3841	323 X LENGTH REQUIRED

D. Aluminum Thresholds – Thermal broken

1. Aluminum alloy 6063, T5 temper
2. Fluted top
3. Features a rigid thermoplastic spline creating a separation to prevent the transfer of outside temperature and frost through the threshold
4. Typical wall thickness .125"
5. 3/16" x 1-3/4" FH HiLo-Tapping Thread, Grey Phillips Drive, Concrete Screws, Salt Spray: ASTM B117 Approved
6. #10 x 1-1/2" FH zinc plated wood screws included. Dark bronze supplied with DKB thresholds
7. Mill finish

Acceptable Mfg.:	Legacy	NGP
Ada Thermal Break Threshold		8433TPV X LENGTH REQUIRED

E. Silicone with pressure sensitive Adhesive

1. Silicone
2. Self-Adhesive
3. Flame resistant & Moisture resistant
4. Temperature range -100°F to 500°F, remains flexible at extreme temperatures
5. Excellent resistance to ozone, UV and aging
6. Recommended for areas using FM200 or Halon Fire Suppression Systems
7. BHMA Certified to ANSI/BHMA A156.22 performance tests for heat, cold and air infiltration
8. Modified acrylic pressure sensitive adhesive protected by release liner
9. Provides high initial adhesion and long-term holding power for permanent mounting in exterior or interior locations
10. End use temperature range of adhesive, long term exposure -30°F up to 250°F
11. Edge Sealing System - category "G" for 20-minute rated category B wood doors perimeter application up to: single swing 4'0 x 8'0, pairs 8'0 x 8'0. Use 9550 at the meeting edge of pairs
12. Smoke and draft control - category "H", up to 3 hours hollow metal fire doors, up to 90 minutes wood fire doors
13. 1/2" wide x 1/4" tall

Acceptable Mfg.:	Legacy	NGP
a. ¼" x ½"	5881S	5050
Weatherstripping	5077	1038N X LENGTH
Weatherstripping		2P X LENGTH REQUIRED

F. Meeting Stiles both doors active

1. Aluminum alloy 6063, T5 temper
2. Synthetic polymer: Polyamide
3. Abrasion resistance, flexibility and memory, Moisture resistant
4. Temperature range -70°F to 425°F
5. REACH and RoHS compliant
6. Fire-rated Astragal Seals cannot replace any astragal required on the door by the door manufacturer to maintain its fire label
7. IBC, NFPA 80, NFPA105, and NFPA 252 require the gap at the meeting edge between fire labeled doors must not exceed 1/8"
8. #6 x 3/4" stainless steel sheet metal screws furnished
9. Screw holes slotted for adjustment
10. Nylon brush plus is gray
11. Anodized aluminum

Acceptable Mfg.:	Legacy	NGP
a. Nylon Brush- 5/16" x 1"	73918	A605A

G. Overlapping astragals

1. Aluminum alloy 6063, T5 temper
2. Synthetic rubber polymer: Siloxane closed cell sponge
3. Premium grade seals specially formulated to withstand greater temperature extremes while providing maximum protection against air infiltration
4. Excellent flexibility and memory
5. Flame resistant & Moisture resistant
6. Temperature range -100°F to 500°F, remains flexible at extreme temperatures
7. Recommended for areas using FM200 or Halon Fire Suppression Systems
8. BHMA Certified to ANSI/BHMA A156.22 performance tests for heat and cold
9. Fire-rated Astragal Seals cannot replace any astragal required on the door by the door manufacturer to maintain its fire label
10. IBC, NFPA 80, NFPA105, and NFPA 252 require the gap at the meeting edge between fire labeled doors must not exceed 1/8"
11. #6 x 3/4" stainless steel sheet metal screws furnished
12. Screw holes slotted for adjustment
13. Silicone plus is tan
14. Anodized aluminum

Acceptable Mfg.:	Legacy	NGP	SMH
Astragal	72918	C607 X LENGTH REQ.	

H. STC Acoustic Systems

1. Type per individual mfg. to be approved prior to fabrication.

Acceptable Mfg.:	Legacy	NGP
a. STC 49 - Acceptable Mfg.	6049STC	STC-3 (52)

PART 3 - PRODUCTS MANUFACTURE

3.1 FINISHES

A. Finish of all hardware shall be BHMA where specifically noted. Surface door closers must have metal covers, plastic is not acceptable.

3.2 KEYING

A. Provide cylinders keyed into a New system- 6 or 7-pin SFIC keying system conforming to the following requirements:

B. Provide removable core cylinders at all exterior openings. Provide construction cores with construction master keying for use during construction. The hardware supplier, accompanied by the Owner or Owner's security agent, shall install permanent keyed cores upon completion of the project. The temporary construction cores are to be returned to the hardware supplier.

C. Provide permanent cores and cylinders keyed by the manufacturer or authorized distributor as directed by the Owner. Provide owner with a copy of the biting list, return receipt requested.

D. Provide patented keys, with a minimum of 5-year warranty against breakage, able to operate the manufacturer's patented restricted cylinders and high security restricted patented cylinders within the same master key system as follows

E. Three keys per core and/or cylinder.

F. Two construction core control keys

G. Two permanent core control keys

H. Six construction master keys for each type (Contractor is to provide one set of construction keys to Architect)

I. Deliver grand master keys, master keys, change keys, and/or key blanks from the factory or authorized distributor directly to the Owner in sealed containers, return receipt requested. Failure to comply with these requirements may be cause to require replacement of all or any part of the keying system that was compromised at no additional cost to the Owner.

3.3 EXAMINATION

A. Examine doors and frames, 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. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 PREPARATION

A. Steel Doors and Frames: Comply with A115 series.

B. Surface-Applied Door Hardware: Drill and tap doors and frames according to SDI 107.

C. Wood Doors: Comply with A115-W series.

3.5 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated in following applicable

publications, unless specifically indicated or required to comply with governing regulations:

B. Standard Steel Doors and Frames: "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."

C. Custom Steel Doors and Frames: Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."

D. Wood Doors: WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

E. Installation: Install each door hardware item to comply with manufacturer's 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. Do not install surface-mounted items until finishes have been completed on substrates involved.

F. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.

G. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

H. Key Control System: Place keys on markers and hooks in key control system cabinet, as determined by final keying schedule.

I. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with Designer.

J. Configuration: Provide the least number of power supplies required to adequately serve doors with electrified door hardware.

K. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Section 079200 - JOINT SEALANTS.

3.6 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.

B. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.

C. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

D. Door Closers: Adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

E. Six-Month Adjustment: Approximately six months after date of Substantial Completion, Installer shall perform the following:

F. Examine and readjust each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

G. Consult with and instruct the Owner's personnel on recommended maintenance procedures.

H. Replace door hardware items that have deteriorated or failed due to faulty design, materials, or installation of door hardware units.

3.7 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish. For sliding doors, clean track after installation before operation to ensure no debris/swarf can damage the wheels. Once installation is complete, tape underneath track to create barrier for any debris/dust throughout the rest of construction phase.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.8 HARDWARE SET SCHEDULE

Listed below.

HARDWARE SET INDEX

Each set is a bookmark (Navigation pane) and a link below; products link to their Part 2 paragraph.

HARDWARE SET # 001 Doors: EA-123, EV-111, WA-141
HARDWARE SET # 002 Doors: EL-01A, WL-1
HARDWARE SET # 004 Doors: 47068
HARDWARE SET # 007 Doors: EA-122
HARDWARE SET # 009 Doors: 16655, 16661, EU-104b, PD-100A, PD-100B, WU-113B
HARDWARE SET # 012A Doors: A-722, WC-A1, WC-A2, WC-B1, WC-B2
HARDWARE SET # 012AG Doors: EU-101, EU-104a, WU-113A, WU-1112
HARDWARE SET # 019 Doors: 46999, 47089, 47197, WU-115
HARDWARE SET # 020 Doors: EA-113, ES1-3, ES1-4, ES1-5, ES1-6, ES2-1A, ES2-3, ES2-4, ES2-5, ES2-6, ES-112, ES-212, ES-312, ES-412, ES-512, ES-612, FW-1A, FW-1B, FW-2A, FW-2B, FW-3A, FW-3B, FW-4A, FW-4B, FW-5A, FW-5B, S4-02B, S4-03B, S4-04B, S4-05B, S5-05A, S5-06A, S5-07, WA-21, WH-13A, WH-13B, WS1-1, WS1-02, WS1-3, WS1-4, WS2-2, WS2-3, WS2-4, WS2-5, WS2-6, WS-66, WS-131, WU-100B, WU-100C
HARDWARE SET # 020E Doors: EL-1, ES2-1B, S4-01C, S4-02A, S5-01, S5-02A, S6-07A, S6-07B, WC-1, WS1-01A, WS2-1, WU-100D
HARDWARE SET # 020EG Doors: ES1-2, ES2-2
HARDWARE SET # 020G Doors: EL-02A, S3-02, S3-03, S3-04, S3-05, S4-01B, S4-03A, S4-04A, S4-05A, S4-06A, S5-02B, S5-03A, S5-03B, S5-04A, S5-04B, S5-05B
HARDWARE SET # 024 Doors: A-700B, A-700C, A-700D, A-701B, A-701C, A-701D, A-705, A-706, A-710, A-714, A-715, A-716, A-717, A-719, A-723, A-724
HARDWARE SET # 031 Doors: EC-2, EC-3, EC-4, EC-5, EC-6, EL-01B
HARDWARE SET # 032 Doors: EEL-1, EEL-2, EEL-3, EEL-4, EEL-5, EEL-6, EL-02B, EL-03B, EL-04B, EL-05B, EL-06B
HARDWARE SET # 035 Doors: 31760, 46925, 47535, A-708, A-709, EU-102, WU-114
HARDWARE SET # 035G Doors: E-1646, ES-11, EU-105, EU-106, EU-108, EU-201, EU-202, EU-203, EU-204, EU-205, EU-206, EU-301, EU-302, EU-303, EU-304, EU-305, EU-306, EU-401, EU-402, EU-403, EU-404, EU-405, EU-406, EU-501, EU-502, EU-503, EU-504, EU-505, EU-506, EU-601, EU-602, EU-603, EU-604, EU-605, EU-606, PD-101, PD-102, PD-601, WU-101, WU-102, WU-103, WU-104, WU-105, WU-106, WU-107, WU-108, WU-201, WU-202, WU-203, WU-204, WU-205, WU-206, WU-207, WU-208, WU-209, WU-301, WU-302, WU-303, WU-304, WU-305, WU-306, WU-307, WU-308, WU-309, WU-401, WU-402, WU-403, WU-404, WU-405, WU-406, WU-407, WU-408, WU-409, WU-501, WU-502, WU-503, WU-504, WU-505, WU-506, WU-507, WU-508, WU-509, WU-601
HARDWARE SET # 037 Doors: A
HARDWARE SET # 038 Doors: B1a, B1b, B2, B5, B6
HARDWARE SET # 039 Doors: C1, C3, C4, E1a, E1b
HARDWARE SET # 040 Doors: C5a, C5b, C7, D2a, D2b, E2
HARDWARE SET # 041 Doors: EC-A21, EC-A22, EC-B21, EC-B22, S4-01A, WU-100A
HARDWARE SET # 042 Doors: WA-112

HARDWARE SET # 043 Doors: WU-116
HARDWARE SET # 044 Doors: EL-03A, EL-04A, EL-05A, EL-06A, S5-06B
HARDWARE SET # 045 Doors: A-702A, EL-07
HARDWARE SET # 046 Doors: A-700A, A-701A, A-718
HARDWARE SET # 047 Doors: A-702B, A-711, A-720, A-721

DOOR INDEX (door number → hardware set)

16655	009	**EEL-2**	032	**EU-505**	035G	**WS1-02**	020
16661	009	**EEL-3**	032	**EU-506**	035G	**WS1-3**	020
31760	035	**EEL-4**	032	**EU-601**	035G	**WS1-4**	020
46925	035	**EEL-5**	032	**EU-602**	035G	**WS2-1**	020E
46999	019	**EEL-6**	032	**EU-603**	035G	**WS2-2**	020
47068	004	**EL-1**	020E	**EU-604**	035G	**WS2-3**	020
47089	019	**EL-01A**	002	**EU-605**	035G	**WS2-4**	020
47197	019	**EL-01B**	031	**EU-606**	035G	**WS2-5**	020
47535	035	**EL-02A**	020G	**EV-111**	001	**WS2-6**	020
A	037	**EL-02B**	032	**FW-1A**	020	**WS-66**	020
A-700A	046	**EL-03A**	044	**FW-1B**	020	**WS-131**	020
A-700B	024	**EL-03B**	032	**FW-2A**	020	**WU-100A**	041
A-700C	024	**EL-04A**	044	**FW-2B**	020	**WU-100B**	020
A-700D	024	**EL-04B**	032	**FW-3A**	020	**WU-100C**	020
A-701A	046	**EL-05A**	044	**FW-3B**	020	**WU-100D**	020E
A-701B	024	**EL-05B**	032	**FW-4A**	020	**WU-101**	035G
A-701C	024	**EL-06A**	044	**FW-4B**	020	**WU-102**	035G
A-701D	024	**EL-06B**	032	**FW-5A**	020	**WU-103**	035G
A-702A	045	**EL-07**	045	**FW-5B**	020	**WU-104**	035G
A-702B	047	**ES1-2**	020EG	**PD-100A**	009	**WU-105**	035G
A-705	024	**ES1-3**	020	**PD-100B**	009	**WU-106**	035G
A-706	024	**ES1-4**	020	**PD-101**	035G	**WU-107**	035G
A-708	035	**ES1-5**	020	**PD-102**	035G	**WU-108**	035G
A-709	035	**ES1-6**	020	**PD-601**	035G	**WU-113A**	012AG
A-710	024	**ES2-1A**	020	**S3-02**	020G	**WU-113B**	009
A-711	047	**ES2-1B**	020E	**S3-03**	020G	**WU-114**	035
A-714	024	**ES2-2**	020EG	**S3-04**	020G	**WU-115**	019
A-715	024	**ES2-3**	020	**S3-05**	020G	**WU-116**	043
A-716	024	**ES2-4**	020	**S4-01A**	041	**WU-201**	035G
A-717	024	**ES2-5**	020	**S4-01B**	020G	**WU-202**	035G
A-718	046	**ES2-6**	020	**S4-01C**	020E	**WU-203**	035G
A-719	024	**ES-11**	035G	**S4-02A**	020E	**WU-204**	035G
A-720	047	**ES-112**	020	**S4-02B**	020	**WU-205**	035G
A-721	047	**ES-212**	020	**S4-03A**	020G	**WU-206**	035G
A-722	012A	**ES-312**	020	**S4-03B**	020	**WU-207**	035G
A-723	024	**ES-412**	020	**S4-04A**	020G	**WU-208**	035G
A-724	024	**ES-512**	020	**S4-04B**	020	**WU-209**	035G
B1a	038	**ES-612**	020	**S4-05A**	020G	**WU-301**	035G
B1b	038	**EU-101**	012AG	**S4-05B**	020	**WU-302**	035G
B2	038	**EU-102**	035	**S4-06A**	020G	**WU-303**	035G
B5	038	**EU-104a**	012AG	**S5-01**	020E	**WU-304**	035G
B6	038	**EU-104b**	009	**S5-02A**	020E	**WU-305**	035G
C1	039	**EU-105**	035G	**S5-02B**	020G	**WU-306**	035G
C3	039	**EU-106**	035G	**S5-03A**	020G	**WU-307**	035G
C4	039	**EU-108**	035G	**S5-03B**	020G	**WU-308**	035G
C5a	040	**EU-201**	035G	**S5-04A**	020G	**WU-309**	035G
C5b	040	**EU-202**	035G	**S5-04B**	020G	**WU-401**	035G
C7	040	**EU-203**	035G	**S5-05A**	020	**WU-402**	035G

D2a	040	**EU-204**	035G	**S5-05B**	020G	**WU-403**	035G
D2b	040	**EU-205**	035G	**S5-06A**	020	**WU-404**	035G
E1a	039	**EU-206**	035G	**S5-06B**	044	**WU-405**	035G
E1b	039	**EU-301**	035G	**S5-07**	020	**WU-406**	035G
E2	040	**EU-302**	035G	**S6-07A**	020E	**WU-407**	035G
E-1646	035G	**EU-303**	035G	**S6-07B**	020E	**WU-408**	035G
EA-113	020	**EU-304**	035G	**WA-21**	020	**WU-409**	035G
EA-122	007	**EU-305**	035G	**WA-112**	042	**WU-501**	035G
EA-123	001	**EU-306**	035G	**WA-141**	001	**WU-502**	035G
EC-2	031	**EU-401**	035G	**WC-1**	020E	**WU-503**	035G
EC-3	031	**EU-402**	035G	**WC-A1**	012A	**WU-504**	035G
EC-4	031	**EU-403**	035G	**WC-A2**	012A	**WU-505**	035G
EC-5	031	**EU-404**	035G	**WC-B1**	012A	**WU-506**	035G
EC-6	031	**EU-405**	035G	**WC-B2**	012A	**WU-507**	035G
EC-A21	041	**EU-406**	035G	**WH-13A**	020	**WU-508**	035G
EC-A22	041	**EU-501**	035G	**WH-13B**	020	**WU-509**	035G
EC-B21	041	**EU-502**	035G	**WL-1**	002	**WU-601**	035G
EC-B22	041	**EU-503**	035G	**WS1-1**	020	**WU-1112**	012AG
EEL-1	032	**EU-504**	035G	**WS1-01A**	020E		

HARDWARE SET # 001
PR 6'0"x7'0"x13/4" 20 MIN
Door #: WA-141
PR 6'0"x7'0"x13/4" 45 MIN
Door #: EA-123
PR 6'0"x7'0"x13/4" NON-RTD
Door #: EV-111
Each to have:

1 EA	NARROW STYLE CVR EXIT DEVICE	6008DNS-W-1079	622	DET
1 EA	CONCEALED VERT ROD LATCH RETRACTION		6008DNV-W-ER-1079	
622	DET			
1 EA	POWER SUPPLY	PS440B	689	CAC
2 EA	CYLINDER WITH SFIC CORE	CYLINDER WITH SFIC CORE	622	FRS
1 EA	DOOR CLOSER	D4550-EDA-CS	622	DET
1 EA	ADA LOW ENERGY OPERATOR	CATHDO100	696	CAC
1 EA	ADA WALL DUAL SWITCH VEST/ENTRY	CM-2520/4	613	CAM
1 EA	ADA SQUARE SWITCH	CM-45/2	613	CAM
1 EA	ADA THERMAL BREAK THRESHOLD	8433TPV X LENGTH REQUIRED	A	NGP
1 SET	WEATHERSTRIPPING	1038N X LENGTH	BLK	NGP
2 EA	AUTO DOOR BOTTOM	522N	BK	NGP
1 SET	ASTRAGAL FOR BOTH DRS ACTIVE	A605 X LENGTH REQUIRED	BLK	NGP
1 SET	FRAME FROG ELECTRIC BOXES BY TAD	POLE	WPK1LS-001	
GRN	FRF			
1 EA	**CONT, GEAR HINGE PREP FOR EPT**	**A120HD X EPT LENGTH REQUIRED**	**CA**	**ABH**
1 EA	**CONT, GEAR HINGE**	**A120HD X LENGTH REQUIRED**	**CA**	**ABH**
1 EA	**POWER TRANSFER**	**CAT EPT**	**689**	**CAC**

Notes:
OPERATION: OS-805 — Exterior Access-Controlled Automatic Door.

↑ Hardware Set Index

HARDWARE SET # 002
PR 6'0"x7'0"x13/4" NON-RTD
Door #: WL-1
PR 6'0"x7'0"x13/4" 45 MIN
Door #: EL-01A
Each to have:

1 EA	**NARROW STYLE CVR EXIT DEVICE**	**F6008DNS-W-1079**	**622**	**DET**
1 EA	**CONCEALED VERT ROD LATCH RETRACTION**		**F6008DNV-W-ER-1079**	**622 DET**
1 EA	POWER SUPPLY	PS440B	689	CAC
2 EA	CYLINDER WITH SFIC CORE	CYLINDER WITH SFIC CORE	622	FRS
1 EA	DOOR CLOSER	D4550-EDA-CS	622	DET
1 EA	ADA LOW ENERGY OPERATOR	CATHDO100	696	CAC
2 EA	ADA SQUARE SWITCH	CM-45/2	613	CAM
2 EA	AUTO DOOR BOTTOM	522N	BK	NGP
1 SET	FRAME FROG ELECTRIC BOXES BY TADPOLE		WPK1LS-001	
GRN	FRF			
6 EA	**HINGE, FULL MORT, STD WGT.**	**BB81 4.5" X 4.5"**	**800**	**PBB**
1 EA	**POWER TRANSFER**	**CAT EPT**	**689**	**CAC**
1 SET	**GASKETING**	**5050C X LENGTH**	**BLK**	**NGP**
1 SET	**ASTRAGAL**	**C607 X LENGTH REQ.**	**BLK**	**NGP**

Notes:
OPERATION: OS-805 — Exterior Access-Controlled Automatic Door.
↑ Hardware Set Index

HARDWARE SET # 004
SGL 4'01/2"x7'91/2"x13/4" NON-RTD
Door #: 47068
Each to have:

1 SET	3/4 OFFSET PIVOT SET 600 LBS.	0117.50	622	ABH
1 EA	ELECTRIFIED 3/4 OFFSET INTER. PIVOT		CM019 - DPS	
622	ABH			
1 EA	NARROW STYLE RIM EXIT DEVICE	4008DNS-ER-W-1079	622	DET
1 EA	POWER SUPPLY	PS440B	689	CAC
1 EA	CYLINDER WITH SFIC CORE	CYLINDER WITH SFIC CORE	622	FRS
1 EA	ADA LOW ENERGY OPERATOR	CATHDO100	696	CAC
2 EA	ADA SQUARE SWITCH	CM-45/2	613	CAM
1 EA	ADA THERMAL BREAK THRESHOLD	8433TPV X LENGTH REQUIRED	A	NGP
1 SET	WEATHERSTRIPPING	1038N X LENGTH	BLK	NGP
1 EA	AUTO DOOR BOTTOM	522N	BK	NGP
1 SET	FRAME FROG ELECTRIC BOXES BY TADPOLE		WPK1LS-001	
GRN	FRF			

Notes:
OPERATION: OS-805 — Exterior Access-Controlled Automatic Door.
↑ Hardware Set Index

HARDWARE SET # 007
SGL 3'6"x7'0"x13/4" NON-RTD
Door #: EA-122
Each to have:

3 EA	EXTERIOR HINGE NRP	BB51-4.5 X 4.5 - NRP	800	PBB
1 EA	CYLINDER WITH SFIC CORE	CYLINDER WITH SFIC CORE	622	FRS
1 EA	STOREROOM MORTISE LOCK	MODULO 745 - SM- M507	622	FRS
1 EA	DOOR CLOSER	D4550-EDA-CS	622	DET
1 EA	ADA THERMAL BREAK THRESHOLD	8433TPV X LENGTH REQUIRED	A	NGP
1 SET	WEATHERSTRIPPING	1038N X LENGTH	BLK	NGP
1 EA	DOOR SWEEP	200N X LENGTH REQUIRED	BLK	NGP

↑ Hardware Set Index

HARDWARE SET # 009
SGL 8'0"x7'0"x1/4" 90 MIN
Door #: EU-104b, WU-113B
SGL 24'0"x7'0"x1/4" NON-RTD
Door #: 16655, 16661
SGL 24'0"x9'0"x1/4" NON-RTD
Door #: PD-100A
SGL 24'0"x8'0"x1/4" NON-RTD
Door #: PD-100B
Each to have:

1 EA	ALL HARDWARE BY OVERHEAD DOOR MANUFACTURER		BY OTHERS	0 MAN

Notes:
Overhead coiling door — all hardware by the door manufacturer.
↑ Hardware Set Index

HARDWARE SET # 012A
PR 6'0"x7'0"x13/4" NON-RTD
Door #: A-722, WC-A1, WC-A2, WC-B1, WC-B2
Each to have:

2 EA	DOOR CLOSER	D4550-EDA-CS	622	DET
1 EA	ADA THERMAL BREAK THRESHOLD	8433TPV X LENGTH REQUIRED	A	NGP
1 SET	WEATHERSTRIPPING	1038N X LENGTH	BLK	NGP
1 SET	ASTRAGAL	C607 X LENGTH REQ.	BLK	NGP
1 EA	EXTERIOR DOOR SWEEP	101V X LENGTH REQUIRED	BLK	NGP
2 EA	AUTO DOOR BOTTOM	522N	BK	NGP
1 EA	**NARROW STYLE CVR EXIT DEVICE**	**6008DNS-W-1079**	**622**	**DET**
1 EA	**CONCEALED VERT ROD LATCH RETRACTION**		**6008DNV-W-ER-1079**	
622	**DET**			
1 EA	**CONT, GEAR HINGE**	**A120HD X LENGTH REQUIRED**	**CA**	**ABH**
1 EA	**CONT, GEAR HINGE PREP FOR EPT**	**A120HD X EPT LENGTH REQUIRED**	**CA**	**ABH**
1 EA	**POWER SUPPLY**	**PS440B**	**689**	**CAC**
1 EA	**POWER TRANSFER**	**CAT EPT**	**689**	**CAC**
1 EA	**CARD READER BY OTHER**	**0**	**0**	**0**

↑ Hardware Set Index

HARDWARE SET # 012AG
PR 6'0"x7'0"x13/4" 90 MIN
Door #: EU-104a, WU-113A
PR 6'0"x7'0"x13/4" NON-RTD
Door #: EU-101, WU-1112
Each to have:

2 EA	HINGE, CONTINUOUS	SL18HD X LENGTH REQUIRED	630	SEL
2 EA	**TOP ROD SVR ROD EXIT DEVICE**	**2103-W-FSB1035**	**630**	**DET**
2 EA	DOOR CLOSER	D4550-EDA-CS	630	DET
1 EA	ADA THERMAL BREAK THRESHOLD	8433TPV X LENGTH REQUIRED	A	NGP
1 SET	WEATHERSTRIPPING	1038N X LENGTH	BLK	NGP
1 SET	ASTRAGAL	C607 X LENGTH REQ.	BLK	NGP
2 EA	EXTERIOR DOOR SWEEP	101V X LENGTH REQUIRED	BLK	NGP

↑ Hardware Set Index

HARDWARE SET # 019
SGL 3'0"x7'0"x13/4" NON-RTD
Door #: 46999, 47089, 47197, WU-115
Each to have:

3 EA	HINGE, FULL MORT, STD WGT.	BB81 4.5" X 4.5"	800	PBB
1 EA	CYLINDER WITH SFIC CORE	CYLINDER WITH SFIC CORE	622	FRS
1 EA	STOREROOM MORTISE LOCK	MODULO 745 - SM- M507	622	FRS
1 SET	GASKETING	5050C X LENGTH	BLK	NGP
1 EA	AUTO DOOR BOTTOM	522N	BK	NGP
1 EA	WALL BUMPERS	1407	622	DON

↑ Hardware Set Index

HARDWARE SET # 020
SGL 3'0"x7'0"x13/4" 180 MIN
Door #: FW-1A, FW-1B, FW-2A, FW-2B, FW-3A, FW-3B, FW-4A, FW-4B, FW-5A, FW-5B
SGL 3'0"x7'0"x13/4" 20 MIN
Door #: WA-21, WH-13A, WH-13B, WS-131
SGL 3'0"x7'0"x13/4" 90 MIN
Door #: ES1-3, ES1-4, ES1-5, ES1-6, ES2-1A, ES2-3, ES2-4, ES2-5, ES2-6, ES-112, ES-212, ES-312, ES-412, ES-512, ES-612, S4-02B, S4-03B, S4-04B, S4-05B, S5-05A, S5-06A, WS1-1, WS2-2, WS2-3, WS2-4, WS2-5
SGL 3'0"x7'0"x13/4" NON-RTD
Door #: S5-07, WU-100B, WU-100C
SGL 3'0"x7'0"x13/4" 45 MIN
Door #: EA-113
SGL xx NON-RTD
Door #: WS1-02, WS1-3, WS1-4, WS2-6, WS-66
Each to have:

3 EA	HINGE, FULL MORT, STD WGT.	BB81 4.5" X 4.5"	800	PBB
1 EA	RATED PASSAGE EXIT DEVICE	F1014D-W-FSB1035	622	DET
1 EA	DOOR CLOSER	D3550-REG	622	DET
1 SET	WEATHERSTRIPPING	2P X LENGTH REQUIRED	BLK	NGP
1 EA	AUTO DOOR BOTTOM	335N X LENGTH REQ.	BK	NGP
1 EA	WALL BUMPERS	1407	622	DON
1 EA	KICKPLATE 10" HIGH	90 - 10" X LENGTH MINUS 2"	613	DON

↑ Hardware Set Index

HARDWARE SET # 020E
SGL 3'0"x7'0"x13/4" NON-RTD
Door #: EL-1, ES2-1B, WC-1, WS1-01A, WS2-1, WU-100D
SGL 3'0"x7'0"x13/4" 90 MIN
Door #: S4-01C, S4-02A, S5-02A
SGL 3'0"x8'0"x13/4" NON-RTD
Door #: S6-07A, S6-07B
SGL 2'111/2"x6'113/4"x13/4" NON-RTD
Door #: S5-01
Each to have:

1 SET	WEATHERSTRIPPING	1038N X LENGTH	BLK	NGP
1 EA	DOOR SWEEP	200N X LENGTH REQUIRED	BLK	NGP
1 EA	KICKPLATE 10" HIGH	90 - 10" X LENGTH MINUS 2"	613	DON
1 EA	CONT, GEAR HINGE PREP FOR EPT	A120HD X EPT LENGTH REQUIRED	CA	ABH
1 EA	POWER TRANSFER	CAT EPT	689	CAC
1 EA	EXIT DEVICE W/LATCH RETRACTION	1008D-W-ER-FSB1035	622	DET
1 EA	CYLINDER WITH SFIC CORE	CYLINDER WITH SFIC CORE	622	FRS
1 EA	DOOR CLOSER	D4550-EDA-CS	622	DET
1 EA	**CARD READERS BY OTHERS**	**0**	**0**	**0**
1 EA	**ADA THERMAL BREAK THRESHOLD**	**8433TPV X LENGTH REQUIRED**	**A**	**NGP**

↑ Hardware Set Index

HARDWARE SET # 020EG
SGL 3'6"x7'0"x13/4" 90 MIN
Door #: ES1-2, ES2-2
Each to have:

1 EA	RATED PASSAGE EXIT DEVICE	F1014D-W-FSB1035	622	DET
1 EA	CYLINDER WITH SFIC CORE	CYLINDER WITH SFIC CORE	622	FRS
1 EA	DOOR CLOSER	D4550-EDA-CS	blk	DET
1 EA	ADA THERMAL BREAK THRESHOLD	8433TPV X LENGTH REQUIRED	A	NGP
1 SET	WEATHERSTRIPPING	1038N X LENGTH	BLK	NGP
1 EA	DOOR SWEEP	200N X LENGTH REQUIRED	BLK	NGP
1 EA	KICKPLATE 10" HIGH	90 - 10" X LENGTH MINUS 2"	622	DON
1 EA	**HVT WGT. HINGE**	**4B81-4.5 X 4.5**	**622**	**PBB**

↑ Hardware Set Index

HARDWARE SET # 020G
SGL 3'0"x7'0"x13/4" 90 MIN
Door #: S3-02, S3-03, S3-04, S3-05, S4-03A, S4-04A, S4-05A, S4-06A, S5-02B, S5-03A, S5-03B, S5-04A, S5-04B, S5-05B
SGL 3'0"x7'0"x13/4" 45 MIN
Door #: EL-02A
SGL 3'0"x7'0"x13/4" NON-RTD
Door #: S4-01B
Each to have:

3 EA	HINGE, FULL MORT, STD WGT.	BB81 4.5" X 4.5"	630	PBB
1 EA	RATED PASSAGE EXIT DEVICE	F1014D-W-FSB1035	630	DET
1 EA	CYLINDER WITH SFIC CORE	CYLINDER WITH SFIC CORE	630	FRS
1 EA	DOOR CLOSER	D3550-REG	630	DET
1 SET	WEATHERSTRIPPING	2P X LENGTH REQUIRED	BLK	NGP
1 EA	AUTO DOOR BOTTOM	335N X LENGTH REQ.	BK	NGP
1 EA	WALL BUMPERS	1407	630	DON
1 EA	KICKPLATE 10" HIGH	90 - 10" X LENGTH MINUS 2"	630	DON

↑ Hardware Set Index

HARDWARE SET # 024
SGL 3'0"x8'0"x13/4" NON-RTD
Door #: A-700B, A-700C, A-700D, A-701B, A-701C, A-701D, A-705, A-706, A-710, A-714, A-715, A-716, A-717, A-719, A-723, A-724
Each to have:

1 SET	CLOSER HINGES	AX-L/R-30-4.5	800	PBB
1 EA	PRIVACY WITH INDICATOR	MODULO 745 - SM - H41 -M527	622	FRS
1 SET	GASKETING	5050C X LENGTH	BLK	NGP
1 EA	AUTO DOOR BOTTOM	335N X LENGTH REQ.	BK	NGP
1 EA	WALL BUMPERS	1407	622	DON

↑ Hardware Set Index

HARDWARE SET # 031
PR 6'0"x7'0"x13/4" 45 MIN
Door #: EC-2, EC-3, EC-4, EC-5, EC-6
SGL 12'0"x7'0"x1/4" 90 MIN
Door #: EL-01B
Each to have:

1 EA	TOTAL DOOR MFG	DOORS AND HARDWARE BY TOTAL DOOR		TBD
TDS				

↑ Hardware Set Index

HARDWARE SET # 032
PR 8'0"x7'0"x13/4" 90 MIN
Door #: EL-02B
PR 8'0"x7'0"x13/4" 45 MIN
Door #: EL-03B, EL-04B, EL-05B, EL-06B
PR 6'0"x7'0"x13/4" 45 MIN
Door #: EEL-2, EEL-3, EEL-4, EEL-5, EEL-6
SGL xx NON-RTD
Door #: EEL-1
Each to have:

1 EA	TOTAL DOOR MFG	DOORS AND HARDWARE BY TOTAL DOOR		TBD
TDS				

↑ Hardware Set Index

HARDWARE SET # 035
SGL 3'0"x7'0"x13/4" NON-RTD
Door #: WU-114
SGL 3'0"x7'0"x13/4" 20 MIN
Door #: 31760, 46925, 47535, EU-102
SGL 3'0"x8'0"x13/4" NON-RTD
Door #: A-708, A-709
Each to have:

3 EA	HINGE, FULL MORT, STD WGT.	BB81 4.5" X 4.5"	800	PBB
1 EA	CYLINDER WITH SFIC CORE	CYLINDER WITH SFIC CORE	622	FRS
1 EA	STOREROOM MORTISE LOCK	MODULO 745 - SM- M507	622	FRS
1 EA	DOOR CLOSER	D3550-REG	622	DET
1 SET	GASKETING	5050C X LENGTH	BLK	NGP
1 EA	AUTO DOOR BOTTOM	522N	BK	NGP
1 EA	WALL BUMPERS	1407	622	DON

↑ Hardware Set Index

HARDWARE SET # 035G
SGL 3'0"x7'0"x13/4" 20 MIN
Door #: E-1646, EU-105, EU-106, EU-108, EU-201, EU-202, EU-203, EU-204, EU-205, EU-206, EU-301, EU-302, EU-303, EU-304, EU-305, EU-306, EU-401, EU-402, EU-403, EU-404, EU-405, EU-406, EU-501, EU-502, EU-503, EU-504, EU-505, EU-506, EU-601, EU-602, EU-603, EU-604, EU-605, EU-606, WU-101, WU-102, WU-103, WU-104, WU-105, WU-106, WU-107, WU-108, WU-201, WU-202, WU-203, WU-204, WU-205, WU-206, WU-207, WU-208, WU-209, WU-301, WU-302, WU-303, WU-304, WU-305, WU-306, WU-307, WU-308, WU-309, WU-401, WU-402, WU-403, WU-404, WU-405, WU-406, WU-407, WU-408, WU-409, WU-501, WU-502, WU-503, WU-504, WU-505, WU-506, WU-507, WU-508, WU-509, WU-601
SGL xx NON-RTD
Door #: ES-11
SGL 3'0"x7'0"x13/4" 45 MIN
Door #: PD-101
SGL 3'0"x7'0"x13/4" NON-RTD
Door #: PD-102, PD-601
Each to have:

3 EA	HINGE, FULL MORT, STD WGT.	BB81 4.5" X 4.5"	630	PBB
1 EA	CYLINDER WITH SFIC CORE	CYLINDER WITH SFIC CORE	630	FRS
1 EA	STOREROOM MORTISE LOCK	MODULO 745 - SM- M507	630	FRS
1 EA	DOOR CLOSER	D3550-REG	630	DET
1 SET	GASKETING	5050C X LENGTH	BLK	NGP
1 EA	AUTO DOOR BOTTOM	522N	BK	NGP
1 EA	WALL BUMPERS	1407	630	DON

↑ Hardware Set Index

HARDWARE SET # 037
SGL 3'0"x7'0"x13/4" 20 MIN
Door #: A (x293)
Each to have:

3 SET	CLOSER HINGES	AX-L/R-30-4.5	800	PBB
1 EA	APT ENTRY SMART LOCK - XS4 MINI W/ KEY OVERRIDE - FRS 745 LEVER	622	XS4 MINI - KEY SAL	
1 EA	CYLINDER WITH SFIC CORE	CYLINDER WITH SFIC CORE	622	FRS
1 EA	3" WIDE X 1/2" HIGH SADDLE THRESHOLD REQUIRED	BLK	323 X LENGTH NGP	
1 SET	GASKETING	5050C X LENGTH	BLK	NGP
1 EA	AUTO DOOR BOTTOM	335N X LENGTH REQ.	BK	NGP
1 EA	WALL BUMPERS	1407	622	DON
1 EA	DOOR VIEWER	UDLV90	622	DON
1 EA	UL DOOR VIEWER COVER	ULDV90 - DVC	622	DON
1 EA	DOOR FLIP GUARD	1606	622	DON

Notes:
Salto XS4 Mini with key override and Frascio 745 lever.
↑ Hardware Set Index

HARDWARE SET # 038
SGL 2'10"x6'8"x13/4" NON-RTD
Door #: B1a (x1103), B2 (x751)
SGL 3'0"x6'8"x13/4" NON-RTD
Door #: B1b, B5, B6
Each to have:

1 EA	PRIVACY SET	T700-745-SM-PY-2 3/8"-ISC-TSTK1	622	FRS
1 EA	BASE STOP	1508	622	DON
3 EA	**HINGE BY PREHANGER**	**HINGE BY PREHANGER**	**0**	**PBB**

Notes:
Hinges by others (door manufacturer).
↑ Hardware Set Index

HARDWARE SET # 039
SGL 2'10"x6'8"x13/4" NON-RTD
Door #: C1, E1a (x404), E1b
SGL 2'6"x6'8"x13/4" NON-RTD
Door #: C3 (x40)
SGL 2'4"x6'8"x13/4" NON-RTD
Door #: C4 (x55)
Each to have:

1 EA	PASSAGE SET	T700-745-SM-PA-2 3/8"-ISC-TSTK1	622	FRS
1 EA	BASE STOP	1508	622	DON
3 EA	**HINGE BY PREHANGER**	**HINGE BY PREHANGER**	**0**	**PBB**

Notes:
Hinges by others (door manufacturer).
↑ Hardware Set Index

HARDWARE SET # 040
PR 4'0"x6'8"x13/4" NON-RTD
Door #: C5a (x711)
PR 5'8"x6'8"x13/4" NON-RTD
Door #: C5b
PR 3'8"x6'8"x13/4" NON-RTD
Door #: C7 (x61)
PR 5'0"x6'8"x13/4" NON-RTD
Door #: D2a (x144)
PR 4'6"x6'8"x13/4" NON-RTD
Door #: D2b, E2 (x49)
Each to have:

2 EA	SINGLE DUMMY TRIM	T700-745-SM-SD-TB-2 3/8"	622	FRS
2 EA	ROLLER LATCH	1702	622	DON
6 EA	**HINGE BY PREHANGER**	**HINGE BY PREHANGER**	**0**	**PBB**

Notes:
Hinges by others (door manufacturer).
↑ Hardware Set Index

HARDWARE SET # 041
SGL 4'0"x7'0"x13/4" 20 MIN
Door #: WU-100A
SGL 3'0"x7'0"x13/4" NON-RTD
Door #: EC-A21, EC-A22, EC-B21, EC-B22
SGL 3'0"x7'0"x13/4" 90 MIN
Door #: S4-01A
Each to have:

1 EA	EXIT DEVICE W/LATCH RETRACTION	1008D-W-ER-FSB1035	622	DET
1 EA	CONT, GEAR HINGE PREP FOR EPT	A120HD X EPT LENGTH REQUIRED	CA	ABH
1 EA	CYLINDER WITH SFIC CORE	CYLINDER WITH SFIC CORE	622	FRS
1 EA	DOOR CLOSER	D4550-EDA-CS	622	DET
1 EA	KICKPLATE 10" HIGH	90 - 10" X LENGTH MINUS 2"	622	DON
1 EA	POWER SUPPLY	PS440B	689	CAC
1 EA	POWER TRANSFER	CAT EPT	622	CAC
1 EA	CAR READER BY OTHERS	CARD READER BY OTHERS	0	0

↑ Hardware Set Index

HARDWARE SET # 042
SGL 3'0"x7'0"x13/4" NON-RTD
Door #: WA-112
Each to have:

1 EA	EXTERIOR HINGE NRP	BB51-4.5 X 4.5 - NRP	800	PBB
1 EA	EXIT DEVICE	1008D-W-CD-FSB1035	622	DET
1 EA	CYLINDER WITH SFIC CORE	CYLINDER WITH SFIC CORE	622	FRS
1 EA	DOOR CLOSER	D4550-EDA-CS	622	DET
1 EA	ADA THERMAL BREAK THRESHOLD	8433TPV X LENGTH REQUIRED	A	NGP
1 SET	WEATHERSTRIPPING	1038N X LENGTH	BLK	NGP
1 EA	DOOR SWEEP	200N X LENGTH REQUIRED	BLK	NGP

↑ Hardware Set Index

HARDWARE SET # 043
PR 6'0"x7'0"x13/4" NON-RTD
Door #: WU-116
Each to have:

2 EA	CONT, GEAR HINGE	A120HD X LENGTH REQUIRED	CA	ABH
1 EA	STOREROOM MORTISE LOCK	MODULO 745 - SM- M507	622	FRS
1 EA	CYLINDER WITH SFIC CORE	CYLINDER WITH SFIC CORE	622	FRS
2 EA	DOOR CLOSER	D4550-EDA-CS	622	DET
1 EA	DUST PROOF STRIKES	1570	622	DON
2 EA	FLUSH BOLTS MANUAL	1555	622	DON
1 SET	ASTRAGAL	C607 X LENGTH REQ.	BLK	NGP
1 EA	THRESHOLD	425 X LENGTH REQUIRED	BK	NGP
2 EA	EXTERIOR DOOR SWEEP	101V X LENGTH REQUIRED	BLK	NGP

↑ Hardware Set Index

HARDWARE SET # 044
SGL 3'0"x7'0"x13/4" 90 MIN
Door #: S5-06B
SGL 3'0"x7'0"x13/4" 45 MIN
Door #: EL-03A, EL-04A, EL-05A, EL-06A
Each to have:

1 EA	CONT, GEAR HINGE PREP FOR EPT	A120HD X EPT LENGTH REQUIRED	CA	ABH
1 EA	STOREROOM MORTISE LATCH RETRACTION		LPM193EU X 17	
622, 626	CAC			
1 EA	CYLINDER WITH SFIC CORE	CYLINDER WITH SFIC CORE	622	FRS
1 EA	DOOR CLOSER	D4550-EDA-CS	622	DET
1 SET	WEATHERSTRIPPING	1038N X LENGTH	BLK	NGP
1 EA	AUTO DOOR BOTTOM	522N	BK	NGP
1 EA	WALL BUMPERS	1407	622	DON
1 EA	POWER TRANSFER	CAT EPT	689	CAC
1 EA	POWER SUPPLY	PS440B	689	CAC
1 EA	CAR READER BY OTHERS	CARD READER BY OTHERS	0	0

↑ Hardware Set Index

HARDWARE SET # 045
PR 7'0"x8'0"x13/4" NON-RTD
Door #: EL-07
PR 6'0"x7'0"x13/4" NON-RTD
Door #: A-702A
Each to have:

8 EA	HINGE, FULL MORT, STD WGT.	BB81 4.5" X 4.5"	800	PBB
1 EA	CONCEALED VERT ROD LATCH RETRACTION		6008DNV-W-ER-1079	
622	DET			
1 EA	NARROW STYLE CVR EXIT DEVICE	6008DNS-1079-W	622	DET
2 EA	CYLINDER WITH SFIC CORE	CYLINDER WITH SFIC CORE	622	FRS
2 EA	DOOR CLOSER	D3550-REG	622	DET
1 EA	DOOR COORDINATOR	2011	622	DON
2 EA	CONCAVE WROUGHT WALL STOP	S123	0	SMH
1 SET	GASKETING	5050C X LENGTH	BLK	NGP
1 EA	AUTO DOOR BOTTOM	522N	BK	NGP

↑ Hardware Set Index

HARDWARE SET # 046
SGL 3'0"x8'0"x13/4" NON-RTD
Door #: A-700A, A-701A, A-718
Each to have:

3 EA	HINGE, FULL MORT, STD WGT.	BB81 4.5" X 4.5"	800	PBB
1 EA	DOOR CLOSER	D3550-REG	622	DET
1 EA	KICKPLATE 10" HIGH	90 - 10" X LENGTH MINUS 2"	622	DON
1 EA	PULL PLATE .125	7816-4" X 16"	622	DON
1 EA	PUSH PLATE .125	76-4" X 16"	622	DON

↑ Hardware Set Index

HARDWARE SET # 047
SGL 3'0"x7'0"x13/4" NON-RTD
Door #: A-702B
SGL 3'0"x8'0"x13/4" NON-RTD
Door #: A-711, A-720, A-721
Each to have:

4 EA	HINGE, FULL MORT, STD WGT.	BB81 4.5" X 4.5"	800	PBB
1 EA	NARROW STYLE MORTISE DEADLOCK	1603 X 7200P	622, 630	ACC
1 EA	DOOR CLOSER	D3550-REG	622	DET
1 SET	SOUND GASKETING SYSTEM	6049STC	CA	LEG
1 EA	WALL BUMPERS	1407	622	DON

Notes:
Note there are two pulls for these openings.
↑ Hardware Set Index

End of section

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SECTION 08 80 00
GLAZING

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 SECTION INCLUDES

A. Insulating glass units.

B. Glazing units.

C. Glazing compounds.

1.03 RELATED REQUIREMENTS

A. Section 05 73 13 - Glazed Decorative Metal Railings: Glass panels in railing systems.

B. Section 07 92 00 - Joint Sealants: Sealants for other than glazing purposes.

C. Section 08 43 13 - Aluminum-Framed Storefronts: Glazing provided as part of storefront assembly.

D. Section 08 83 00 - Mirrors.

1.04 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.

E. ASTM C1036 - Standard Specification for Flat Glass.

F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.

G. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass.

H. ASTM C1193 - Standard Guide for Use of Joint Sealants.

I. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass.

J. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings.

K. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.

L. GANA (GM) - GANA Glazing Manual.

M. GANA (SM) - GANA Sealant Manual.

N. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use.

O. NFRC 100 - Procedure for Determining Fenestration Product U-factors.

P. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

Q. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for glazing during and after installation.

B. Preconstruction Testing:
   1. Preconstruction Adhesion and Compatibility Testing: Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
      a. Testing will not be required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted

1.06 SUBMITTALS

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

B. Product Data on Insulating Glass Unit, Glazing Unit, Plastic Sheet Glazing Unit, and Plastic Film 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. Samples: Submit two samples 12 by 12 inch in size of glass units.

E. Samples: Submit 8 inch long bead of glazing sealant, color as selected.

F. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

G. Certificate: Certify that products of this section meet or exceed specified requirements.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for glazing sealants.
   1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

I. Preconstruction adhesion and compatibility test report.

J. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data, signed and sealed by the qualified professional engineer responsible for their preparation and licensed in Louisiana.

K. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.07 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods. Maintain one copy on site.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

C. Source Limitations:
   1. Obtain glass from single source and single manufacturer for each product and installation method.
   2. Obtain glazing accessories from single source and single manufacturer for each product and installation method.

1.08 MOCK-UPS

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

B. Provide materials listed in this section for use in mock-up of exterior skin systems including glass and air barrier and vapor retarder seal.

C. Locate where directed.

D. Mock-ups may not remain as part of the Work.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original unopened packaging. Inspect for damage.

B. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.10 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.

1.11 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. All Warranty requirements shall be from Date of Substantial Completion.

C. 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.

D. Laminated Glass: Provide a five (5) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Glass Manufacturers:
1. Cardinal Glass Industries: www.cardinalcorp.com.
2. GGI (General Glass):www.generalglass.com.
3. Guardian Industries Corp: www.sunguardglass.com.
4. Oldcastle Building Envelope: www.obe.com.
5. Saint Gobain North America: www.saint-gobain.com.
6. Vitro Architectural Glass: www.vitroglazings.com.

B. Laminated Glass Manufacturers:
1. Cardinal Glass Industries: www.cardinalcorp.com.
2. Guardian Industries Corp: www.sunguardglass.com.
3. Oldcastle Building Envelope: www.obe.com.
4. Pilkington North America Inc: www.pilkington.com/na.
5. Saint Gobain North America: www.saint-gobain.com.
6. Viracon, Architectural Glass segment of Apogee Enterprises, Inc: www.viracon.com.
7. Vitro Architectural Glass: www.vitroglazings.com.
8. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 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, without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
1. Design Pressure: Calculated in accordance with ASCE 7 and as indicated on Drawings for Components and Cladding.
2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
3. 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.
    a. AAMA TIR-11 establishes a deflection limit of L/175 for spans less than 13 feet 6 inches and L/240 + 1/4 inch for spans greater than that. The additional 1/4 inch provides for a smooth transition between the L/175 criteria below 13 feet 6 inches, and the L/240 + 1/4 inch criteria above it.
    b. Design glazing units to reliably perform and remain reliably engaged on all edges under all service and thermal stresses, including those associated with partial shading.

4. Limit center of glass deflection to the lesser of 3/4 -inches or L/100 (where L is short side dimension of glass unit), or flexure limit of glass, whichever is less, with full recovery of glazing materials.
5. Glass thicknesses listed are minimum.
6. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
7. Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass to resist each of the following combinations of loads:
    a. Outward design wind pressure minus the weight of the glass. Base design on glass type factors for short-duration load.
    b. Inward design wind pressure plus the weight of the glass plus half of the design snow load. Base design on glass type factors for short-duration load.
    c. Half of the inward design wind pressure plus the weight of the glass plus the design snow load. Base design on glass type factors for long-duration load.
8. Glass Type Factors for Wired Glass:
    a. Short-Duration Glass Type Factor for Wired Glass: 0.5.
    b. Long-Duration Glass Type Factor for Wired Glass: 0.3.

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, as follows:

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 7 computer program.
2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 7 computer program.
3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Design glass, including comprehensive engineering analysis according to ASTM E1300 by a qualified professional engineer, using the following design criteria:
1. Design Wind Pressures: As indicated on Drawings.
2. Design Snow Loads: As indicated on Drawings.
3. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
4. Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass to resist each of the following combinations of loads:
    a. Outward design wind pressure minus the weight of the glass. Base design on glass type factors for short-duration load.
    b. Inward design wind pressure plus the weight of the glass plus half of the design snow load. Base design on glass type factors for short-duration load.
    c. Half of the inward design wind pressure plus the weight of the glass plus the design snow load. Base design on glass type factors for long-duration load.
5. Glass Type Factors for Wired Glass:
    a. Short-Duration Glass Type Factor for Wired Glass: 0.5.
    b. Long-Duration Glass Type Factor for Wired Glass: 0.3.
6. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 3/4

-inches , whichever is less and keeps glazing retained in place with a suitable margin of safety under design conditions.

7. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components

2.04 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. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
   4. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
   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.

2.05 INSULATING GLASS UNITS

A. 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: Low conductivity thermoplastic and stainless steel.
      a. Spacer Width: As required for specified insulating glass unit.
      b. Products:
         1) Technoform Glass Insulation; TGI Spacer-M: www.glassinsulation.us.
   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.

B. Type GL-1 - Insulating Glass Units: Vision glass, double glazed.
   1. Applications: Exterior glazing unless otherwise indicated, including but not limited to the following locations: Windows at apartment units.
   2. Space between lites filled with air.
   3. Outboard Lite: Heat-strengthened float glass, 1/4 inch thick, minimum.
      a. Tint: Matching Basis of Design.
      b. Coating: Low-E (passive type), on #2 surface. Basis of Design:
   4. Inboard Lite: Heat-strengthened float glass, 1/4 inch thick, minimum.
      a. Tint: Matching Basis of Design.
   5. Total Thickness: 1 inch.
   6. Thermal Transmittance (U-Value): Not more than value specified for Basis of Design.
   7. Visible Light Transmittance (VLT): Provide VLT percentage in accordance with Basis of Design, plus or minus 3%.
   8. Solar Heat Gain Coefficient (SHGC): 0.25, maximum.
   9. Visible Light Reflectance: Provide VLR percentage in accordance with Basis of Design, plus or minus 3%.
   10. Glazing Method: Dry glazing method, gasket glazing.

C. Type GL-2 - Insulating Glass Units: Vision glass, double glazed.

1. Applications: Glazing in exterior assemblies other than apartment or guest room window glazing, including but not limited to aluminum storefront and aluminum storefront swing doors.
2. Space between lites filled with air.
3. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
    a. Provide fully tempered float glass at all doors and windows where within 24 inches from door opening as measured horizontally, or within 18 inches from floor as measured vertically (whether or not indicated on Drawings), and in other locations as indicated on Drawings or otherwise mandated by code.
    b. Tint: Matching Basis of Design.
    c. Coating: Low-E (passive type), on #2 surface.
4. Inboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
    a. Provide fully tempered float glass at all doors and windows where within 24 inches from door opening as measured horizontally, or within 18 inches from floor as measured vertically.
    b. Tint: Clear.
5. Total Thickness: 1 inch.
6. Thermal Transmittance (U-Value): Not more than value specified for Basis of Design.
7. Visible Light Transmittance (VLT): Provide VLT percentage in accordance with Basis of Design, plus or minus 3%.
8. Solar Heat Gain Coefficient (SHGC): 0.25, maximum.
9. Visible Light Reflectance: Provide VLR percentage in accordance with Basis of Design, plus or minus 3%.
10. Glazing Method: Dry glazing method, gasket glazing.

D. Type GL-3 - Insulating Glass Units: Spandrel glazing.
1. Applications: Exterior spandrel 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: Matching Glass Type for Outboard Lite specified for GL-2.
    b. Coating: Same as on vision units, on #2 surface.
4. Inboard Lite: Fully tempered float glass, 1/4 inch thick.
    a. Tint: Clear.
    b. Opacifier: Ceramic frit, on #4 surface.
    c. Opacifier Color: As indicated on Drawings, or if not indicated, as selected by Architect from manufacturer's full range.
5. Total Thickness: 1 inch.
6. Thermal Transmittance (U-Value): Not more than value specified for Basis of Design.
7. Glazing Method: Dry glazing method, gasket glazing.

2.06 GLAZING UNITS

A. Type GL-4 - Monolithic Interior Vision Glazing:
1. Applications: Interior glazing unless otherwise indicated.
2. Glass Type: Fully tempered float glass.
3. Tint: Clear.
4. Thickness for glazing smaller than 2 feet by 4 feet: 1/4", nominal.
5. Thickness for all other glazing: 3/8 inch, nominal.

B. Type GL-5 - Security Glazing: Laminated glass, 2-Ply.
1. Applications: Glazed Balcony Guardrail Assemblies and Entrance Canopy panels.
2. Tint: Clear.
3. Thickness: 9/16 inch.
4. Outer Lite: Tempered glass.
5. Interlayer: Ionoplast, thickness as required to meet performance criteria.
6. Inside Lite: Tempered glass.

2.07 GLAZING COMPOUNDS

A. General:

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. VOC Content: For sealants used inside of the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D.
4. Colors of Exposed Glazing Sealants: Match Architect's samples.

2.08 ACCESSORIES

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. 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.

C. 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.

D. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

E. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

F. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.

G. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

H. 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.

B. Verify that the minimum required face and edge clearances are being provided.

C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

D. Verify that sealing between joints of glass framing members has been completed effectively.

E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, and paint.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 INSTALLATION - WET/DRY GLAZING METHOD (TAPE AND SEALANT)

A. Application - Interior Glazed: Set glazing infills from the interior of the building.

B. Cut glazing tape to length and install against permanent stops, projecting 1/16 inch above sight line.

C. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

D. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.

E. Install removable stops, spacer shims inserted between glazing and applied stops at 24 inch intervals, 1/4 inch below sight line.

F. Fill gaps between pane and applied stop with silicone type sealant to depth equal to bite on glazing, to uniform and level line.

G. Carefully trim protruding tape with knife.

3.06 FIELD QUALITY CONTROL

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

B. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

C. Monitor and report installation procedures and unacceptable conditions.

3.07 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove nonpermanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. 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.

3.08 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

3.09 SCHEDULE

A. Apartment Unit Windows (Exterior Use): Type GL-1. Coordinate with Exterior Window Section 08 53 13.

B. Metal-Framed Storefronts and Swing Doors: Type GL-2.

C. Spandrel Panels: Type GL-3

D. Interior Use: Type GL-4.

E. Glazed balcony rails and divider panels GL-5.

END OF SECTION

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SECTION 08 83 00
MIRRORS

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 SECTION INCLUDES

A. Glass mirrors.

B. Acrylic safety mirrors: Shatterproof mirrors at locations including, but not limited to restrooms near or serving pools.

1.03 RELATED REQUIREMENTS

A. Section 09 21 16 - Gypsum Board Assemblies: Substrates on which mirrors will be installed.

B. Section 10 28 00 - Toilet, Bath, and Laundry Accessories: Metal mirror frames.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.

B. ASTM C1036 - Standard Specification for Flat Glass.

C. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror.

D. GANA (GM) - GANA Glazing Manual.

E. GANA (SM) - GANA Sealant Manual.

F. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.

G. California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

1.05 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 Mirror Mastic: Provide chemical, functional, and environmental characteristics, limitations, special application requirements.

D. Mirror Mastic Compatibility Test Reports: From mirror manufacturer indicating that mirror mastic was tested for compatibility and adhesion with mirror backing and substrates on which mirrors are installed.

E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

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.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM) and GANA (SM) for glazing installation methods.

B. Fabricate, store, transport, receive, install, and clean mirrors in accordance with manufacturer's recommendations.

1.07 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.

1.08 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

A. Mirrors: Subject to compliance with requirements, manufacturers offering mirrors that may be incorporated into the Work include, but are not limited to, the following:
   1. Binswanger Mirror/ACI Distribution: www.binswangerglass.com.
   2. Charlottesville Glass & Mirror: www.charlottesvilleglassandmirror.com
   3. Lenoir Mirror Co: www.lenoirmirror.com.
   4. Trulite Glass and Aluminum Solutions: www.trulite.com.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Decorative Mirrors:
   1. As indicated on Interior Design Drawings.
   2. Substitutions: Not permitted.

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: ASTM C1036, Type 1 - Transparent Flat, Class 1 - Clear, Quality - Q1 (high-quality mirrors); silvering, protective coating, and quality requirements in compliance with ASTM C1503.
   1. Locations; As indicated on Interior Design Drawings.
   2. Thickness: 1/4 inch.
   3. Size: As indicated on Drawings.

C. Acrylic Plastic Mirror: Abrasive resistant; clear; mirrored coating; single layer.
   1. Plastic type, thickness and coating thickness vary by manufacturer.
   2. Size: As indicated on Drawings.

2.03 ACCESSORIES

A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness.

C. Mirror Mastic: Adhesive setting compound, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Gunther Mirror Mastics.
      b. Palmer Products Corporation.
   2. VOC Content: Not more than 70 g/L when calculated according to 40 CFR 59, Subpart D.
   3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.04 MIRROR HARDWARE

A. Mirror Top and Bottom Clips: Low-profile clips.
   1. Mirror Attachment Accessories: Stainless steel J-profile channels.

B. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

C. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces of gypsum wallboard are clean, free of obstructions, and ready to receive mirrors.

3.02 PREPARATION

A. Clean contact surfaces.

3.03 INSTALLATION

A. Install mirrors in accordance with manufacturer's written instructions.

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.
   1. Edge of mirrors shall not come into contact with silicone sealant.

D. Installation in Frames:
   1. Install mirrors resting on setting blocks. Install applied stop and center mirror by use of spacer shims at 24 inches on center and at 1/4 inch below sight line.
   2. Locate and secure mirror using glazers' clips.
   3. Fill gaps between mirror and stops with glazing compound until flush with sight line, and tool surface to straight flush line.

E. Frameless Mirrors: Set mirrors in proper place with adhesive, applied in accordance with adhesive manufacturer's instructions.
   1. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
   2. Apply mastic to comply with mastic manufacturer’s written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
   3. After mastic is applied, align mirrors and press into place while maintaining a minimum air space of 1/8" (3 mm) between back of mirrors and mounting surface.

3.04 CLEANING

A. Remove labels after work is complete.

B. Clean mirrors and adjacent surfaces.

END OF SECTION

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SECTION 08 91 00
LOUVERS

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 SECTION INCLUDES

A. Louvers, frames, and accessories.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

B. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating.

C. AMCA 511 - Certified Ratings Program Product Rating Manual for Air Control Devices.

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

E. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

1.04 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. Test Reports: Independent agency reports showing compliance with specified performance criteria.

D. Maintenance Data: Include lubrication schedules, adjustment requirements.

1.05 QUALITY ASSURANCE

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Louvers:
   1. Airline Louvers: www.airlinelouvers.com.
   2. Airolite Company, LLC: www.airolite.com.
   3. Construction Specialties, Inc: www.c-sgroup.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 LOUVERS

A. Louvers: 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 required by code and as indicated on 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 insect screens at intake louvers and bird screens at exhaust louvers.

B. Stationary Louvers: Horizontal blade, extruded aluminum construction, with intermediate mullions matching frame.

1. Free Area: 50 percent, minimum.
2. Blades: Drainable.
3. Frame: Depth as indicated on drawings, channel profile; corner joints mitered and, with continuous recessed caulking channel each side.
4. Aluminum Thickness: Frame 12 gauge, 0.0808 inch minimum; blades 12 gauge, 0.0808 inch minimum.

C. Operable Louvers: Operable horizontal blades, extruded aluminum construction.
1. Free Area: 50 percent, minimum.
2. Operation: As indicated on Mechanical Drawings.
3. Movable Blades: Straight, pivoted at, with vinyl, rubber, or polyethylene blade edge and jamb seals; rattle-free linkage.
4. Frame: Depth as indicated on drawings, channel profile; corner joints mitered and, with continuous recessed caulking channel each side.
5. Aluminum Thickness: Frame 12 gauge, 0.0808 inch minimum; blades 12 gauge, 0.0808 inch minimum.
6. Aluminum Finish: Superior performing organic coatings; finish welded units after fabrication.

D. Curtain Wall Glazing Louvers: Horizontal blade, extruded aluminum construction with glazing frame welded or mechanically fastened onto louver.
1. Free Area: 40 percent, minimum.
2. Blades: Drainable.
3. Frame: 1-1/4 inch deep, channel profile; corner joints mitered, with continuous recessed caulking channel.
4. Aluminum Thickness: Frame 14 gauge, 0.0641 inch minimum; blades 14 gauge, 0.0641 inch minimum.

2.03 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Formed Aluminum: Formed sheet, ASTM B209 (ASTM B209M).

C. Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

D. Stainless Steel: ASTM A666/A666M, Type 304, soft temper, smooth surface, No. 4 brushed finish.

2.04 FINISHES

A. Superior Performing Organic Coatings System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent 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.
1. Manufacturers:
a. PPG Metal Coatings; Duranar: www.ppgmetalcoatings.com.
b. Valspar; Fluropon: www.valsparcoilextrusion.com.
c. Substitutions: See Section 01 60 00 - Product Requirements.

B. Primer: Zinc chromate, alkyd type.

C. Color: As indicated on drawings.

2.05 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. Screens: Frame of same material as louver, with reinforced corners; removable, screw attached; installed on inside face of louver frame.

C. Bird Screen: Interwoven wire mesh of steel, 14 gauge, 0.0641 inch diameter wire, 1/2 inch open weave, diagonal design.

D. Insect Screen: 18 x 16 size aluminum mesh.

E. Fasteners and Anchors: Galvanized or Stainless steel, as required by manufacturer for warranted installation.

F. Flashings: Of same material and finish as louver frame, formed or extruded to required shape, single length in one piece per location.

G. 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.

B. Verify that field measurements are as indicated on Shop Drawings and as instructed by manufacturer.

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.

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.

END OF SECTION

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SECTION 09 05 61
COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
   1. Resilient tile and sheet.
   2. Carpet tile.
   3. Thin-set ceramic tile and stone tile.
   4. Other materials as required to comply with warranty requirements.

B. Patching compound.

C. Remedial floor coatings.

1.03 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete admixture for slabs to receive adhered flooring, to prevent moisture content-related flooring failures.

B. Section 03 30 00 - Cast-in-Place Concrete: Limitations on curing requirements for new concrete floor slabs.

C. Section 03 35 00 - Concrete Finishing: Moisture emission reducing curing and sealing compound for slabs to receive adhered flooring, to prevent moisture content-related flooring failures; to remain in place, not to be removed.

D. Section 03 35 19 - Colored Concrete Stain Finish, 03 35 33 - Stamped Concrete Finishing, 03 35 43 - Polished Concrete Finishing, and 03 35 60 - Integrally Colored Concrete: Concrete finishes impacted by concrete curing methods and remedial products and procedures identified in this Section.

E. Section 03 54 00 - Cast Underlayment: Remedial products and procedures for poured gypsum underlayment systems.

F. Division 09 Sections for various flooring materials.

1.04 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50 mm [2 in.] Cube Specimens).

B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters, and Gypsum Concrete.

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.06 SUBMITTALS

A. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
   1. Moisture and alkalinity (pH) limits and test methods.
   2. Manufacturer's required bond/compatibility test procedure.

B. Testing Agency's Report:

1. Description of areas tested; include floor plans and photographs if helpful.
2. Summary of conditions encountered.
3. Moisture and alkalinity (pH) test reports.
4. Copies of specified test methods.
5. Recommendations for remediation of unsatisfactory surfaces.
6. Product data for recommended remedial coating.
7. Submit report to Architect.
8. Submit report not more than two business days after conclusion of testing.

C. Adhesive Bond and Compatibility Test Report.

D. Floor Moisture Testing Technician Certificate: International Concrete Repair Institute (ICRI) Concrete Slab Moisture Testing Technician- Grade I certificate.

1.07 QUALITY ASSURANCE

A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.

B. Contractor may perform adhesive and bond test with Contractor's own personnel or hire a testing agency.

C. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.

D. Contractor's Responsibility Relating to Independent Agency Testing:
1. Provide access for and cooperate with testing agency.
2. Confirm date of start of testing at least 10 days prior to actual start.
3. Allow at least 4 business days on site for testing agency activities.
4. Achieve and maintain specified ambient conditions.
5. Notify Architect when specified ambient conditions have been achieved and when testing will start.

E. Floor Moisture Testing Technician Qualifications: International Concrete Repair Institute (ICRI) Concrete Slab Moisture Testing Technician Certification- Grade I.

F. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

1.08 COORDINATION

A. Coordinate the Work of this Section with manufacturer's written instructions and proprietary products and procedures for flooring preparation and with other Division 09 and Division 03 trades, whether or not explicitly listed in Related Requirements Article above.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with manufacturer’s written instructions and recommendations.

B. Deliver materials in manufacturer’s unopened packaging until ready for installation; include installation instructions.

C. Keep materials from freezing.

1.10 FIELD CONDITIONS

A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.

B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.01 MATERIALS

A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
   1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
   2. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.

B. Remedial Floor Coating, Two-Component: Single-layer coating resistant to water vapor transmission meeting flooring manufacturer's emission limits, resistant to alkalinity (pH) level found, and suitable for flooring adhesion without further treatment.
   1. Thickness: As required for application and in accordance with manufacturer's written installation instructions.
   2. Use product recommended in writing by testing agency.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

A. Perform following operations in the order indicated:
   1. Preliminary cleaning.
   2. Specified remediation, if required.
   3. Patching, smoothing, and leveling, as required.
   4. Other preparation specified.
   5. Adhesive bond and compatibility test.
   6. Protection.

B. Remediations:
   1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
   2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
   3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.02 PRELIMINARY CLEANING

A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.

B. Do not use solvents or other chemicals for cleaning.

3.03 MOISTURE VAPOR EMISSION TESTING

A. Where the floor covering manufacturer's written requirements conflict with either the referenced test method or this specification, comply with the manufacturer's written requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F1869 and as follows.

D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.

E. If test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.

F. Report: Report the information required by the test method.

3.04 INTERNAL RELATIVE HUMIDITY TESTING

A. Where the floor covering manufacturer's written requirements conflict with either the referenced test method or this specification, comply with the manufacturer's written requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F2170 Procedure A and as follows.

D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.

E. If test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.

F. Report: Report the information required by the test method.

3.05 ALKALINITY TESTING

A. Where the floor covering manufacturer's written requirements conflict with either the referenced test method or this specification, comply with the manufacturer's written requirements.

B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.
   1. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.
   2. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.
   3. Use of a digital pH meter with probe is acceptable; follow meter manufacturer's instructions.

C. If test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

3.06 PREPARATION

A. See individual floor covering section(s) for additional requirements.

B. Comply with recommendations of testing agency.

C. Comply with written requirements and recommendations of floor covering manufacturer.

D. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.

E. Do not fill expansion joints, isolation joints, or other moving joints.

3.07 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with written requirements and recommendations of floor covering manufacturer.

3.08 APPLICATION OF REMEDIAL FLOOR COATING

A. Comply with written requirements and recommendations of coating manufacturer.

3.09 PROTECTION

A. Cover prepared floors with building paper or other durable covering.

END OF SECTION

SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES

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 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Metal stud wall framing.

C. Metal channel ceiling framing.

D. Resilient channels.

E. Shaft wall framing.

F. Area Separation Wall framing.

G. Acoustic insulation.

H. Gypsum sheathing.

I. Cementitious backing board.

J. Gypsum wallboard.

K. Joint treatment and accessories.

L. Textured finish system.

1.03 RELATED REQUIREMENTS

A. Section 03 54 00 - Cast Underlayment: Other components as part of fire-rated floor-ceiling assemblies.

B. Section 05 40 00 - Cold-Formed Metal Framing: Structural steel stud framing.

C. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.

D. Section 07 21 00 - Thermal Insulation: Acoustic insulation.

E. Section 07 84 00 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.

F. Section 07 92 00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

G. Section 09 30 00 - Tiling: Tile.

1.04 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members.

B. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing.

C. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing.

D. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units.

E. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units.

F. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

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

H. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.

I. ASTM B69 - Standard Specification for Rolled Zinc.

J. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

K. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

L. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board.

M. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.

N. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

O. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

P. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.

Q. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications.

R. 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.

S. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.

T. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

U. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

V. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel.

W. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel.

X. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing.

Y. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units.

Z. ASTM C1396/C1396M - Standard Specification for Gypsum Board.

AA. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels.

BB. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

CC. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

DD. ASTM E413 - Classification for Rating Sound Insulation.

EE. GA-216 - Application and Finishing of Gypsum Panel Products.

FF. GA-600 - Fire Resistance and Sound Control Design Manual.

GG. UL (FRD) - Fire Resistance Directory.

HH. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordinate gypsum board manufacturer's tested UL assemblies for selected gypsum board products with UL assemblies listed on Drawings. Confirm selected manufacturer's proprietary products conform to UL assembly requirements.

B. Coordination: Coordinate the installation of gypsum board assemblies with size, location, and installation of service utilities.

C. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.06 SUBMITTALS

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

B. Product Data:
   1. Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

C. Quality Control Data: Provide Installers Qualification Data.

1.07 QUALITY ASSURANCE

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.
   1. If conflicts are discovered between requirements stated in the drawing details or specifications and the requirements for the UL or similar testing agency assembly indicated, the requirements of the testing agency shall prevail.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

C. Visually inspect building interior wall and floor surfaces for settlement, consolidation, and differential movement. Repair gypsum board and level flooring as necessary to maintain smooth surfaces and transitions. Repair finish materials as necessary.

D. Source Limitations: For each type of material required to complete the non-structural metal framing systems specified in this section provide products from a single manufacturer.

E. Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

F. Asian Gypsum Panels: Gypsum panel products manufactured in China or neighboring Asian countries are not acceptable.

G. Stock interior gypsum board on each floor prior to final installation of windows and doors. Windows may be temporarily anchored to structural framing prior to dry-in building and prior to stocking interior gypsum board.
   1. Place no more than one stack of interior gypsum board in each bedroom with a maximum height of 18 inches. Each stack shall span on different floor trusses.
   2. Place no more than two stacks of interior gypsum board in each living room with a maximum height of 18 inches. Each stack shall span on different floor trusses.
   3. Orient stacks flat and perpendicular to truss span.
   4. Do not stack gypsum board panels on edges.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack materials flat on elevated platforms to prevent sagging.

B. Store metal products to prevent corrosion.

1.09 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install panels that are wet, those that are moisture damaged, or otherwise visibly damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, fuzzy or splotchy surface contamination and discoloration, or irregular shape.
   2. Contractor shall remediate any material that exhibits moisture damage or similar conditions listed above under the direction of an Environmental Specialist.

1.10 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Contractor shall repair gypsum board to maintain smooth surfaces and transitions for a minimum period of one year after Date of Substantial Completion. Repair finish materials as necessary

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:
   1. Acoustic Attenuation: STC as indicated calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

C. Fire Rated Assemblies: Provide completed assemblies complying with applicable codes and UL assemblies as indicated on Drawings.
   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. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.

B. Manufacturers - Metal Framing, Connectors, and Accessories:
   1. ClarkDietrich: www.clarkdietrich.com.
   2. MarinoWARE: www.marinoware.com.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

C. 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/240 at 5 psf (typical) and L/360 at 10 psf for tile finishes, plaster fnishes, and partitions supporting cabinets.
   1. Studs: "C" shaped with flat or formed webs with knurled faces.
   2. Runners: "U" shaped, sized to match studs.
   3. Ceiling Channels: C-shaped.
   4. Furring; RC-2: Hat-shaped sections, minimum depth of 1/2 inch, for non-sound rated assemblies.
   5. Resilient Furring Channels; RC-1: 1/2 inch depth, for attachment to substrate through one leg only, for sound rated assemblies.
      a. Clarkwestern Dietrich Building Systems LLC.
         1) ClarkDietrich: RC Deluxe™ Resilient Channel (RCSD).
      b. No Substitutions allowed

D. Shaft Wall Studs and Accessories: AISI S220; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.
   1. Galvanized coating G40 minimum (G60 acceptable).
   2. H-Stud and C-Runner:
      a. 2 inches wide by 18 mils, 0.0179 inches thick (design thickness 0.0188 inches).
   3. Products:
      a. As indicated in rated assemblies listed on Drawings.

E. Area Separation Wall Studs and Accessories: AISI S220; galvanized sheet steel, of size and properties necessary to comply with specified performance requirements.
   1. Galvanized coating G40 minimum (G60 acceptable).
   2. H-Stud and C-Runner:
      a. 2 inches wide by 18 mils, 0.0179 inches thick (design thickness 0.0188 inches).
   3. Aluminum breakaway clips:

a. 2 inches wide with 2 inch vertical leg and horizontal leg of adequate dimesion to attach breakaway clips to structural framing.

4. Products:
   a. As indicated in rated assemblies listed on Drawings.

F. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection and prevent rotation of studs while maintaining structural performance of partition.
   1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100.
   2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot-dipped galvanized coating.
   3. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems indicated on Drawings.
   4. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-resistance rating of the wall assembly.

G. Deflection and Firestop Track: Intumescent strip factory-applied to track flanges expands when exposed to heat or flames to provide a perimeter joint seal.
   1. Products:
      a. ClarkDietrich: www.clarkdietrich.com.
      b. MarinoWare; :www.marinoware.com.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

H. Preformed Top Track Firestop Seal:
   1. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems indicated on Drawings.
   2. Products:
      a. Hilti, Inc; Top Track Seal CFS TTS: www.us.hilti.com.
      b. Specified Technologies Inc; SpeedFlex TTG Track Top Gasket: www.stfirestop.com.
      c. MarinoWare; Fas Track 1000:www.marinoware.com.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

I. Non-structural Framing Accessories:
   1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
   2. 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.
   3. Framing Connectors: ASTM A653/A653M G90 galvanized steel clips; secures cold rolled channel to wall studs for lateral bracing.

J. Grid Suspension Systems: Steel grid system of main tees and support bars connected to structure using hanging wire.
   1. Products:
      a. USG Corporation; Drywall Suspension System: www.usg.com.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 BOARD MATERIALS

A. Gypsum Wallboard: Gypsum panels as defined below; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   3. Glass mat faced gypsum panels as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness as paper-faced gypsum panels.
   4. Unfaced fiber-reinforced gypsum panels as defined in ASTM C1278/C1278M, suitable for paint finish, of the same core type and thickness as paper-faced gypsum panels.
   5. 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.

a. At ceiling assemblies indicated with a fire-rating, use type required by indicated tested assembly; if no tested assembly is indicated, use Type C board, UL listed.

6. Thickness, unless otherwise indicated on Drawings:
   a. Vertical Surfaces: 5/8 inch.
   b. Ceilings: 5/8 inch.
   c. Multi-Layer Assemblies: Thicknesses as indicated on Drawings.
7. Mold-Resistant, Paper-Faced Products:
   a. American Gypsum Company; M-Bloc Type X: www.americangypsum.com.
   b. American Gypsum Company; M-Bloc Type C: www.americangypsum.com.
   c. CertainTeed Corporation; M2Tech 5/8" Type X Moisture & Mold Resistant Drywall: www.certainteed.com.
   d. Georgia-Pacific Gypsum; ToughRock® Mold-Guard.
   e. Georgia-Pacific Gypsum; ToughRock® Fireguard X Mold-Guard.
   f. National Gypsum Company; Gold Bond® XP Gypsum Board.
   g. USG Corporation; Sheetrock® Brand Mold Tough Gypsum Panels.
   h. USG Corporation; Sheetrock® Brand Mold Tough™ AR Firecode® Core Gypsum Panel
   i. Substitutions: See Section 01 60 00 - Product Requirements.
8. Glass Mat Faced Products:
   a. CertainTeed Saint-Gobain; GlasRoc® Sheathing Type X.
   b. Georgia-Pacific Gypsum; DensArmor Plus: www.gpgypsum.com.
   c. National Gypsum Company; Gold Bond eXP Fire-Shield Interior Extreme Gypsum Panel: www.nationalgypsum.com.
   d. USG Corporation; Sheetrock Brand Glass-Mat Panels Mold Tough Regular 1/2 in. (12.7 mm): www.usg.com.
   e. Substitutions: See Section 01 60 00 - Product Requirements.

B. Backing Board For Wet Areas: One of the following products:
1. Application: Surfaces behind tile in wet areas, including manufactured housing, tub and shower surrounds, and shower ceilings.
2. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
   a. Products:
      1) Custom Building Products; WonderBoard® Lite Backerboard; www.custombuildingproducts.com.
      2) National Gypsum Company; PermaBase Cement Board; www.nationalgypsum.com.
      3) National Gypsum Company; PermaBase Flex Brand Cement Board; www.nationalgypsum.com.
      4) USG Corporation; Fiberock Brand Aqua-Tough AR: www.usg.com.
      5) Substitutions: See Section 01 60 00 - Product Requirements.
3. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
   a. Fire-Resistance-Rated Type: Type X core, thickness 5/8 inch.
   b. Products:
      1) CertainTeed Saint-Gobain; GlasRoc® Sheathing: www.certainteed.com.
      2) Georgia-Pacific Gypsum; DensShield Tile Backer; www.gpgypsum.com.
      3) National Gypsum Company; Gold Bond eXP Tile Backer; www.nationalgypsum.com.
      4) USG Corporation; Durock Glass Mat Tile Backer; www.usg.com
      5) Substitutions: See Section 01 60 00 - Product Requirements.

C. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
1. Application: Vertical surfaces behind thinset tile, except in wet areas.
2. 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.

3. Type: Regular and Type X, in locations indicated.
4. Board Thickness: 5/8 inch.
5. Edges: Tapered.
6. Products:
    a. CertainTeed Saint-Gobain; GlasRoc® Sheathing: www.certainteed.com.
    b. Georgia-Pacific Gypsum; DensShield Tile Backer.
    c. National Gypsum Company; Gold Bond Brand XP Gypsum Board.
    d. USG Corporation; Sheetrock Brand Mold Tough Gypsum Panels.
    e. Substitutions: See Section 01 60 00 - Product Requirements.

D. Sag Resistant 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 identified on Drawings as requiring sag resistance, unless otherwise indicated.
2. Thickness: 1/2 inch, unless otherwise listed in UL Assembly.
3. Edges: Tapered.
4. Products:
    a. CertainTeed Corporation; 1/2" Easi-Lite: www.certainteed.com.
    b. Georgia-Pacific Gypsum[<>]; ToughRock Span 24 Ceiling Board: www.gpgypsum.com.
    c. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond High Strength LITE Gypsum Board: www.goldbondbuilding.com.
    d. USG Corporation; 1/2 Inch Sheetrock Brand UltraLight Sag-Resistant Interior Gypsum Ceiling Board.: www.usg.com.
    e. Substitutions: See Section 01 60 00 - Product Requirements.

E. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
1. Application: Exterior sheathing, unless otherwise indicated.
2. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
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. Edges: Square.
5. Glass Mat Faced Products:
    a. CertainTeed Corporation; GlasRoc Type X Exterior Sheathing: www.certainteed.com.
    b. Georgia-Pacific Gypsum; DensGlass Sheathing: www.gpgypsum.com.
    c. National Gypsum Company; Gold Bond eXP Sheathing: www.nationalgypsum.com.
    d. USG Corporation; USG Securock Brand Sheathing: www.usg.com.
    e. Substitutions: See Section 01 60 00 - Product Requirements.

F. Back of Parapet Sheathing:
1. Application: Exterior sheathing at roof side of parapets.
2. Products: Subject to the requirements of the construction type, rating requirements, and roof manufacturer substrate requirements, parapets shall be constructed in accordance with the Drawings and the following:
    a. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M

G. Exterior Soffit Board: Exterior gypsum soffit board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Ceilings and soffits in protected exterior areas, unless otherwise indicated.
2. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X.
3. Type X Thickness: 5/8 inch.
4. Type C Thickness: 5/8 inch.
5. Edges: Tapered.
6. Products: As indicated in and to be coordinated with specified UL Assemblies indicated on Drawings.

a. Georgia-Pacific Gypsum; ToughRock Fireguard C Soffit Board: www.buildgp.com.
b. National Gypsum Company; Gold Bond Brand Exterior Soffit Board.
c. USG Corporation; Sheetrock Exterior Gypsum Ceiling Board.
d. Substitutions: See Section 01 60 00 - Product Requirements.

H. Shaftwall and Coreboard: Type X; 1 inch thick by 24 inches wide, beveled long edges, ends square cut.
1. Manufacturer of shaftwall and coreboard shall be in accordance with the UL Assembly as defined on the Drawings.
2. Glass Mat Faced Type: Glass mat shaftliner gypsum panel or glass mat coreboard gypsum panel as defined in ASTM C1658/C1658M.
3. Glass Mat Faced Products: As indicated in and to be coordinated with specified UL Assemblies indicated on Drawings.
a. American Gypsum Company; M-Glass Shaft Liner.
b. CertainTeed Corporation; GlasRoc Shaftliner Type X: www.certainteed.com.
c. Georgia-Pacific Gypsum; DensGlass Shaftliner (mold-resistant).
d. National Gypsum Company; Gold Bond Brand eXP Shaftliner.
e. USG Corporation; USG Sheetrock Brand Glass-Mat Liner Panels Mold Tough: www.usg.com.

2.04 GYPSUM BOARD ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness and insulating value as indicated on Drawings.

B. Preformed Acoustical Seal at Mullions; for use at joints between window mullions and partitions.
1. Solid neoprene rubber strip with offset two-sided pressue-sensitive adhesive.strips.
a. Configurations: Flat strip of rubber, 1-1/2 inch wide by 1/8 inch thick.
b. Color: Black.
2. Capable of increasing STC performance at joint by 15dBA in accordance with ASTM E90, Small Scale test.
3. Meets IBC requirements for filling void at non-fire-resistance-rated fire barriers and exterior curtain wall systems.
4. Products:
a. STC Sound Control; STC Mullion Seal: www.stcsoundcontrol.com. (Basis of Design)
b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

D. Water-Resistive Barrier: Where located on Drawings and as specified in other Division 07 Section.

E. Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless noted otherwise. Zinc meets or exceeds requirements of ASTM B69. Types as detailed or required for finished appearance.
1. Rigid Corner Beads: Low profile, for 90 degree outside corners and archways.
a. Products:
1) CertainTeed Corporation; No-Coat Drywall Corner: www.certainteed.com.
2) ClarkDietrich; Strait-Flex Big-Stick: www.clarkdietrich.com.
3) Phillips Manufacturing Co; kwikSTIK Paper Corner Bead: www.phillipsmfg.com.
4) Trim-Tex, Inc; Fast Edge®, with or without paper: www.trim-tex.com.
5) USG Corporation, Inc.; USG Beadex® Brand Paper-Faced Metal Drywall Bead and Trim: www.usg.com.
6) Other mud-in corner bead products approved in writing by gypsum board manufacturer.
7) Substitutions: See Section 01 60 00 - Product Requirements.
2. Wall Mounted Deflection Beads: Flexible gasket and bead with 1-1/8 inch flange.
3. Interior Expansion Joints: #093
a. Fire-Resistance Rated: 1 hour when joint system tested in accordance with UL 2079.

b. Type: V-shaped metal with factory-installed protective tape.
c. Products:
1) ClarkDietrich; #093 Zinc Control Joint (ZNCJ): www.clarkdietrich.com.
(a) Non-rated: 093 Zinc Control Joint (ZNCJ).
(b) Fire-Rated: FAS-093X Control Joint.
2) Marino:https://www.marinoware.com/product/zinc-control-joint-093-10/
(a) Non-rated: ZINC CONTROL JOINT 093 – 10′
(b) Fire-Rated: Limitation: where sound transmission and/or fire ratings are prime considerations, an adequate seal must be provided behind the control joint.
3) Phillips Manufacturing Co; 093 Expansion Control Joint: www.phillipsmfg.com.
(a) Non-rated: 093 Zinc Expansion Control Joint
(b) Fire-rated: Limitation: where sound transmission and/or fire ratings are prime considerations, an adequate seal must be provided behind the control joint.

4. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.

F. Decorative Metal Trim:
1. Reveal Depth: 5/8 inch.
2. Material: Extruded aluminum alloy 6063-T5 temper.
3. Finish: Anodized, clear, unless otherwise indicated on Drawings.
4. Provide fire rated profiles with factory applied intumescent strip along the back wall based on the UL rating of the wall, whether or not identified as such on the Drawings.
a. Tamlyn; XtremeInterior: Fire Rated Profiles: www.xtremeias.com.
b. Substitutions: See Section 01 60 00 - Product Requirements.

G. Joint Materials: ASTM C475/C475M and as recommended in writing by gypsum board manufacturer for project conditions.
1. Fiberglass Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
2. Paper Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
3. Joint Compound: Setting type, field-mixed.

H. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.

I. Textured Finish Materials: Vinyl-based compound; plain (non-aggregate).
1. Products:
a. CertainTeed Corp.; ProRoc Easi-Tex Spray Texture.
b. National Gypsum Company; Perfect Spray EM Texture.
c. USG Corporation; BEADEX FasTex Wall and Ceiling Spray Texture.
d. Substitutions: See Section 01 60 00 - Product Requirements.
2. Texture: As scheduled on Interior Design Drawings.
a. Walls: Smooth, or textured as selected by Owner.
b. Ceilings: Smooth, or textured as selected by Owner.

J. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs less than 0.033 inch in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.

K. Nails for Attachment to Wood Members: ASTM C514.

L. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

M. Adhesive for Attachment to Wood ASTM C557 and Wood ASTM C557:

N. Exterior Soffit Vents: One piece, perforated, ASTM B221 6063 T5 alloy aluminum, with edge suitable for direct application to gypsum board and manufactured especially for soffit application. Provide ventilation area shown on Drawings. Where ventilation area is not shown on Drawings, provide continuous vent.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this Section to commence.

B. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

C. Examine panels before installation. Reject panels that are wet, stained, or otherwise damaged.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SHAFT WALL INSTALLATION

A. Shaft Wall Framing: Install in accordance with manufacturer's written installation instructions and rated assemblies indicated on the Drawings.
   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. On walls over sixteen feet high, screw-attach studs to runners top and bottom.

3.03 AREA SEPARATION WALL INSTALLATION

A. Area Separation Wall Framing: Install in accordance with manufacturer's written installation instructions and rated assemblies indicated on the Drawings.
   1. Fasten C-Runners to structure with short leg to finished side, using appropriate power-driven fasteners at not more than 24 inches on center.
   2. Install H-Studs and gypsum shaftwall liner panels at spacing required to meet performance requirements.
   3. Plumb wall and secure to floor, floor trusses, and roof framing with aluminum breakaway clips. Install breakaway clips on each side of wall.

B. Shaft Wall Liner: Cut panels to accurate dimensions and install sequentially between special friction studs.
   1. On walls over sixteen feet high, screw-attach studs to runners top and bottom.

3.04 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C1007AISI S220 and manufacturer's written instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.

C. Studs: Space studs as indicated.
   1. Extend partition framing to structure where indicated and to ceiling in other locations.
   2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's written instructions.
   3. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's written instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Furring for Fire-Resistance Ratings: Install as required for fire-resistance ratings indicated, sound ratings indicated, and to GA-600 requirements.

F. Blocking: Install wood blocking for support of:
   1. Framed openings.
   2. Wall-mounted cabinets.
   3. Plumbing fixtures.
   4. Toilet partitions.
   5. Toilet accessories.

6. Wall-mounted door hardware.
7. Other locations indicated on Drawings.

3.05 INSTALLATION OF METAL FURRING

A. Metal furring installation at walls comply with requirements of ASTM C754 and as follows;
   1. Install hat-shaped furring channels at non-sound rated partitions.
      a. Space channels as indicated on Drawings, not to exceed 24 inches on center or as required per UL assembly at fire-rated partitions.
   2. Install resilient furring channels at sound rated partitions.
      a. At non-rated partitions that require sound rating, space channels as indicated in sound test to maintain specified sound rating.
      b. At fire-rated partitions that require sound rating, space channels as indicated in UL assembly.
      c. Install with the mounting flange of the resilient furring channel down.
      d. The mounting flange at the floor or starter row shall be installed in the inverted position.
      e. Fasten resilient channels to studs only. Do not anchor to bottom track or sill member.

B. Metal Furring installation at ceiling assemblies comply with ASTM C754 and as follows;
   1. Install hat-shaped furring channels at non-sound-rated ceiling assemblies.
      a. At non-fire-rated assemblies, space channels as indicated on Drawings, not to exceed 16 inches on center, or as recommended in writing by gypsum board manufacturer to prevent sagging.
      b. At fire-rated assemblies, space channels as required by UL assembly.
   2. Install resilient furring at sound-rated ceiling assemblies.
      a. At non-fire-rated assemblies, space channels as indicated on Drawings, not to exceed 12 inches on center, or as recommended in writing by gypsum board manufacturer to prevent sagging.
      b. At fire-rated partitions that require sound rating, space channels as indicated in UL assembly.
      c. Install with the mounting flange of the resilient furring channel down.
      d. The mounting flange at the floor or starter row shall be installed in the inverted position.
      e. Fasten resilient channels directly to ceiling framing members only.

3.06 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install as follows:
   1. At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written recommendations.

3.07 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's written instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
   1. Exception: Tapered edges to receive joint treatment at right angles to framing.

C. Double-Layer, Nonrated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.
   1. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. Multilayer Applications On Ceilings: Apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 12 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
   1. Fastening Methods: Fasten base layers and face layers separately to supports with screws.
   2. Where multilayer gypsum board application calls for gypsum board to be attached to furring channels, verify that furring is capable of supporting weight of the number of layers required to complete the installation.

E. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of the assembly listing indicated on the Drawings.
   1. For sound rated construction with resilient channels, gypsum board fasteners shall only penetrate the resilient channel and shall not penetrate the wall or ceiling framing.

F. Identification and markings of fire-resistance rating of building elements, components, or assemblies.
   1. Provide permanent identification with signs or stenciling in the concealed space at accessible concealed floor, floor-ceiling or attic space, fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions, or any other wall required to have protected openings or penetrations.
      a. Locate within 15 feet of the end of each wall and at intervals not exceeding 30 feet measured horizontally along the wall or partition.
      b. Lettering shall be not less than 3 inches in height with a minimum 3/8-inch stroke in a contrasting color incorporating the suggested wording, “FIRE AND/OR SMOKE BARRIER—PROTECT ALL OPENINGS,” or other wording.

G. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.

H. Exterior Soffits: Install exterior soffit board perpendicular to framing, with staggered end joints over framing members or other solid backing.

I. Cementitious Backing Board: Install over framing or wallboard substrate where indicated, in accordance with ANSI A108.11 and manufacturer's written instructions.

3.08 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet apart on walls and ceilings over 30 feet long.
   2. At exterior soffits, not more than 30 feet apart in both directions.
   3. Remove plastic tape only after joint compound or plaster has been applied and the finish is completed.
   4. Where fire and/or sound control are required, an approved sealant or backing must be installed behind the control joint to maintain the fire rating.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

D. Decorative Trim: Install at locations shown on Drawings and in accordance with manufacturer's written instructions.

E. Exterior Soffit Vents: Install according to manufacturer's written instructions and in locations indicated on the Drawings. Provide vent area indicated on Drawings.

3.09 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 5: Walls and ceilings to receive wall coverings, semi-gloss or gloss paint finish, and other areas specifically indicated on Drawings.
   2. Level 4: Walls and ceilings to receive paint finish other than as listed in level 5, unless otherwise indicated on Drawings.
   3. Level 3: Walls to receive textured wall finish.
   4. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.

5. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.

B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.

C. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

D. Fill and finish joints and corners of cementitious backing board as recommended in writing by manufacturer and in accordance with TNCA method specified for each application.

3.10 TEXTURE FINISH

A. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's written instructions and to match approved sample.

3.11 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

3.12 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, stained, or otherwise damaged.
   1. Indications that panels are wet or stained include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Contractor shall be responsible for environmental testing and remediation of damaged in-place panels.

END OF SECTION

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SECTION 09 22 16
NON-STRUCTURAL METAL FRAMING

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 SECTION INCLUDES

A. Metal partition, ceiling, and soffit framing.

B. Framing accessories.

1.03 RELATED REQUIREMENTS

A. Section 05 40 00 - Cold-Formed Metal Framing: Requirements for structural, load-bearing, metal stud framing and exterior wall stud framing.

B. Section 05 40 00 - Cold-Formed Metal Framing: Execution requirements for anchors for attaching work of this section.

C. Section 07 21 00 - Thermal Insulation: Acoustic insulation.

D. Section 07 92 00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.04 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

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

D. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.

E. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

F. 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.

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

H. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

I. ASTM E413 - Classification for Rating Sound Insulation.

J. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).

1.05 SUBMITTALS

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

B. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.

C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.

PART 2 PRODUCTS

2.01 PERFORMANCE CRITERIA

A. Maximum deflection: L/240 at horizontal load of 5 psf, unless otherwise noted.

B. Maximum deflection for plaster and tile finishes: L/360 at 10 psf, unless otherwise noted.

C. Maximum deflection for partitions supporting cabinets or other millwork: L/360.
   1. Coordinate horizontal load with cabinet and millwork manufacturer, but not less than 10 psf.

D. Elevator shaft pressure load:

Elevator velocity ft./min.	One or two elevators per shaft	Three or more elevators per shaft
0 to 180	5.0 psf	5.0 psf
180 to 700	7.5 psf	5.0 psf

2.02 FRAMING MATERIALS

A. Fire Rated Assemblies: Comply with applicable code and as indicated on Drawings.

B. Loadbearing Studs: As specified in Section 05 40 00.

C. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws, and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
   1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code when evaluated in accordance with AISI S100.
   2. Material: ASTM A653/A653M steel sheet, SS Grade 50.
   3. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems as indicated on Drawings.

D. Deflection and Firestop Track: Intumescent strip factory-applied to track flanges expands when exposed to heat or flames to provide a perimeter joint seal.
   1. Products:
      a. ClarkDietrich; BlazeFrame Firestop Deflection Track: www.clarkdietrich.com.
      b. MarinoWare; FAS Track: www.marinoware.com.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

E. Preformed Top Track Firestop Seal:
   1. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems indicated on Drawings.

F. Non-Loadbearing Framing Accessories:
   1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
   2. 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.
   3. Framing Connectors: ASTM A653/A653M steel clips; secures cold rolled channel to wall studs for lateral bracing.
   4. Sheet Metal Backing: 0.0395 inch thick.
   5. Fasteners: ASTM C1002 self-piercing self-tapping screws.
   6. Anchorage Devices: Powder actuated, Drilled expansion bolts, Screws with sleeves, or as defined in fire and or sound tested assemblies indicated on Drawings.
   7. Acoustic Insulation: See Section 07 21 00.
   8. Touch-Up Primer for Corrosion Protected Surfaces: SSPC-Paint 20 Type I - Inorganic.

G. Sound Isolation Tape: Elastomeric foam tape for sound decoupling.
   1. Surface Burning Characteristics: Provide assemblies with flame spread index of 75 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
   2. Tape Thickness: 1/4 inch.
   3. Locations: Where required by fire, sound, or other tested assembly identified on the Drawings.

H. Backing Plate: Proprietary fire-retardant-treated wood blocking and bracing in width indicated.

1. Basis-of-Design Product: Subject to compliance with requirements, provide ClarkDietrich Building Systems; Danback Fire-Retardant Treated Wood Backing Plate: D16F for studs at 16" o.c. and D24F for studs at 24" on center.

I. Acoustic Sealant: As specified in Section 07 92 00 - Joint Sealants.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that rough-in utilities are in proper location.

3.02 INSTALLATION OF STUD FRAMING

A. Extend partition framing to structure where indicated and to ceiling in other locations.

B. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

C. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

D. Align and secure top and bottom runners at 24 inches on center.

E. At partitions indicated with an acoustic rating:
   1. Provide components and install as required to meet the requirements of the sound tested assembly indicated on Drawings.
   2. Provide components and install as required to produce STC ratings as indicated, based on published tests by manufacturer conducted in accordance with ASTM E90 with STC rating calculated in accordance with ASTM E413.
   3. Place one bead of acoustic sealant between runners and substrate , studs and adjacent construction.
   4. Place one bead of acoustic sealant between studs and adjacent vertical surfaces.
   5. Sound Isolation Tape: Apply to vertical studs and top and bottom tracks/runners in accordance with manufacturer's instructions.

F. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.

G. Install studs vertically at spacing indicated on Drawings.

H. Align stud web openings horizontally.

I. Secure studs to tracks using crimping method. Do not weld.

J. Stud splicing is not permissible.

K. Fabricate corners using a minimum of three studs.

L. Install double studs at wall openings, door and window jambs, not more than 2 inches from each side of openings.

M. Coordinate erection of studs with requirements of door frames and other opening types; install supports and attachments.

N. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.

O. Blocking: Use wood or sheet metal blocking secured to studs. Provide blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, and opening frames.
   1. Wood blocking shall be treated in accordance with the wall rating, tested assembly, or as required by code whether or not indicated on Drawings.

3.03 CEILING AND SOFFIT FRAMING

A. Comply with requirements of ASTM C754.

B. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.

C. Install furring independent of walls, columns, and above-ceiling work.

D. Securely anchor hangers to structural members or embed them in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.

E. Space main carrying channels at maximum 72 inches on center, and not more than 6 inches from wall surfaces. Lap splice securely.

F. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.

G. Place furring channels perpendicular to carrying channels, not more than 2 inches from perimeter walls, and rigidly secure. Lap splices securely.

H. Reinforce openings in suspension system that interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches past each opening.

I. Laterally brace suspension system.

3.04 TOLERANCES

A. Maximum Variation From True Position: 1/8 inch in 10 feet.

B. Maximum Variation From Plumb: 1/8 inch in 10 feet.

END OF SECTION

SECTION 09 30 00
TILING

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 SECTION INCLUDES

A. Tile for floor applications at locations indicated on Drawings.

B. Tile for wall applications at locations indicated on Drawings.

C. Tile for shower receptors.

D. Trim and accessories, including but not limited to thresholds.

E. Setting materials.

F. Grouts.

G. Maintenance materials.

H. Crack isolation and waterproofing membranes.

I. Cleaners

1.03 RELATED REQUIREMENTS

A. Section 03 05 16 - Underslab Vapor Barrier : Underslab Vapor Retarder installation requirements.

B. Section 03 54 00 - Cast Underlayment: Hydraulic and cementitious underlayments where required by TCNA (HB) or TCNA (HB-GP) method specified.

C. Section 06 10 00 - Rough Carpentry: Sub-flooring.

D. Section 07 92 00 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.

E. Section 09 21 16 - Gypsum Board Assemblies: Tile backer board.

F. Section 09 30 05 - Tile Setting Materials and Accessories: Metal Edge Strips.

1.04 REFERENCE STANDARDS

A. American National Standards Institute (ANSI) A108/A118 Series for Ceramic Tile Installation; current edition as of date printed on this Section.

B. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units.

C. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive.

D. ANSI A118.5 - American National Standard Specifications for Chemical Resistant Furan Mortars and Grouts for Tile Installation.

E. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation.

F. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units.

G. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation.

H. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation.

I. ANSI A137.1 - American National Standard Specifications for Ceramic Tile.

J. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products.

K. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel.

L. ASTM D4068 - Standard Specification for Chlorinated Polyethylene (CPE) Sheeting for Concealed Water-Containment Membrane.

M. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

N. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

O. TCNA (HB-GP) - Handbook for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs Installation.

P. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation.

Q. Manufacturer's printed installation instructions.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by affected installers.

1.06 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. Samples

D. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches in size illustrating pattern, color variations, and grout joint size variations.

E. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

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. Coordinate directly with Owner for quantities of and storage locations for attic stock.

1.07 QUALITY ASSURANCE

A. Provide single source manufacturer for all installation materials to assure compatibility and to be in compliance for a full system warranty.

1.08 MOCK-UPS

A. Construct tile mock-up where directed by Owner, incorporating all components specified for the location.
   1. Minimum size of mock-up is 3 feet x 3 feet.
   2. Demolish mock-up when directed by Owner, and remove debris from the site.

1.09 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.

B. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.10 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. Wall Tile, Type ANSI A137.1: As indicated on Interior Design Drawings.
   1. Moisture Absorption: 7.0 to 20.0 percent as tested in accordance with ASTM C373.
   2. Sizes, edge treatment, surface finish, and color(s): As indicated on drawings.
   3. Trim Units: Matching profile shapes in sizes coordinated with field tile.

4. Products:
    a. Substitutions: Not permitted.

B. Floor Tile : ANSI A137.1, and as follows:
1. Moisture Absorption: 3.0 to 7.0 percent.
2. Sizes, edge treatment, surface finish, and color(s): As shown on the Drawings.
3. Pattern: See installation diagram.
4. Trim Units: Matching profile shapes in sizes indicated.
5. Products:
    a. As scheduled.
    b. Substitutions: Not permitted.

2.02 TRIM AND ACCESSORIES

A. Ceramic Accessories: Scheduled finish, same color and finish as adjacent field tile; same manufacturer as tile.

B. Pre-Formed Accessories To Be Covered with Tile: High density expanded polystyrene with ANSI A118.10 waterproofing finish or membrane.
1. Shower Pans:
    a. LATICRETE International, Inc; LATICRETE HYDRO BAN Pre-Sloped Shower Pan: www.laticrete.com.
    b. Noble Company; Pro Base II Preformed Shower Base: www.noblecompany.com.
    c. Permabase; _____
    d. Schluter-Systems: www.schluter.com.
    e. Substitutions: See Section 01 60 00 - Product Requirements.
2. Shower Curbs:
    a. LATICRETE International, Inc: www.laticrete.com.
    b. Noble Company: www.noblecompany.com.
    c. Schluter-Systems: www.schluter.com.

C. Ceramic Trim: Matching bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.
1. Manufacturers: Same as for tile.

D. Non-Ceramic Trim: Extruded aluminum profiles, style and dimensions to suit application, and as indicated on Drawings.
1. Applications:
    a. Open edges of wall and floor tile.
    b. Inside and outside wall corners.
    c. Transition between floor finishes of different heights.
    d. Thresholds at door openings.
    e. Floor and wall expansion and control joints.
    f. Floor-to-wall joints.
    g. Borders and other trim as indicated on drawings.
2. Products:
    a. Schluter-Systems: www.schluter.com.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

E. Thresholds: 2 inches wide by full width of wall or frame opening; kerfed at 45 degree angle with radiused top edge on both long edges; without holes, cracks, or open seams.
1. Thickness: thickness to fit application.
2. Material: Solid surface acrylic resin, mineral filler, and pigments; non-porous, color and pattern consistent throughout thickness.
3. Color and Pattern: tonal to match floor tile.
4. Applications:
    a. At doorways where tile terminates, unless noted otherwise on Drawings.

2.03 SETTING MATERIALS

A. Provide setting materials made by the same manufacturer as grout.

2.04 GROUTS

A. Grouting Materials: Provide grouting materials and admixtures from same manufacturer and compatible with setting materials.
   1. Provide grout with mildew and fungus resistant additives.

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. Use this for all joint widths from 1/16” to 1/2" wide.
   3. Color(s): As shown on the Drawings

C. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
   1. Applications: Locations indicated on Drawings.
   2. Color(s): As shown on the Drawings.
   3. Products:
      a. Custom Building Products; CEG-IG 100% Solids Industrial Grade Epoxy Grout: www.custombuildingproducts.com.
      b. LATICRETE International, Inc; LATICRETE SPECTRALOCK 2000 IG: www.laticrete.com.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

D. Furan Grout: ANSI A118.5 chemical resistant furan resin grout.
   1. Color(s): As indicated on Drawings.
   2. Products:
      a. Custom Building Products; CEG-IG 100% Solids Industrial Grade Epoxy Grout: www.custombuildingproducts.com.
      b. LATICRETE International, Inc; LATICRETE SPECTRALOCK 2000 IG: www.laticrete.com.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 MAINTENANCE MATERIALS

A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
   1. Applications: Between tile and plumbing fixtures.
   2. Color: As selected by Architect from manufacturer's full line.
   3. Products:
      a. As specified in Division 07 Section "Joint Sealants".

B. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
   1. Composition: Water-based colorless silicone.

C. Tile Sealer: Stain protection for ceramic tile and natural stone tile.
   1. Characteristics:
      a. Water-based, penetrating sealer. Ready for use in as little as 4 hours.
   2. Products:
      a. Custom Building Products; Aqua Mix Sealer's Choice Gold: www.custombuildingproducts.com.

D. Tile Maintenance:
   1. Characteristics
      a. Daily tile cleaner that renews the sealed surface as it cleans.
   2. Products:
      a. Custom Building Products; Aqua Mix AquaShield™ Cleaner & Resealer: www.custombuildingproducts.com.

E. Grout Release: Temporary, water-soluble pre-grout coating.

2.06 THICK-BED MATERIALS

A. Mortar Bed Materials: Portland cement, sand, latex additive, and water.

B. Waterproofing Membrane Under Mortar Bed at Showers and Tiled Tubs: Use the following or any material specified for thin-set waterproofing applications.
   1. Material: Chlorinated polyethylene sheet, 40 mils thick, minimum; complying with ASTM D4068.

2.07 ACCESSORY MATERIALS

A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
   1. Thickness: 40 mils, maximum.
   2. Crack Resistance: No failure at 1/8 inch gap, minimum.

B. 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:

C. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 7/16 inch thick; 2-inch wide coated glass fiber tape for joints and corners.
   1. Products:
      a. As specified in Section 09 21 16.

D. Backer Board: Coated glass mat type complying with ASTM C1178/C1178M; inorganic fiberglass mat on both surfaces and integral acrylic coating vapor retarder.
   1. Products:
      a. As specified in Section 09 21 16.

E. Backer Board: High-density polystyrene with waterproof membrane and facer on both sides and compatible alkaline-resistant joint tape.
   1. Thickness: 1/2 inch.
   2. Products:
      a. As specified in Section 09 21 16.

F. Mesh Tape: 2 inch wide self-adhesive fiberglass mesh tape.

2.08 CLEANERS

A. Acceptable manufacturers:
   1. American Olean Tile Company Div., National Gypsum Company.
   2. Aqua Mix (Custom Building Products)
   3. Klein Company, Inc.
   4. Summitville Tiles, Inc.

B. Type, based on Summitville Tiles, Inc. products; use for cleaning following conditions.
   1. Ceramic tile (acidic cleaner): SL-7.
   2. Latex grout: SL-66.
   3. Non-acid latex grout cleaner: SL-44.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive tile.

B. Verify wall surfaces are smooth and flat within tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

D. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).
   1. Test as Follows:
      a. Alkalinity (pH): ASTM F710.
      b. Moisture Vapor Emission: ASTM F1869.
   2. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Vacuum clean surfaces and damp clean.

B. Seal substrate surface cracks with filler.

C. Install cementitious backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to feather edge.

D. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

A. Install tile, thresholds, and stair treads and installation materials in accordance with applicable requirements of ANSI, manufacturer's instructions, and TCNA (HB) recommendations.

B. Lay tile to pattern indicated on drawings. Do not interrupt tile pattern through openings.
   1. Center tile in spaces with tiles of equal width at opposite walls, with no tiles less than 1/2 tile wide.
   2. Floor and wall tile to be installed in a 1/3 offset running bond or brick laid pattern, unless otherwise indicated on Drawings.
   3. Drain tops shall be adjustable square type and align with tile pattern.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
   1. Cut and drill tile and trim shapes without damage to exposed faces. Rub cut edges smooth with carborundum stone.
   2. Grind and fit tiles at intersections, against trim, and at built-in fixtures and accessories. Fit around outlets, pipes, fixtures, and fittings so plates, escutcheons, and collars overlap Work.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install ceramic accessories rigidly in prepared openings.

G. Install non-ceramic trim in accordance with manufacturer's instructions.

H. Install thresholds where indicated on drawings.

I. Sound tile after setting. Replace hollow sounding units.

J. Keep control and expansion joints free of mortar, grout, and adhesive.

K. Keep expansion joints free of adhesive or grout. Apply sealant to joints.

L. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

M. Grout tile joints unless otherwise indicated. Use latex modified grout unless otherwise indicated.
   1. Tub to tile joints to be caulked in lieu of grouting.
   2. Seal perimeter of plumbing fixtures at tile with silicone sealant in accord with Section 07 92 00 - Joint Sealants.

N. 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.

O. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, with latex modified thin set bond coat, unless otherwise indicated.

B. Over wood substrates, install in accordance with TCNA (HB) Method F142, with standard grout, unless otherwise indicated on drawings.

C. Over wood substrate with backer board underlayment, install in accordance with TCNA (HB) Method F144, for cementitious backer boards, with standard grout.

D. Over wood substrate with backer board underlayment, install in accordance with TCNA (HB) Method F146, for coated glass mat backer boards, with standard grout.

3.05 INSTALLATION - SHOWERS AND BATHTUB WALLS

A. At bathtub walls with prefabricated receptors, install in accordance with TCNA (HB) Method B411, mortar bed on studs with waterproofing membrane.

B. Grout with standard grout.

C. Seal joints between tile work and other work with sealant Type as specified in Section 07 90 05.

3.06 INSTALLATION - WALL TILE

A. Over cementitious backer units install in accordance with TCNA (HB) Method W223, organic adhesive.

B. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.

C. 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.

3.07 CLEANING

A. Clean tile and grout surfaces as Work Progresses, preventing accumulation of setting and grouting materials or debris on tile faces.

B. Follow manufacturer written instructions for cleaning tile, using cleaners approved by the tile and grout manufacturer.

3.08 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

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SECTION 09 51 00
ACOUSTICAL CEILINGS

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 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Suspended grid ceiling system.

C. Acoustical units.

D. Accessories.

1.03 REFERENCE STANDARDS

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

B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

C. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

D. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.

E. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions.

F. ASTM E1264 - Standard Classification for Acoustical Ceiling Products.

G. UL (FRD) - Fire Resistance Directory.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

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

B. Product Data: Provide data on suspension system components and acoustical units.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

A. Fire-Resistive Assemblies: Complete assembly listed and classified by UL for the fire resistance indicated, where indicated on Drawings.

B. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

C. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

1.07 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.

B. Acoustical Panels: Mineral fiber with membrane-faced overlay, with the following characteristics:
   1. Application(s): "Cloud" ceilings.
   2. Classification: ASTM E1264 Type IV.
   3. Size: As indicated on Drawings.
   4. Panel Edge: Square.
   5. Tile Edge: Square.
   6. Color: White.
   7. Suspension System: Concealed grid.
   8. Products:
      a. Armstrong World Industries, Inc; ACOUSTIBuilt™: www.armstrongceilings.com. (Basis of Design)
      b. CertainTeed Ceilings: www.certainteedceilings.com.
      c. USG Corporation: www.usg.com/ceilings.

C. Acoustical Panels: Glass fiber with membrane-faced overlay, with the following characteristics:
   1. Classification: ASTM E1264 Type XII.
      a. Form: 2, cloth.
      b. Pattern: "E" - lightly textured.
   2. Size: 24 by 48 inch.
   3. Thickness: 3/4 inch.
   4. Panel Edge: Narrow Reveal.
   5. Tile Edge: Square.
   6. Color: White.
   7. Suspension System: Exposed.
   8. Products:
      a. Armstrong World Industries, Inc; Optima: www.armstrongceilings.com.
      b. CertainTeed Ceilings; Symphony F, Narrow Reveal: www.certainteedceilings.com. (Basis of Design)
      c. USG Corporation; Halcyon Acoustical Panels: www.usg.com/ceilings.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
   1. Materials:
      a. Steel Grid: ASTM A653/A653M, G60 coating, unless otherwise indicated.
      b. Aluminum Grid: Aluminum sheet, ASTM B209/B209M.

B. Exposed Suspension System: Hot-dipped galvanized steel grid and cap.
   1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
   2. Profile: Tee; 9/16 inch face width.
   3. Finish: Baked enamel.
   4. Color: White.
   5. Products:
      a. Armstrong World Industries, Inc: www.armstrongceilings.com.
      b. CertainTeed Ceilings: www.certainteedceilings.com.
      c. USG Corporation: www.usg.com/ceilings.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

C. Exposed Suspension System: Aluminum grid and cap.

1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
2. Profile: Tee; 9/16 inch face width.
3. Finish: Baked enamel.
4. Products:
    a. Armstrong World Industries, Inc: www.armstrongceilings.com.
    b. CertainTeed Ceilings: www.certainteedceilings.com.
    c. USG Corporation: www.usg.com.
    d. Substitutions: See Section 01 60 00 - Product Requirements.

D. Concealed Suspension System: Hot-dipped galvanized steel grid and cap.
1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
2. Profile: Tee; 15/16 inch face width.
3. Finish: Baked enamel.
4. Color: White.
5. Products:
    a. Armstrong World Industries, Inc: www.armstrongceilings.com.
    b. CertainTeed Ceilings: www.certainteedceilings.com.
    c. USG Corporation; Donn Brand DX/DXL 15/16 inch Concealed Acoustical Suspension System: www.usg.com.
    d. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.

C. Hold-Down Clips: Manufacturer's standard clips to suit application.

D. Perimeter Moldings: Same metal and finish as grid.
1. Size and Profile: As required for installation conditionsand as detailed on Drawings.

E. Metal Edge Trim for Suspension Systems: Steel or extruded aluminum; provide attachment clips, splice plates, and preformed corner pieces for complete trim system.
1. Trim Height: As detailed on Drawings.
2. Finish: As indicated on Drawings.
3. Color: As indicated on Drawings.
4. Products:
    a. Armstrong World Industries, Inc: www.armstrongceilings.com.
    b. CertainTeed Ceilings: www.certainteedceilings.com.
    c. USG Corporation: www.usg.com/ceilings.
    d. Substitutions: See Section 01 60 00 - Product Requirements.

F. Acoustical Sealant For Perimeter Moldings: Specified in Section 07 92 00.

G. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 PREPARATION

A. Install after major above-ceiling work is complete.

B. Coordinate the location of hangers with other work.

C. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

3.03 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, ASTM C636/C636M, ASTM E580/E580M, ASTM C636/C636M, and ASTM E580/E580M and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Locate system on room axis according to reflected ceiling plan.

D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.

E. Coordinate the location of hangers with other work including but not limited to sprinklers, plumbing, HVAC, electrical, and low voltage systems.

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. Form expansion joints as detailed. Form to accommodate plus or minus 1 inch movement. Maintain visual closure.

3.04 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

E. Cutting Acoustical Units:
   1. Make field cut edges of same profile as factory edges.

F. Install hold-down clips on each panel to retain panels tight to grid system; comply with fire rating requirements.

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.

3.06 CLEANING

A. Clean and touch up minor finish damage in accordance with manufacturer's written requirements. Remove and replace components that cannot be successfully cleaned and repaired.

B. Clean all concealed spaces above suspended ceiling systems prior to Date of Substantial Completion.

3.07 PROTECTION

A. Remove and replace panels damaged during construction period prior to Date of Substantial Completion.

B. Protect panels from contact with contaminating substances resulting from construction operations. Remove any such substances by method approved by ceiling grid manufacturer.

END OF SECTION

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SECTION 09 65 00
RESILIENT FLOORING

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 SECTION INCLUDES

A. Resilient tile flooring.

B. Resilient base.

C. Installation accessories.

1.03 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied resilient flooring.

B. Section 03 54 00 - Cast Underlayment: Self-leveling floor underlayment for interior residential units.

1.04 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

C. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile.

D. ASTM F1861 - Standard Specification for Resilient Wall Base.

E. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

F. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

G. BAAQMD 8-51 - Bay Area Air Quality Management District Regulation 8, Rule 51, Adhesive and Sealant Products; www.baaqmd.gov; 2002.

H. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

I. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.

1.05 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 plans and floor patterns.

D. Verification Samples: Submit two samples, 8 by 8 inch in size illustrating color and pattern for each resilient flooring product specified.

E. Field Report: Submit one report with passing results of concrete slab preparation indicating compliance with ASTM F710 for this project.

F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

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.
   2. Coordinate directly with Owner for quantities of and storage locations for attic stock.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum five years documented experience.

B. Installer Qualifications: Company specializing in installing specified flooring with minimum five years documented experience.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Protect roll materials from damage by storing on end.

D. Do not double stack pallets.

1.09 FIELD CONDITIONS

A. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

B. 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

2.01 PLANK FLOORING

A. Luxury Vinyl Planking:
   1. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
   2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.
   3. Manufacturers:
      a. As scheduled on Interior Design Drawings.
      b. Substitutions: Not permitted.

2.02 TILE FLOORING

A. Vinyl Composition Tile: As indicated on Interior Design Drawings.
   1. Manufacturers:
      a. As scheduled.
      b. Substitutions: Not permitted.
   2. Minimum Requirements: Comply with ASTM F1066, 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, NFPA 253, ASTM E 648, or NFPA 253.

2.03 RESILIENT BASE

2.04 ACCESSORIES

A. Accessory Materials: Unless indicated otherwise on the Drawings, provide the following:
   1. Reducers: Vinyl equal to Mercer Products Company, Inc.: Tile Reducer, #600 Series, actual series determined by tile thickness.
   2. Transition Strip: Johnsonite: MT-00-B aluminum track with CE-49-A beige carpet to tile adapter.
   3. Edge Trim: Vinyl equal to Mercer Products Company, Inc.: Royal Custom Edge #100.
   4. Tub Trim: Vinyl equal to Johnsonite TM-50-A, one inch high, color; Lustre White.
   5. Colors: Selected by Interior Designer from manufacturer's standard colors.

B. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

C. Primers, Adhesives, Seam Sealer, and Waterproofing: Types recommended and approved in writing by flooring manufacturer.
   1. Provide waterproofing at locations indicated on Drawings.
   2. Provide skim coat and or primer compatible with floor finish.
   3. Provide only products having lower volatile organic compound (VOC) content than required by the more stringent of the South Coast Air Quality Management District Rule No.1168 and the Bay Area Air Quality Management District Regulation 8, Rule 51.

D. Moldings, Transition and Edge Strips: As indicated on Interior Design Drawings.
   1. Manufacturers:
      a. Substitutions: Not permitted.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
   1. Test as Follows:
      a. Alkalinity (pH): ASTM F710.
      b. Internal Relative Humidity: ASTM F2170.
      c. Moisture Vapor Emission: ASTM F1869.
      d. Adhesion Bond Test.
   2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.

C. Prohibit traffic until filler is fully cured.

D. Clean substrate.

E. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Adhesive-Applied Installation:
   1. Spread only enough adhesive to permit installation of materials before initial set.
   2. Fit joints and butt seams tightly.
   3. Set flooring in place, press with heavy roller to attain full adhesion.

D. Loose-Laid Installation: Set flooring in place in accordance with manufacturer's instructions.

3.04 INSTALLATION - SOUND CONTROL UNDERLAYMENT

A. Install in accordance with underlayment manufacturer's written instructions.

3.05 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.

3.06 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.07 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.08 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

3.09 SCHEDULE

A. Refer to Interior Design Drawings for Basis of Design materials, colors and locations.

END OF SECTION

SECTION 09 68 13
TILE CARPETING

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 SECTION INCLUDES

A. Carpet tile, as scheduled on Interior Design Drawings.

B. Accessories.

1.03 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied flooring.

B. Section 03 54 00 - Cast Underlayment: Substrate to receive adhesive-applied carpet.

1.04 REFERENCE STANDARDS

A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials.

B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

F. CRI (GLP) - Green Label Plus Testing Program - Certified Products.

G. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

1.05 SUBMITTALS

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

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

D. Field Report: Submit one report with passing results of concrete slab preparation indicating compliance with ASTM F710 for this project.

E. 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. Coordinate directly with Owner for quantities of and storage locations for attic stock.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum five years documented experience.

B. Installer Qualifications: Company specializing in installing carpet tile with minimum five years documented experience and approved by carpet tile manufacturer.

1.07 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation, or as directed in writing by carpet manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Tile Carpeting:
   1. As indicated on Interior Design Drawings.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Tile Carpeting: As selected by and scheduled on Interior Design Drawings, manufactured in one color dye lot.
   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.

2.03 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Edge 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.

D. Carpet Tile Adhesive: Recommended by carpet tile manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces, and are ready to receive carpet tile.

B. 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.

3.02 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. Vacuum clean substrate.

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, unless indicated otherwise on Drawings.

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.

END OF SECTION

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SECTION 09 68 16
SHEET CARPETING

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 SECTION INCLUDES

A. Carpet and accessories, as scheduled on Interior Design Drawings.

B. Accessories.

1.03 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied carpet.

B. Section 03 54 00 - Cast Underlayment: Substrate to receive adhesive-applied carpet.

1.04 REFERENCE STANDARDS

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

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

D. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

E. CRI (GL) - Green Label Testing Program - Certified Products.

F. CRI 104 - Standard for Installation of Commercial Carpet.

G. CRI 105 - Standard for Installation of Residential Carpet.

1.05 SUBMITTALS

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

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Samples: Submit two samples 24 x 24 inch in size illustrating color and pattern for each carpet and cushion material specified.

D. Field Report: Submit one report with passing results of concrete slab preparation indicating compliance with ASTM F710 for this project.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional requirements.
   2. Coordinate directly with Owner for quantities of and storage locations for attic stock.

1.06 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.

1.07 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 MANUFACTURERS

A. Carpet:
   1. As indicated on Interior Design Drawings.
   2. Substitutions: Not permitted.

B. Cushion:
   1. As indicated on Interior Design Drawings.
   2. Substitutions: Not permitted.

2.02 CARPET

A. Residential Units, Common Areas, and Amenity Areas.
   1. Characteristics:
      a. Style: As indicated on Interior Design Drawings
      b. Face Weight: As indicated on Interior Design Drawings
      c. Fiber Type: As indicated on Interior Design Drawings
      d. Color: As indicated on the Finish Schedule.
      e. Stain Protection: As indicated on Interior Design Drawings
      f. Flame spread, fuel contribution, and smoke development: Meeting ASTM E84.

2.03 CUSHION

A. Carpet Cushion: As scheduled on Interior Design Drawings. Meeting CRI 104/CRI 105 requirements.

B. Location: Where cushion is indicated on the Finish Schedule.

2.04 ACCESSORIES

A. Tackless Strip: Carpet gripper, of type recommended by carpet manufacturer to suit application, with attachment devices.
   1. Provide stripping with two rows of pins for carpet installations less than 20 ft. in width; three rows for carpet over 20 ft. in width

B. Base Gripper: Tackless strip type, with special lipped edge, standard finish, color as selected.

C. Moldings and Edge Strips: Material and, color as selected. Meeting all accessible route requirements.

D. Adhesives:
   1. Compatible with materials being adhered; maximum VOC content of 50 g/L; CRI (GL) certified.

E. Seam Adhesive: Recommended by carpet manufacturer.

F. Carpet Adhesive: Recommended by carpet manufacturer.

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. 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.

3.02 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. Clean substrate.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet and cushion in accordance with manufacturer's written instructions and CRI 104 (Commercial).

C. Verify carpet match before cutting to ensure minimal variation between dye lots.

D. Lay out carpet and locate seams in accordance with shop drawings.
   1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
   2. Do not locate seams perpendicular through door openings.
   3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
   4. Locate change of color or pattern between rooms under door centerline.
   5. Provide monolithic color, pattern, and texture match within any one area.

E. Install carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance.

3.04 DOUBLE-GLUE-DOWN INSTALLATION

A. Install in accordance with manufacturer's written instructions and CRI 104.

3.05 CLEANING

A. Carpet to receive Stain & Soil Repellant R2X stain guard product treatment.

B. Remove excess adhesive from floor and wall surfaces without damage.

C. Clean and vacuum carpet surfaces just prior to Date of Substantial Completion.

END OF SECTION

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SECTION 09 72 00
WALL COVERINGS

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 SECTION INCLUDES

A. Wall coverings.

1.03 RELATED REQUIREMENTS

A. Section 09 21 16 - Gypsum Board Assemblies: Preparation and priming of substrate surfaces.

1.04 DEFINITIONS

A. Specialty Wall Covering: Wall covering with wall preparation requirements outlined in manufacturer recomendations that may exceed the minimum requirements outlined in this Section, including but not limited to wood veneer, large format, and custom graphics.

1.05 REFERENCE STANDARDS

A. ASTM D1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Coating Systems.

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

1.06 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, 12 by 12 inch in size illustrating color, finish, and texture.

E. Installer's Qualification Statement.

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. Extra Wall Covering Materials: 25 linear feet of each color and pattern of wall covering; store where directed.
   3. Package and label each roll by manufacturer, color and pattern, and destination room number.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and accessories to Project site in original packages, containers, or bundles, labeled with manufacturer's name, product brand name, and lot number.

B. Inspect roll materials at arrival on site, to verify acceptability.

C. Protect packaged adhesive from temperature cycling and cold temperatures.

D. Do not store roll goods on end.

1.09 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 Coverings: Types as scheduled on Interior Design Drawings.

C. Adhesive: Type recommended and approved in writing by wall covering manufacturer to suit application to substrate.

D. Termination Trim: Profile, material, and color as scheduled on Interior Design Drawings.

E. Substrate Filler: Type recommended and approved in writing by wall covering manufacturer; compatible with substrate.

F. Substrate Primer and Sealer: As scheduled on Interior Design Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are prime painted and ready to receive work and comply with requirements of wall covering manufacturer.

B. Measure moisture content of surfaces using an electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.

C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet nor vary at a rate greater than 1/16 inch/ft.

3.02 PREPARATION

A. Provide Level 5 finish for drywall surfaces to receive "specialty wall covering" as outlined in Section 09 21 16 - Gypsum Board Assemblies, including but not limited to wood veneer, large format, and custom graphics.

B. Fill cracks in substrate and smooth irregularities with filler; sand smooth.

C. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.

D. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

E. Surfaces: Correct defects and clean surfaces that affect work of this section.

F. Apply two coats of primer sealer to substrate surfaces. Allow to dry. Lightly sand smooth.

G. Vacuum clean surfaces free of loose particles.

3.03 INSTALLATION

A. Apply adhesive and wall covering in accordance with manufacturer's instructions.

B. Razor trim edges on flat work table. Do not razor cut on gypsum board surfaces.

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. Install wall covering before installation of bases and items attached to or spaced slightly from wall surface.

H. Do not install wall covering more than 1/4 inch below top of resilient base.

I. Cover spaces above and below windows, above doors, in pattern sequence from roll.

J. Apply wall covering to electrical wall plates prior to replacing.

K. Where wall covering tucks into reveals, or metal wallboard or plaster stops, apply with contact adhesive within 6 inches of wall covering termination. Ensure full contact bond.

L. Install termination trim.

M. 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

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SECTION 09 81 16
ACOUSTIC BLANKET INSULATION

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 SECTION INCLUDES

A. Glass fiber acoustical blanket insulation for interior partitions, also referred to as Sound Blankets or SAB.

1.03 RELATED REQUIREMENTS

A. Section 07 21 00 - Thermal Insulation.

B. Section 09 21 16 - Gypsum Board Assemblies.

C. Section 09 22 16 - Non-Structural Metal Framing.

D. Section 13 34 19 - Metal Building Systems.

1.04 REFERENCE STANDARDS

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

C. ASTM C834 - Standard Specification for Latex Sealants.

D. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications.

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

F. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

G. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

H. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C.

1.05 SUBMITTALS

A. Product Data: Submit product characteristics, performance criteria, and limitations, including installation instructions, for each type of product indicated.

1.06 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
   1. Surface-Burning Characteristics: ASTM E84.
   2. Fire-Resistance Ratings: ASTM E119.
   3. Combustion Characteristics: ASTM E136.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer’s original packaging.

B. Store and protect products in accordance with manufacturer’s instructions. Store in a dry indoors location. Protect insulation materials from moisture and soiling.

C. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

D. Do not install insulation that has been damaged or wet. Remove it from jobsite.
   1. An exception may be allowed in cases where the contractor is able to demonstrate that wet insulation when fully dried out (either before installation or afterward following

exposure to system operating temperatures) will provide installed performance that is equivalent in respects to new, completely dry insulation. In such cases, consult the insulation manufacturer for technical assistance.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. CertainTeed Saint-Gobain; NoiseReducer ™ Sound Attenuation Batts: www.certainteed.com.

B. Johns Manville Industrial Insulation Group; Sound-SHIELD® Formaldehyde-Free™ Fiberglass Insulation: www.jm.com.

C. Knauf; KN Series with ECOSE® Technology: www.knaufinsulation.us.

D. Owens Corning Corp: www.owenscorning.com.
   1. EcoTouch® Sound Attenuation Batts with PureFiber® Technology.
   2. Sound Attenuation Batts (SAB).

E. Other manufacturers are acceptable, subject to the project requirements and the requirements of this Section.
   1. Refer to and coordinate with rated assembly designs indicated on Drawings.

F. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 SOUND ATTENUATION BATT (SAB) INSULATION

A. Type: Unfaced glass fiber acoustical insulation, complying with ASTM C665, Type I.

B. Thickness; As indicated on Drawings.

C. Surface Burning Characteristics: ASTM E84.
   1. Maximum flame spread: 10.
   2. Maximum smoke developed: 10.

D. Fire Resistance Ratings: Passes ASTM E119 as part of a complete fire tested wall assembly.

E. Sound Transmission Class: ASTM C423, STC rating; As indicated on Drawings.

F. Dimensional Stability: Linear Shrinkage less than 0.1%.

2.03 AUXILIARY MATERIALS

A. Acoustical Sealant
   1. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C834ASTM C834.
   2. Product shall effectively reduce airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions under which the work of this Section is to be performed. Notify the Architect in writing of any unsatisfactory conditions. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Verify mechanical and electrical services within the partition have been tested and inspected.

3.02 INSTALLATION

A. Comply with manufacturer's written installation instructions.

B. Friction-fit blanket insulation in place, until the interior finish is applied. Install batts to fill entire stud cavity, with no gaps, voids, or areas of compression. If stud cavity is less than 8 feet in height, cut lengths to friction fit against floor and ceiling tracks. Walls with penetrations require that insulation be carefully cut to fit around outlets, junction boxes, and other irregularities.

C. Where walls are not finished on both sides or where insulation does not fill the cavity depth, install supplementary support to hold product in place.

D. Where insulation must extend higher than 8 feet, provide temporary support to hold product in place, until finish material is applied.

3.03 STC-RATED ASSEMBLIES

A. Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

B. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.04 PROTECTION

A. Protect installed insulation as recommended by manufacturer.

END OF SECTION

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SECTION 09 91 13.01
PAINTING SCHEDULE EXTERIOR

SCHEDULE:

1.01 EXTERIOR APPLICATIONS:

A. Alkyd Gloss Enamel on Pre-Primed Metal Doors & Frames:
   1. Primer:
      a. Pittsburgh Paints: 6-208 Speedhide Rust Inhibitive Alkyd Metal Primer.
      b. Sherwin Williams: B50 Series Kem Kromik Universal Metal Primer.
      c. Benjamin Moore: Super Spec HP Alkyd Metal Primer P06.
      d. BEHR Metal Primer 435.
   2. First and Second Coats:
      a. Pittsburgh Paints: 4308H Urethane Modified Industrial Alkyd.
      b. Sherwin Williams: Industrial Alkyd Enamel B54 Series.
      c. Benjamin Moore: Moore Urethane Alkyd Enamel P22.
      d. BEHR Premium Urethane Alkyd Enamel Semi-Gloss 3900.

B. Deep Cover, Full Gloss, Alkyd Enamel on Pre-Primed Ferrous Metal Stairs & Railing:
   1. Primer:
      a. Pittsburgh Paints: 6-208 Speedhide Rust Inhibitive Alkyd Metal Primer.
      b. Sherwin Williams: B50 Series Kem Kromik Universal Metal Primer.
      c. Benjamin Moore: Super Spec HP Alkyd Metal Primer P06.
      d. BEHR Metal Primer 435.
   2. First and Second Coats:
      a. Pittsburgh Paints: 4308H Urethane Modified Industrial Alkyd.
      b. Sherwin Williams: Industrial Alkyd Enamel B54 Series.
      c. Benjamin Moore: Moore Urethane Alkyd Enamel P22.
      d. BEHR Premium Urethane Alkyd Enamel Semi-Gloss 3900.

C. Acrylic Paint on Garage Concrete Columns: Non-breathable.
   1. Primer:
      a. Pittsburgh Paints: 4-603XI; Perma Crete Acrylic Alkali Resistant Primer.
      b. Sherwin Williams: Loxon Masonry Primer A24W300.
      c. Benjamin Moore: Super Spec Masonry Acrylic HB Masonry Primer 068.
      d. BEHR Pro Concrete & Masonry Primer PR060.
   2. First and Second Coats:
      a. Pittsburgh Paints: 6-2045XI Series Speedhide 100% Acrylic Exterior Satin Finish.
      b. Sherwin Williams: A-100 Exterior Latex Satin A82-100 Series.
      c. Benjamin Moore: Super Spec Exterior Acrylic Satin 184-01.
      d. BEHR Pro e600 100% Acrylic Exterior Satin Finish PR640.

D. Acrylic Paint on Fiber Cement Siding and Trim:
   1. Primer (if not factory-primed):
      a. Pittsburgh Paints: 4-603XI; Perma Crete Acrylic Alkali Resistant Primer.
      b. Sherwin Williams: Loxon Masonry Primer A24W300.
      c. Benjamin Moore: Super Spec Masonry Acrylic HB Masonry Primer 068.
      d. BEHR Pro Concrete & Masonry Primer PR060.
   2. First and Second Coats:
      a. Pittsburgh Paints: 6-2045XI Series Speedhide 100% Acrylic Exterior Satin Finish.
      b. Sherwin Williams: A-100 Exterior Latex Satin A82-100 Series.
      c. Benjamin Moore: Super Spec Exterior Acrylic Satin 184-01.
      d. BEHR Pro e600 100% Acrylic Exterior Satin Finish PR640.

E. Acrylic Paint on Wood, Trim, and Frames:
   1. Primer:
      a. Pittsburgh Paints: 17-921XI Seal Grip Interior Exterior Universal Acrylic Primer.
      b. Sherwin Williams: Exterior Latex Wood Primer B42W08041.
      c. Benjamin Moore: Fresh Start All Purpose Acrylic Primer 023.

d. BEHR Multi-Surface Interior/Exterior Stain Blocking Primer & Sealer 436.
2. First and Second Coats:
a. Pittsburgh Paints: 6-2045XI Series Speedhide 100% Acrylic Exterior Satin Finish.
b. Sherwin Williams: A-100 Exterior Latex Satin A82-100 Series.
c. Benjamin Moore: Super Spec Exterior Acrylic Satin 184-01.
d. BEHR Pro e600 100% Acrylic Exterior Satin Finish PR640.

F. Acrylic Paint on Galvanized Metal as part of the Exterior Finish (Flashing):
1. Primer:
a. Pittsburgh Paints: 90-1908 Series Pitt Tech Plus EP DTM Acrylic Primer Finish.
b. Sherwin Williams: All Surface Enamel Latex Primer A41W01210.
c. Benjamin Moore: Super Spec HP Acrylic Metal Primer P04.
d. BEHR Multi-Surface Interior/Exterior Stain Blocking Primer & Sealer 436.
2. First and Second Coats:
a. Pittsburgh Paints: 6-2045XI Series Speedhide 100% Acrylic Exterior Satin Finish.
b. Sherwin Williams: A-100 Exterior Latex Satin A82-100 Series.
c. Benjamin Moore: Super Spec Exterior Acrylic Satin 184-01.
d. BEHR Pro e600 100% Acrylic Exterior Satin Finish PR640.

G. Acrylic Paint on Exterior Gypsum Surfaces:
1. Primer for walls and ceilings:
a. Pittsburgh Paints: 4-603XI; Perma Crete Acrylic Alkali Resistant Primer.
b. Sherwin Williams: Loxon Acrylic Primer, A24W300 Series.
c. Benjamin Moore: High Build Acrylic Masonry Primer, 068.
d. BEHR Multi-Surface Interior/Exterior Stain Blocking Primer & Sealer 436.
2. First and Second Coats:
a. Pittsburgh Paints: 6-2045XI Series Speedhide 100% Acrylic Exterior Satin Finish.
b. Sherwin Williams: A-100 Exterior Latex Satin A82-100 Series.
c. Benjamin Moore: Super Spec Exterior Acrylic Satin 184-01.
d. BEHR Pro e600 100% Acrylic Exterior Satin Finish PR640.

H. Acrylic Paint on Exterior PVC Vent Stacks (paint to match roofing finish):
1. Primer:
a. Pittsburgh Paints: 17-921XI; Seal Grip Interior exterior Universal Acrylic Primer.
b. Sherwin Williams: PrepRite Pro Block LatexPrimer/Sealer: B51-600.
c. Benjamin Moore: Equal Product.
d. BEHR Multi-Surface Interior/Exterior Stain Blocking Primer & Sealer 436.
2. First and Second Coats:
a. Pittsburgh Paints: 6-2045XI Series Speedhide 100% Acrylic Exterior Satin Finish.
b. Sherwin Williams: A-100 Exterior Latex Satin A82-100 Series.
c. Benjamin Moore: Super Spec Exterior Acrylic Satin 184-01.
d. BEHR Pro e600 100% Acrylic Exterior Satin Finish PR640.

I. Textured Coating on CMU or Concrete walls:
1. Block filler (CMU only replacing primer):
a. Pittsburgh Paints: Perma-Crete Concrete Block & Masonry Surfacer//Filler 4-100XI.
b. Sherwin Williams: Prep-Rite Latex Block FillerB25W25.
c. Benjamin Moore: Latex Block Filler M88 Series.
d. BEHR Pro: Block Filler Primer, PR050
2. Primer (Concrete only):
a. Pittsburgh Paints: 4-603XI; Perma Crete Acrylic Alkali Resistant Primer.
b. Sherwin Williams: Loxon Masonry Primer A24W300.
c. Benjamin Moore: Super Spec Masonry Acrylic HB Masonry Primer 068.
d. BEHR Pro Concrete & Masonry Primer PR060.
3. First and Second Coats:
a. Pittsburgh Paints: 4-50 Perma Crete Exterior Acrylic Texture Coating Fine Texture.
b. Sherwin Williams: UltraCrete Texture Coating A44W800.
c. Benjamin Moore: SuperSpec Masonry Coating Fine Texture 060.

d. BEHR Pro Acrylic Texture Coating PR710.

J. Parking Striping for fully cured concrete and asphalt surfaces:
1. Characteristics:
a. Product Type: Alkyd.
b. Sheen: Flat: 0 to 5 (60º & 85º Gloss Meter).
c. Volume Solids*: 53% +/- 2%.
d. Weight Solids*: 77% +/- 2%.
e. VOC*: 350 g/L max.
f. Weight/Gallon: 5.8 kg +/- 91 g.
g. Coverage: 3.78 L covers approximately 106.64 linear meters of 10.2 cm wide stripe.
1) Does not include loss due to surface irregularities and porosity or material loss due to application method or mixing.
h. Wet Film Thickness: 15 mils; 381microns.
i. Dry Film Thickness: 8.0 mils; 203 microns.
j. Drying Time at 25ºC; 50% relative humidity:
1) Touch: 30 minutes.
2) Traffic: 30 minutes.
2. Colors:
a. Traffic White; in locations indicated on Drawings.
1) Pittsburgh Paints: Traffic marking paint.
2) Sherwin Williams: SW 7006 (Extra White)
b. Safety Yellow, Lead-free; in locations indicated on Drawings.
1) Pittsburgh Paints: PC875 (Safety Yellow)
2) Sherwin Williams: SW 4084 (Safety Yellow)
c. Safety Green for EV Charging Stations.
1) Pittsburgh Paints: PC855 (Safety Green)
2) Sherwin Williams: SW 4085 (Safety Green)
d. Safety Blue for Accessible parking space symbols and striping.
1) Pittsburgh Paints: PC865 (Safety Blue)
2) Sherwin Williams: SW 4086 (Safety Blue)
3. First and Second Coats:
a. Pittsburgh Paints: ZONELINE™; Traffic & Zone Marking Paint; Alkyd.
b. Substitutions: Section 01 60 00 - Product Requirements.

END OF SECTION

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SECTION 09 91 13
EXTERIOR PAINTING

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 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Materials for backpriming woodwork.

D. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Exposed surfaces of steel lintels and ledge angles.
   3. Mechanical and Electrical:
      a. Plumbing vent stacks.
   4. Parking Striping.

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, and operating parts of equipment.
   5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, zinc, and lead.
   6. Floors, unless specifically indicated.
   7. Glass.
   8. Concealed pipes, ducts, and conduits.

1.03 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Shop-primed items.

B. Section 05 51 00 - Metal Stairs: Shop-primed items.

C. Section 07 46 46 - Fiber-Cement Siding; Factory primed siding and trim.

D. Section 09 91 23 - Interior Painting.

1.04 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.05 REFERENCE STANDARDS

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

B. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating.

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

D. SSPC-SP 1 - Solvent Cleaning.

E. SSPC-SP 2 - Hand Tool Cleaning.

F. SSPC-SP 13/NACE No.6 - Surface Preparation of Concrete.

1.06 SUBMITTALS

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

B. Product Data: Provide complete list of products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
3. Manufacturer's installation instructions.

C. Samples: Submit two painted samples, illustrating selected colors and textures for each color and system selected with specified coats cascaded. Submit on aluminum sheet, ____x____ inch in size.

D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

E. 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 Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
3. Label each container with color in addition to the manufacturer's label.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum ten years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience and with minimum three years experience.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.09 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 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. Base Manufacturer: Pittsburgh Paints: www.pittsburghpaintsco.com (formerly PPG Paints).
2. Behr Process Corporation:; Pro Line www.behr.com.
3. Sherwin-Williams Company: www.sherwin-williams.com.

C. Primer Sealers: Same manufacturer as top coats.

D. Substitutions: See Section 01 60 00 - Product Requirements.

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. Supply each paint material in quantity required to complete entire project's work from a single production run.
3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.

B. Flammability: Comply with applicable code for surface burning characteristics.

C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

D. Colors: As indicated in Color Schedule.
1. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Owner.
2. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.03 PAINT SYSTEMS - EXTERIOR

A. As indicated in the Schedule listed in 09 91 13.01 - Painting Schedule Exterior.

2.04 PRIMERS

A. Primers: Provide the primer listed in the Schedule, unless other primer is required or recommended in writing by manufacturer of top coats.

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. Test shop-applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Fiber Cement Siding: 12 percent.
2. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove 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. Clean concrete according to ASTM D4258. Allow to dry.

3. Prepare surface as recommended by top coat manufacturer and in accordance with SSPC-SP 13/NACE No.6.

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.

I. Exterior Gypsum Board: Fill minor defects with exterior filler compound. Spot prime defects after repair.

J. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

K. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
   2. Prepare surface according to SSPC-SP 2.

L. 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.

M. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.

N. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.

O. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with tinted primer.

P. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.

C. Apply products in accordance with manufacturer's written instructions.

D. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

E. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

F. Apply each coat to uniform appearance.

G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

H. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection.

B. Owner will provide field inspection.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

3.07 SCHEDULE - PAINT SYSTEMS

A. Section 09 91 13.01 - Painting Schedule Exterior

END OF SECTION

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SECTION 09 91 23.01
PAINTING SCHEDULE INTERIOR

SCHEDULE:

1.01 INTERIOR APPLICATIONS:

A. Concrete Walls (Normal Service): Repair Walls; Fill air holes, cracks, and honeycombs.
   1. Primer:
      a. Pittsburgh Paints: 6-2 Speedhide Interior Latex Primer Sealer.
      b. Sherwin Williams: Pro-Mar 200 Zero VOC Int. Latex Primer B28W02600.
      c. Benjamin Moore: Super Spec Latex Enamel Undercoater & Primer 253.
      d. BEHR: Multi-Surface Primer and Sealer, 436
   2. First and Second Coats: Sheen: As indicated on Drawings.
      a. Pittsburgh Paints: Speedhide Zero VOC Interior Latex.
      b. Sherwin Williams: Pro-Mar 200 Latex.
      c. Benjamin Moore: Super Spec Interior Latex.
      d. BEHR Pro: i300 Series Zero VOC Latex

B. Concrete Walls (Hard Service Areas): Repair Walls; Fill air holes, cracks, and honeycombs.
   1. Primer:
      a. Pittsburgh Paints: 17-921XI; Seal Grip Acrylic Universal Primer.
      b. Sherwin Williams: PrepRite Pro Block LatexPrimer/Sealer: B51-600.
      c. Benjamin Moore: Fresh Start All Purpose Acrylic Primer 023.
      d. BEHR: Multi Surface Primer and Sealer, 436
   2. First and Second Coats: Sheen: As indicated on Drawings.
      a. Pittsburgh Paints: PPG Amerlock 2 VOC Polyamide Epoxy Coating.
      b. Sherwin Williams: Pro Industrial High Performance Epoxy B67 Series.
      c. Benjamin Moore: Super Spec Epoxy Mastic P45 Series.
      d. BEHR: n/a

C. CMU Walls (Normal Service Areas):
   1. Block Filler:
      a. Pittsburgh Paints: Perma-Crete Concrete Block & Masonry Surfacer//Filler 4-100XI.
      b. Sherwin Williams: Prep-Rite Latex Block FillerB25W25.
      c. Benjamin Moore: Latex Block Filler M88 Series.
      d. BEHR Pro: Block Filler Primer, PR050
   2. First and Second Coats: Sheen: Semi-gloss.
      a. Pittsburgh Paints: Speedhide Zero VOC Interior Latex Semi Gloss Enamel.
      b. Sherwin Williams: Pro-Mar 200 Latex Semi Gloss Enamel B31W2200.
      c. Benjamin Moore: Super Spec Interior Latex Semi-Gloss Enamel 276.
      d. BEHR Pro: i300 Zero VOC Semi-Gloss, PR370

D. CMU Walls (Hard Service Areas):
   1. Primer:
      a. Pittsburgh Paints: Perma-Crete Concrete Block & Masonry Surfacer/Filler 4-100XI.
      b. Sherwin Williams: SW Heavy Duty Block Filler B42W46.
      c. Benjamin Moore: "Equal Product".
      d. BEHR Pro: Block Filler Primer, PR050
   2. First and Second Coats: Sheen: Semi-gloss.
      a. Pittsburgh Paints: PPG Amerlock 2 VOC Polyamide Epoxy Coating.
      b. Sherwin Williams: Pro Industrial High Performance Epoxy B67 Series.
      c. Benjamin Moore: Super Spec Epoxy Mastic P45 Series.
      d. BEHR: n/a

E. Gypsum Wallboard:
   1. Primer:
      a. Pittsburgh Paints: 6-2 Speedhide Interior Latex Primer Sealer.
      b. Sherwin Williams: Pro-Mar 200 Zero VOC Int. Latex Primer B28W02600.
      c. Benjamin Moore: Super Spec Latex Enamel Undercoater & Primer 253.

d. BEHR: Drywall Plus Primer & Sealer, 73
2. First and Second Coats: Walls; Sheen: As indicated on Drawings.
a. Pittsburgh Paints: Speedhide Zero VOC Interior Latex Wall Paint.
b. Sherwin Williams: Pro-Mar 200 Interior Latex Wall Paint B30W251.
c. Benjamin Moore: Super Spec Interior Latex Wall Paint 275.
d. BEHR Pro: i300 Zero VOC Interior Latex Paint
3. First and Second Coats: Ceilings; Sheen: As indicated on Drawings.
a. Pittsburgh Paints: Speedhide Zero VOC Interior Latex Wall Paint.
b. Sherwin Williams: Pro-Mar 200 Interior Latex Wall Paint B30W251.
c. Benjamin Moore: Super Spec Interior Latex Wall Paint 275.
d. Behr Pro: i300 Zero VOC Interior Latex Wall Paint

F. Gypsum Wallboard (Public Areas):
1. Primer:
a. Pittsburgh Paints: 6-2 Speedhide Interior Latex Primer Sealer.
b. Sherwin Williams: Pro-Mar 200 Zero VOC Int. Latex Primer B28W02600.
c. Benjamin Moore: Super Spec Latex Enamel Undercoater & Primer 253.
d. BEHR: Drywall Pus Primer & Sealer, 73
2. First and Second Coats: Walls; Sheen: As indicated on Drawings.
a. Pittsburgh Paints: Speedhide Zero VOC Interior Latex.
b. Sherwin Williams: Pro-Mar 200 Interior Latex.
c. Benjamin Moore: Super Spec Interior Latex.
d. BEHR Pro: i300 Zero VOC Interior Latex
3. First and Second Coats: Ceilings; Sheen: As indicated on Drawings.
a. Pittsburgh Paints: Speedhide Zero VOC Interior Latex.
b. Sherwin Williams: Pro-Mar 200 Interior Latex.
c. Benjamin Moore: Super Spec Interior Latex.
d. BEHR Pro: i300 Zero VOC Interior Latex

G. Steel Stairs, Handrails, & Miscellaneous Steel Fabrications:
1. Primer:
a. Pittsburgh Paints: PPG Amerlock 2 VOC Polyamide Epoxy Coating
b. Sherwin Williams: Pro Industrial High Performance Epoxy B67 Series.
c. Benjamin Moore: Super Spec Epoxy Mastic P45 Series.
d. BEHR: n/a
2. First and Second Coats: Sheen: Semi-gloss.
a. Pittsburgh Paints: PPG Amerlock 2 VOC Polyamide Epoxy Coating.
b. Sherwin Williams: Pro Industrial High Performance Epoxy B67 Series.
c. Benjamin Moore: Super Spec Epoxy Mastic P45 Series.
d. BEHR: n/a

H. Steel Doors & Frames (Pre-Primed):
1. Primer:
a. Pittsburgh Paints: 90-1908 Pitt Tech Plus EP DTM Acrylic Primer Finish.
b. Sherwin Williams: Pro-Cryl Universal Acrylic Primer B66 Series.
c. Benjamin Moore: Super Spec HP Acrylic Metal Primer P04.
d. BEHR: Multi Surface Primer & Sealer, 436
2. First and Second Coats: Sheen: Gloss.
a. Pittsburgh Paints: 90-1510 Pitt Tech DTM Acrylic Industrial Gloss Enamel.
b. Sherwin Williams: Pro Industrial Gloss Acrylic Coating B66-600 Series.
c. Benjamin Moore: Super Spec DTM Acrylic Gloss Enamel P28.
d. BEHR: Premium Plus Hi-Gloss Enamel, 8150

I. Wood or Hardboard Doors, Wood Frames and Trim:
1. Primer:
a. Pittsburgh Paints: 17-921XI Seal Grip Interior Acrylic Primer/Finish.
b. Sherwin Williams: PrepRite Pro Block LatexPrimer/Sealer: B51-600.
c. Benjamin Moore: Fresh Start All Purpose Acrylic Primer 023.

d.
2. First and Second Coats: Sheen: As indicated on Drawings
    a. Pittsburgh Paints: Speedhide Zero VOC Interior Latex.
    b. Sherwin Williams: Pro-Mar 200 Latex.
    c. Benjamin Moore: Super Spec Interior Latex.
    d. BEHR Pro: i300 Zero VOC Interior Latex

J. Painted Wood Trim (Base, Casing, Crown, Chair-Rail, etc.):
1. Primer:
    a. Pittsburgh Paints: 17-921XI Seal Grip Interior Acrylic Primer/Finish.
    b. Sherwin Williams: PrepRite Pro Block LatexPrimer/Sealer: B51-600.
    c. Benjamin Moore: Fresh Start All Purpose Acrylic Primer 023.
    d. BEHR: Multi-surface Primer & Sealer, 436
2. First and Second Coats: Sheen: Satin.
    a. Pittsburgh Paints: Speedhide Zero VOC Interior Latex.
    b. Sherwin Williams: Pro-Mar 200 Latex.
    c. Benjamin Moore: Super Spec Interior Latex.
    d. BEHR: Premium Plus Zero VOC Interior Latex Satin, 7050

K. Stained Wood Doors, Frames, and Trim:
1. Stain Coat:
    a. Pittsburgh Paints: Varathane Classic Interior Oil Stain.
    b. Sherwin Williams: Wood Classics Interior Oil Stain A48-200 series.
    c. Benjamin Moore: Benwood Waterborne Interior Stain 205.
    d. BEHR: Fast Drying Water Based Wood Stain, BB4500
2. First and Second Coats: Sheen: As indicated on Drawings.
    a. Pittsburgh Paints: Proluxe Specialty Int/Ext Waterbased Polyurethane Acrylic.
    b. Sherwin Williams: Wood Classics Poly Varnish A67 series.
    c. Benjamin Moore: Benwood Interior Polyurethane - Low Lustre 435.
    d. BEHR: Premium Fast Drying Water Based Polyurethane, B8100 Series

L. Concrete Floors (Clear, Dust Seal):
1. First and Second Coats:
    a. Pittsburgh Paints: 4-6200 Perma-crete Plex-Seal WB Int/Ext Clear Sealer.
    b. Sherwin Williams: H&C Concrete Sealer Wet Look Water-Based.
    c. Benjamin Moore: Super Spec HP Clear Acrylic Sealer P27.
    d. BEHR Premium Wet look Sealer, 985

M. Concrete Floors (Color Coats), Standard-use:
1. Primer:
    a. Pittsburgh Paints: PPG Flooring 2445 Breathable Primer.
    b. Sherwin Williams: General Polymers 3460 Aquarmor WBE, Water-Based Epoxy.
    c. Benjamin Moore: Equal Product.
    d. Verdia High Performance Epoxy VCHPE
2. First and Second Coats:
    a. Pittsburgh Paints: First coat: PPG Flooring 2640 Breathable Floor Coating
        1) First coat: PPG Flooring 2640 Breathable Floor Coating
        2) Second Coat: PPG Flooring 2550 Waterborne Urethane Coating
    b. Sherwin Williams: Resutile Aqua 4410, Water-Based Urethane.
    c. Benjamin Moore: Equal Product.
    d. Verdia High Performance Epoxy VCHPE

N. Interior Equipment:
1. As indicated in individual Sections for Divisions 21 through 28.

END OF SECTION

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SECTION 09 91 23
INTERIOR PAINTING

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 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Materials for backpriming woodwork.

D. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Prime surfaces to receive wall coverings.
   3. 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. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.

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. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
   6. Marble, granite, slate, and other natural stones.
   7. Floors, unless specifically indicated.
   8. Ceramic and other tiles.
   9. Glass.
   10. Concrete masonry units in utility, mechanical, and electrical spaces.
   11. Acoustical materials, unless specifically indicated.
   12. Concealed pipes, ducts, and conduits.

1.03 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Shop-primed items.

B. Section 05 51 00 - Metal Stairs: Shop-primed items.

C. Section 05 70 00 - Decorative Metal: Interior Stairs.

D. Section 06 20 00 - Finish Carpentry: Interior standing and running trim.

E. Section 08 11 13 - Hollow Metal Doors and Frames: interior face of exterior door panels.

F. Section 08 14 16 - Flush Wood Doors: Interior doors.

G. Section 08 17 23 - Integrated Wood Door Assemblies.

H. Section 09 21 16 - Gypsum Board Assemblies: Interior walls and ceilings.

I. Section 09 91 13 - Exterior Painting.

J. Section 09 96 00 - High-Performance Coatings.

1.04 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.05 REFERENCE STANDARDS

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

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

C. SSPC-SP 1 - Solvent Cleaning.

D. SSPC-SP 2 - Hand Tool Cleaning.

1.06 SUBMITTALS

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

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
   2. Cross-reference to specified paint system products to be used in project; include description of each system.
   3. Manufacturer's installation instructions.

C. Samples: Submit two painted samples, illustrating selected colors and textures for each color and system selected with specified coats cascaded. Submit on aluminum sheet, ____x____ inch in size.

D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

E. 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 Paint and Finish Materials: 1 gal of each color; from the same product run, store where directed.
   3. Label each container with color in addition to the manufacturer's label.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum ten years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience and with minimum three years experience.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.09 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.

D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 fc measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Paints:
   1. Base Manufacturer: Pittsburgh Paints: www.pittsburghpaintsco.com (formerly PPG Paints).
   2. Behr Process Corporation; Pro Line www.behr.com.
   3. Sherwin-Williams Company: : www.sherwin-williams.com.

C. Primer Sealers: Same manufacturer as top coats.

D. Substitutions: See Section 01 60 00 - Product Requirements.

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. Supply each paint material in quantity required to complete entire project's work from a single production run.
   3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Flammability: Comply with applicable code for surface burning characteristics.

C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

D. Colors: To be selected from manufacturer's full range of available colors.
   1. Selection to be made by Architect after award of contract.
   2. Extend colors to surface edges; colors may change at any edge as directed by Architect.
   3. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted.
   4. In utility areas, finish equipment, piping, conduit, and exposed duct work in colors according to the Owner's direction.

2.03 PRIMERS

A. Primers: Provide scheduled primer, or as required or recommended by manufacturer of top coats.

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 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been adequately prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. Test shop-applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
   1. Gypsum Wallboard: 12 percent.
   2. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Surfaces with mildew shall be removed and replaced.

F. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

G. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

H. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
   2. Prepare surface according to SSPC-SP 2.

I. 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.

J. 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.

K. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.

L. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

M. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions.

C. 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. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

F. Sand wood and metal surfaces lightly between coats to achieve required finish.

G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection.

B. Owner will provide field inspection.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

3.07 SCHEDULE - PAINT SYSTEMS

A. Section 09 91 23.01 - Painting Schedule Interior

END OF SECTION

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SECTION 09 96 00
HIGH-PERFORMANCE COATINGS

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 SECTION INCLUDES

A. High performance coatings.

B. Surface preparation.

1.03 RELATED REQUIREMENTS

A. Section 05 12 13 - Architecturally-Exposed Structural Steel Framing: Substrates to receive the Work of this Section.

B. Section 09 91 23 - Interior Painting: Requirements for mechanical and electrical equipment surfaces.

1.04 ABBREVIATIONS AND ACRONYMS

A. DFT: Dry Film Thickness.

B. VOC: Volatile Organic Compounds.

1.05 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.

B. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating.

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual.

D. SCAQMD 1113 - Architectural Coatings.

E. SSPC-SP 1 - Solvent Cleaning.

F. SSPC-SP 2 - Hand Tool Cleaning.

G. SSPC-SP 3 - Power Tool Cleaning.

H. SSPC-SP 11 - Power-Tool Cleaning to Bare Metal.

1.06 SUBMITTALS

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

B. Product Data: Provide data indicating coating materials and UL designations/classification.
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. Cross-reference to specified coating system(s) product is to be used in; include description of each system.

C. Samples: Submit two samples 8 by 8 inch in size illustrating colorsmatching Architect's selection indicated on Drawings.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements and comply with VOC limits specified.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Maintenance Data: Include cleaning procedures and repair and patching techniques.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Coating Materials: 1 gallon of each type and color.
   2. Label each container with manufacturer's name, product number, color number, and room names and numbers where used.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of coating, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Coating 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.

1.09 FIELD CONDITIONS

A. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the coating product manufacturer.

C. Do not install materials when temperature is below 55 degrees F or above 90 degrees F.

D. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

F. Restrict traffic from area where coating is being applied or is curing.

1.10 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 bond, , gloss, and color retention for a 15 year period from the Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide high performance coating products from the same manufacturer.

B. High-Performance Coatings:
   1. Pittsburgh Paints: www.pittsburghpaintsco.com. (Distributor of PPG Protective & Marine).
   2. Sika Corporation: www.sikafloorusa.com.
   3. Sherwin-Williams Company: www.protective.sherwin-williams.com/industries.
   4. Tnemec Company, Inc: www.tnemec.com. (Basis of Design)
      a. Materials specified are those that have been evaluated for the specific service. Products of Tnemec Company, Inc., are listed to establish a standard of quality. Equivalent materials of other manufacturers may be substituted on written approval of the Architect. Requests for substitution shall include manufacturers literature for each product giving the name, product number, generic type, descriptive information, solids-by-volume, recommended dry film thickness, and certified ASTM test reports showing results to equal the performance of the specified products listed herein. In addition, a list of five projects shall be submitted in which each product has been used and rendered a minimum of five years of satisfactory service. All requests for substitution shall be made in writing, prior to submission of bids.
   5. Substitutions: Section 01 60 00 - Product Requirements.

2.02 TOP COAT MATERIALS

A. Coatings - General: Provide complete multi-coat systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated; number of coats specified does not include primer or filler coat.

1. Lead Content: Not greater than 0.06 percent by weight of total nonvolatile content.
2. Chromium Content, as Hexavalent Chromium, Zinc Chromate, or Strontium Chromate: None.
3. Volatile Organic Compound (VOC) Content:
    a. Provide coatings that comply with the most stringent requirements specified in the following:
        1) 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
        2) SCAQMD 1113 Rule.
    b. 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.
4. Colors: As scheduled on Drawings.

B. High-Build Epoxy Coating for exposed CMU faces in the service yard::
1. Number of Coats: Three.
    a. Block Filler:
        1) Tnemec; Series 130-6602 applied at 60-80 Sq. Ft/Gal, (18-20 mils DFT).
        2) Pittsburgh Paints; Perm-crete Int/Ext Concrete Block & Masonry Surfacer 4-100XI.
    b. Intermediate Coat:
        1) Tnemec; Series 156 applied at 136-204 Sq. Ft/Gal, (4-6 mils DFT).
        2) Pittsburgh Paints, Perma-Crete Pitt-Flex Elastomeric Coating-Smooth, 4-110XI, (5.4-7.2 mils DFT).
    c. Finish Coat:
        1) Tnemec; Series 156 applied at 136-204 Sq. Ft/Gal, (4-6 mils DFT).
        2) Pittsburgh Paints, Perma-Crete Pitt-Flex Elastomeric Coating-Smooth, 4-110XI, (5.4-7.2 mils DFT).

C. Urethane Coatingfor exterior steel canopy framing::
1. System Type: Zinc/Urethane/Fluoropolymer.
2. Surface Preparation: SSPC-SP 6.
3. Shop Primer: Coordinate with Division 05 Section "Structural Steel."
    a. Tnemec; Series 90.97 primer, (2.5 to 3.5 mils DFT).
    b. Pittsburgh Paints; PPG Amercoat 68 HS, (2.0-5.0 mils DFT).
4. Field Touch Up after steel erection:
    a. Tnemec; Series 1, (2.5 to 3.5 mils DFT).
    b. Pittsburgh Paints; PPG Amercoat 68 HS, (2.0-5.0 mils DFT).
5. Field First Coat:
    a. Tnemec; Series 73 Endura Shield, (2.0 to 3.0 mils DFT).
    b. Pittsburgh Paints; Coraflon ADS 650, (3-5 mils DFT).
6. Field Finish Coat:
    a. Tnemec; Series 1071 Fluoronar, (2.0 to 3.0 mils DFT).
    b. Pittsburgh Paints; Coraflon ADS Intermix, (1.5-2.2 mils DFT).
7. Total DFT: 6.5 to 9.5 mils.
8. Finish Color: As indicated on Drawings.
9. Provide 15 year gloss and color retention warranty.

D. High-Build Epoxy Coating: Two coats, water-base epoxy, gloss finish.
1. Tnemec; Series 287, (2.0 - 4.0 mils DFT).
2. Pittsburgh Paints; Aquapon WB EP, 98 E-1, (2.0-4.0 mils DFT).

E. High-Build Urethane Coating: Two coats, two-part, aliphatic moisture-curing polyurethane, semi-gloss finish.
1. Tnemec; Series 1095, (2.0 - 5.0 mils DFT).
2. Pittsburgh Paints; Pitthane, 95-8800 Series, (2.0-5.0 mils DFT).

F. Primers: As recommended by coating manufacturer for specific substrate, unless otherwise specified.

G. Shellac: Pure, white type.

2.03 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of coated surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Do not begin application of coatings until substrates have been properly prepared.

C. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.

D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

F. Test shop-applied primer for compatibility with subsequent cover materials.

G. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.

H. Proceed with coating application only after unacceptable conditions have been corrected.
   1. Commencing coating application constitutes Contractor's acceptance of substrates and conditions.

3.02 PREPARATION

A. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

B. Clean surfaces of loose foreign matter.

C. Remove substances that would bleed through finished coatings. If unremovable, seal surface with shellac.

D. Remove finish hardware, fixture covers, and accessories and store.

E. 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 coating manufacturer.
   3. Clean surfaces with pressurized water. Use pressure range of 600 to 1,500 psi at 6 to 12 inches. Allow to dry.

F. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Where shop-primed surfaces are not primed as specified in Part 2 above: 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 in accordance with primer specified in Part 2 above.
   3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning", and protect from corrosion until coated.
   4. In addition, for surfaces to be finished with Coating Type suitable for ferrous metals, remove tight rust, and shop primer, if any to bare metal using power tools according to SSPC-SP 11 "Power Tool Cleaning to Bare Metal", and protect from corrosion until coated.

3.03 PRIMING

A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

B. Concrete Masonry: Apply masonry filler to thickness required to fill holes and produce smooth surface; minimum thickness of 30 mils.

3.04 COATING APPLICATION

A. Apply coatings in accordance with manufacturer's written instructions, to thicknesses specified.

B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.05 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for general requirements for field inspection.

B. Dry Film Thickness Testing: Owner will engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
   1. Touch up and restore coated surfaces damaged by testing.
   2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, and specified thickness, Contractor shall pay for retesting and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations, and specified thickness.

3.06 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Clean surfaces immediately of overspray, splatter, and excess material.

C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.07 PROTECTION

A. Protect finished work from damage.

3.08 SCHEDULE

A. Colors: As indicated on Finish Schedule.

B. Framing, supports, anchors, base plates, and all ferrous metals connected to and part of the exterior Steel Canopy.

C. Exterior Ferrous Metal Railings and Handrails, Fences, Gates: Urethane, gloss, shop-applied after cleaning to bare metal, all surfaces coated including surfaces to be concealed or embedded in concrete.

D. Steel Lintels to be Embedded in Concrete and Masonry: Coal tar epoxy coating, shop-applied, all surfaces.

END OF SECTION

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SECTION 10 14 00
SIGNAGE

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 SECTION INCLUDES

A. Provide signs including, but not limited to, the following:
   1. Community identification and entrance signage
   2. Exterior directional signs.
   3. Exterior regulatory signs.
   4. Dwelling unit numbers.
   5. Building signs.
   6. Parking area signs.
   7. Room signs.
   8. Postal boxes

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design.

B. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council.

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. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
   1. When room numbers to appear on signs differ from those on Drawings, include the drawing room number on schedule.
   2. When content of signs is indicated to be determined later, request such information from Owner at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
   3. Submit for approval by Owner prior to fabrication.

D. Manufacturer'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.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store tape adhesive at normal room temperature.

1.07 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Ampco Graphics Inc.: www.apcosigns.com.

B. Best Sign Systems, Inc.: www.bestsigns.com.

C. Cosco Industries (ADA signs): www.coscoarchitecturalsigns.com.

D. Cosco Industries (non-ADA signs): www.coscoarchitecturalsigns.com.

E. InPro Corporation : www.inprocorp.com.

F. Mohawk Sign Systems, Inc: www.mohawksign.com.

G. Seton Identification Products: www.seton.com/aec.

H. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 SIGNAGE

A. Style: Refer to Drawings (under separate contract directly with the Owner).

2.03 MATERIALS

A. Dwelling Unit Numbers: Silkscreened plaque.

B. Building Numbers: 6-inch high painted aluminum. Allow four numbers for each building. Submit samples for approval when submitting bid.

C. Room Signs: 1/4-inch thick acrylic of size and text indicated on the Drawings, including but not limited to: "FIRE EXTINGUISHER", "MEN", "WOMEN", "METER ROOM".

D. Fasteners: Unless otherwise indicated, use concealed fasteners in all work of this Section. Fabricate fasteners from metals that are non-corrosive to sign surface materials and mounting substrates.

E. Adhesive: Provide manufacturer’s recommended adhesive compatible with mounting substrates.

2.04 FABRICATION

A. All lettering shall be executed in such a manner that all edges and corners are true and clean and are correctly spaced and photographically precise.

B. Sign edges shall be straight and free from saw marks and other imperfections.

2.05 SIGN TYPES

A. 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.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs and mount at heights indicated on Drawings and in accordance with ADA Standards and ICC A117.1.
   1. Room and Door Signs: Locate on wall at latch side of door with centerline of sign mounted as indicated on Drawings.
   2. If no location is indicated, obtain from and coordinate with Owner.

D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

END OF SECTION

SECTION 10 14 05
EXTERIOR BUILDING SIGNS

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 SECTION INCLUDES

A. Dimensional letter signs.

1.03 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications.

B. Division 26 - Electrical; lighting elements and connections.

1.04 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).

B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

C. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

D. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

F. ASTM D4802 - Standard Specification for Poly(Methyl Methacrylate) Acrylic Plastic Sheet.

G. NFPA 70 - National Electrical Code.

1.05 SUBMITTALS

A. Product data for each type of sign specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.

B. Shop drawings showing fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, grounds, layout, reinforcement, accessories, and installation details.
   1. Provide message list for each sign required, including large-scale details of wording and lettering layout.
   2. For signs supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed as a unit of Work in other Sections.
   3. Templates: Furnish full-size spacing templates for individually mounted dimensional letters.

C. Wiring diagrams from the manufacturer for illuminated sign units.

D. Samples: Provide the following samples of each sign component for initial selection of color, pattern and surface texture as required and for verification of compliance with requirements indicated.
   1. Samples for verification of color, pattern, and texture selected and compliance with requirements indicated:
      a. Aluminum: Samples of each finish type and color, on 6-inch-long sections of extrusions and not less than 4-inch squares of sheet or plate.

1.06 QUALITY ASSURANCE

A. Sign Fabricator Qualifications: Firm experienced in producing signs similar to those indicated for this Project, with a record of successful in-service performance, and sufficient production capacity to produce sign units required without causing delay in the Work.

B. UL and NEMA Compliance: Provide lighting fixtures and electrical components for illuminated signs that are labeled and listed by UL and comply with applicable NEMA standards.

C. Single-Source Responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.

1.07 MOCK UP

A. Provide two full sized templates, one each for the different sized signs. The templates are to be erected at the job site for review by the Owner for final determination of the sign location.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store signs by means that will prevent damage and contamination by other materials.

B. Handle and store signs in original manufacturer's protective packaging. Do not remove from protective packaging until ready for installation.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Include structural analysis calculations for signs indicated to comply with design loads; signed and sealed by a qualified, licensed professional engineer responsible for their preparation.
   1. Design sign structure and anchorage to comply with components and cladding requirements indicated on Structural Drawings.
   2. Signs and supporting elements shall withstand the effects of gravity and other loads within limits and under conditions indicated.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes; 120 deg F ambient, 180 deg F material surface.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.02 FABRICATORS

A. Turn-Key Specialty Exterior Sign Contractor capable of fabrication and installation. Approval subject to capabilitiies to meet the Owner's project schedule.
   1. DeNyse Companies; 4521 Industrial Access Rd; Douglasville, GA 30134; 1.800.941.SIGN (7446); www.denyseco.com.
   2. Other Fabrication and Installation Contractors are accepptable, subject to the performance criteria listed in this Section and matching the capabilities of the Basis of Design Contractor.

2.03 MATERIALS

A. Aluminum Sheet and Plate: Alloy and temper recommended by the sign manufacturer for the type of use and finish indicated, and with not less than the strength and durability properties specified in ASTM B209/B209M.

B. Aluminum Extrusions: Alloy and temper recommended the sign manufacturer for the type of use and finish indicated with not less than strength and durability specified in ASTM BASTM B221

C. Stainless-Steel Sheet: ASTM A240/A240M or ASTM A666/A666M , Type 304, stretcher-leveled standard of flatness.

D. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

E. Fasteners: Use concealed fasteners fabricated from metals that are not corrosive to the sign material and mounting surface.

F. Anchors and Inserts: Use stainless steel anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt

devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.04 DIMENSIONAL LETTERS

A. Fabricated Letters: Fabricate letters to required sizes and styles, using materials and thickness indicated. Form exposed faces and sides of characters to produce surfaces free from warp and distortion. Include internal bracing for stability and attachment of mounting accessories.

B. Aluminum Sheet: Not less than 0.090 inch thick. fabricate by Heliarc welding process.

C. Illuminated Units: Illuminate dimensional letters in the manner indicated using manufacturer's standard lighting components, including but not limited to neon tubes, transformers, insulators, and other components.
   1. Make provisions for servicing and concealed connections to the building electrical system.
   2. Provide sealed joint construction to prevent light leakage and water intrusion.
   3. Backlighted Units: Provide concealed lighting elements to render a smooth and consistent appearance across the entire illuminated surface.
      a. Include manufacturer's hardware for projection mounting of the characters at the distance from the wall surface indicated.
      b. White neon, LED, and other light sources are acceptable, provided they meet the requirements for illumination, sign color rendering, visibility, and meet local lighting ordinances.
      c. Coordinate electrical characteristics with those of the power supply provided.

2.05 FINISHES

A. Aluminum Finishes: Baked-Enamel or Powder-Coat Finish, AAMA 2604; minimum dry film thickness 1.5 mils.

B. Stainless Steel Finishes: Remove tool marks, die marks, and stretch lines; blend into finish.
   1. Polished: Grind and polish surfaces to produce uniform finish, free of cross scratches or other marks and blemishes.
      a. Mirrorlike Reflective, Nondirectional Polish; No. 8.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrates and structural supports are ready to receive work.

B. Verify electrical infrastructure is installed with proper power supply.

C. Make corrections prior to beginning installation. Proceeding with installation indicates acceptance of substrates and structural supports.

3.02 INSTALLATION

A. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.
   1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.

3.03 CLEANING AND PROTECTION

A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements.

B. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

C. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

END OF SECTION

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SECTION 10 21 13.19
PLASTIC TOILET COMPARTMENTS

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 SECTION INCLUDES

A. Solid plastic toilet compartments.

B. Urinal screens.

1.03 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Concealed steel support members.

B. Section 06 10 00 - Rough Carpentry: Blocking and supports.

C. Section 10 28 00 - Toilet, Bath, and Laundry Accessories.

D. Division 22 PLUMBING for plumbing fixtures.

1.04 REFERENCE STANDARDS

A. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.06 SUBMITTALS

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

B. Product Data: Provide data on panel construction, hardware, and accessories.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Solid Plastic Toilet Compartments:
   1. All American Metal Corp - AAMCO: www.allamericanmetal.com.
   2. ASI Accurate Partitions: www.asi-accuratepartitions.com.
   3. ASI Global Partitions: www.asi-globalpartitions.com.
   4. Inpro: www.inprocorp.com.
   5. General Partitions Mfg. Corp.: www.generalpartitions.com
   6. Partition Systems International of South Carolina; PolyLife HDPE Toilet Partitions: www.psisc.com.
   7. Sanymetal; a Crane Plumbing company: www.
   8. Scranton Products; Aria Partitions: www.scrantonproducts.com.
   9. Substitutions: Section 01 60 00 - Product Requirements.

2.02 PLASTIC TOILET COMPARTMENTS

A. Solid Plastic Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), tested in accordance with NFPA 286; floor-mounted unbraced.
   1. Color: As selected by Interior Designer from manufacturer's full range.

B. Doors:
   1. Thickness: 1 inch.
   2. Width: 24 inch.
   3. Width for Handicapped Use: 36 inch, out-swinging.
   4. Height: 55 inch.

C. Panels:
   1. Thickness: 1 inch.

2. Height: 55 inch.
3. Depth: As indicated on Drawings.

D. Pilasters:
1. Thickness: 1 inch.
2. Width: As required to fit space; minimum 3 inch.

E. Screens: Without doors; to match compartments; mounted to wall with two panel brackets.
1. Thickness: 1 inch.
2. Screen Height: 55 inch.
a. Mounted such that top of panel is not less than 60" above the finished floor.
3. Depth: As indicated on Drawings.

2.03 ACCESSORIES

A. Pilaster Shoes: Formed chromed steel with satin finish, 3 inch high, concealing floor fastenings.
1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.
2. Provide ceiling attachment using two adjustable hanging studs, attached to above-ceiling framing.

B. Wall and Pilaster Brackets: Stainless steel; manufacturer's standard type for conditions indicated on drawings.

C. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.
1. For attaching panels and pilasters to brackets: Through-bolts and nuts ; tamper proof.

D. Hinges: Stainless steel, manufacturer's standard finish.
1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
2. Continuous-type hinge, self closing.

E. Door Hardware: Stainless steel, manufacturer's standard finish.
1. Door Latch: Slide type with exterior emergency access feature.
2. Door Strike and Keeper with Rubber Bumper: Mount on pilaster in alignment with door latch.
3. Provide door pull for outswinging doors.

F. Coat Hook with Rubber Bumper: One per compartment, mounted on door.

G. Toilet Partition Suspension Members: As specified in Section 05 50 00.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated on shop drawings.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 inch to 1/2 inch space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

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SECTION 10 26 00
WALL AND DOOR PROTECTION

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 SECTION INCLUDES

A. Corner guards.

1.03 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Blocking for wall and corner guard anchors.

B. Section 09 21 16 - Gypsum Board Assemblies: Placement of supports in stud wall construction.

C. Section 09 91 23 - Interior Painting: Backpaint for clear plastic corner guards.

1.04 REFERENCE STANDARDS

A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.

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

C. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies.

1.05 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. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

D. 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.

1.06 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. Protect work from UV light damage.

D. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.

E. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 5-year manufacturer warranty for metal crash rails. Complete forms in Owner's name and register with manufacturer.

1. Failures include, but are not limited to, the following:
    a. Structural failures or internal connection failures.
    b. Deterioration of materials beyond that expected of normal use, as intended by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Corner Guards:
   1. Construction Specialties, Inc; LG-118: www.c-sgroup.com,
   2. Koroseal Interior Products; Lexan Corner Guard J118: www.koroseal.com.
   3. Pawling Corp: www.pawling.com.
   4. Schluter: www.schluter.com.
   5. Wallguard; 2335.1 - 1 1/8" wings 4 ft no tape/undrilled: www.wallguard.com.
   6. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PRODUCT TYPES

A. Corner Guards - Surface Mounted, Transparent Plastic:
   1. Material: Clear polycarbonate, extruded.
   2. Thickness: 0.075 inch minimum.
   3. Performance: Resist lateral impact force of 100 lbs at any point without damage or permanent set.
   4. 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.
   5. 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.
   6. Width of Wings: 1-1/8 inches, with radiused corner and rounded wing tips.
   7. Corner Angle: 90 degrees, unless otherwise noted on Drawings.
   8. Length: One piece, 48 inches.
   9. Mounting: Back-paint corner guards prior to application onto painted wall surfaces.
      a. Apply with adhesive.
      b. Mechanical fasteners shall not be used.

2.03 FABRICATION

A. Fabricate components with tight joints, corners and seams.

B. Form end trim closure by capping and finishing smooth.

2.04 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Provide wall and door protection systems of each type from a single source and manufacturer.

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.
   1. Test painted or wall covering surfaces for adhesion in inconspicuous area, as recommended by manufacturer. Follow adhesive manufacturer's recommendations for remedial measures at locations and/or application conditions where adhesion test's results are unsatisfactory.

D. Start of installation constitutes acceptance of project conditions.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's written instructions, level and plumb, secured rigidly in position to supporting construction.

B. Position corner guard 1 inch above wall base for full length of guard or to height as indicated on Drawings.
   1. Apply adhesive with 1/8 inch V-notch trowel to an area of wall surface that can be completed within cure time of the adhesive.

2. Use a roller to ensure maximum contact with adhesive.

3.03 TOLERANCES

A. Maximum Variation From Required Height: 1/8 inch.

B. Maximum Variation From Level or Plane For Visible Length: 1/8 inch.

3.04 CLEANING

A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants in accordance with manufacturer's written instructions and protect from damage until Owner occupancy.

END OF SECTION

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SECTION 10 28 00
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

A. Residential toilet, shower, and bath accessories.

B. Utility room accessories.

1.03 RELATED REQUIREMENTS

A. Section 06 10 00: Concealed supports for accessories, including in wall framing and plates and above ceiling framing.

B. Section 08 83 00 - Mirrors: Other mirrors.

C. Section 09 30 00 - Tiling: Ceramic washroom accessories.

1.04 REFERENCE STANDARDS

A. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

B. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.06 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. Toilet, Shower, and Bath Accessories:
   1. American Specialties, Inc: www.americanspecialties.com.
   2. Bobrick Washroom Equipment, Inc.: www.bobrick.com.
   3. Bradley Corporation: www.bradleycorp.com.
   4. Georgia-Pacific Professional: www.blue-connect.com.
   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.
   1. Grind welded joints smooth.
   2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.

B. Stainless Steel Sheet: ASTM A666/A666M, Type 304.

C. Adhesive: Contact type, waterproof.

D. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

E. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

B. Chrome/Nickel Plating: ASTM B456, SC 2, satin finish, unless otherwise noted.

C. Back paint components where contact is made with building finishes to prevent electrolysis.

2.04 RESIDENTIAL TOILET, SHOWER, AND BATH ACCESSORIES

A. Toilet Paper Holder: As scheduled by Owner's Interior Designer: surface mounted, single roll, concealed attachment.
   1. Material: Stainless steel; satin finish.

B. Towel Bar: As scheduled by Owner's Interior Designer: tubular bar; rectangular mounting posts, concealed attachment.
   1. Mounting Post Material: Stainless steel; satin finish.
   2. Bar Material: Stainless steel; satin finish.

C. Towel Ring: As scheduled by Owner's Interior Designer: post with hanging ring, concealed attachment.
   1. Post Material: Stainless steel; satin finish.
   2. Ring Material: To match post material.

D. Shower Curtain Rod: As scheduled by Owner's Interior Designer; Curved tube, 1 inch diameter, with mounting flanges for concealed attachment.
   1. Material: Stainless steel; satin finish.

E. Shower Curtain: Mildew resistant fabric with corrosion resistant metal grommets.
   1. Material: As scheduled by Owner's Interior Designer.
   2. Color: As selected from manufacturer's standard colors.
   3. Shower Curtain Hooks: Stainless steel spring wire.

F. Robe Hook: Single-prong, concealed attachment.
   1. Material: Stainless steel; satin finish.

2.05 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.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.

D. Verify that field measurements are as indicated on product data.

E. See Section 06 10 00 for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
   1. Grab Bars: As indicated on drawings.
   2. Mirrors: 40 inch, measured from floor to bottom of mirrored surface.
   3. Other Accessories: As indicated on drawings.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

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SECTION 10 28 19
TUB AND SHOWER ENCLOSURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

A. Frameless tub and shower doors; enclosures.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.

C. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes.

D. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.

E. ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing.

F. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

G. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.

H. ASTM C1036 - Standard Specification for Flat Glass.

I. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.

1.04 SUBMITTALS

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

B. Product Data: Provide manufacturer's literature for enclosure.

C. Shop Drawings: Indicate layout, dimensions, identification of components, and interface with adjacent construction.

D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

E. Specimen Warranty.

1.05 QUALITY ASSURANCE

A. Coordination: Coordinate the installation of the Work in this Section with size, location and installation of other Work adjacent to and connected with the assemblies outlined in other Sections.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's original unopened packaging until installation to prevent soiling and physical damage.

B. Handle to prevent damage to finished surfaces and operating mechanisms.

C. Protect pre-finished surfaces from damage or staining.

1.07 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 structural failure and excessive degradation of metal finishes.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Tub and Shower Enclosures:

1. American Shower Door: www.americanshowerdoor.com.
2. Century Shower Door, Inc.: www.showerdoor.com
3. HMI Glass: www.hmiglass.com.
    a. SE-1; TruFit Swing Shower Door System with fixed panels.
    b. Provide add alternate for Microban® Product Glass Protection.
4. Seawin Global:www.seawinglobal.com.
    a. SE-1; "Flex X Duo" or "Metro"- Pivot Shower Door with fixed panels.

2.02 TUB AND SHOWER ENCLOSURES - GENERAL

A. Shower Enclosure Types:
    1. Shower Enclosure SE-1; 1-sided enclosure with swing door.

B. Exposed Fittings and Hardware: Stainless Steel.

C. Patch Fittings for Semi-Frameless or Frameless Enclosures: Hinges and Glass mounts.
    1. Edge Profile: Square.
    2. Mounting: Clamp, with set screw, no hole in glass..

D. Concealed Fasteners: Manufacturer's standard stainless steel.

E. Exposed Fasteners: Manufacturer's standard stainless steel.

F. Glass Corner Condition: Mitered glass.

G. Towel Bar: Provide on one door, full width.

H. Shower Door Height: As indicated on the Drawings..

I. Tub Door Height: As indicated on the Drawings..

J. Door or Opening Width: As indicated on the Drawings..

K. Door Pull: Back-to-backRecessed; mounted through the glass.

L. Door Bumper: Provide resilient door bumpers at sliding doors.

M. Latch: Full length magnetic strips in side channel and strike jamb at swinging doors.

N. Provide swinging doors with a continuous drip rail and wiper blade at bottom of panel. Attach drip rail adhesively with transparent double-sided tape with no exposed screws.

2.03 FRAMELESS TUB AND SHOWER ENCLOSURES

A. Description: Fixed and operable glass panels not individually framed in metal extrusions. Metal components in the enclosure may include header or bottom channel or clips on any stationary panels, hinges, and handle.

B. Configuration: Frameless spray panel enclosure with fixed panel and swing panel with rounded top corner.

C. Head Condition: No header with exposed top glass edge.

D. Frameless Glass Doors:
    1. Door Glass Thickness: As determined by manufacturer based on panel size., tempered.
    2. Swinging Doors:
        a. Hinges: Glass-to-glass patch hinges; self-closing; swing in and out.

2.04 MATERIALS

A. Tempered Glass: Annealed clear flat glass meeting requirements of ASTM C1036, Type I, Quality Q3, fully tempered in accordance with ASTM C1048, Kind FT, and as follows:
    1. Comply with 16 CFR 1201, Category 2 and ANSI Z97.1.
    2. Thickness: As indicated in enclosure and door types above.
    3. Coating: Water and stain resistant.
    4. Exposed Edges: Ground and polished smooth with 45 degree chamfers.
    5. Prepare glazing panels for indicated fittings and hardware before tempering.
    6. Temper glass materials horizontally; visible tong marks or tong mark distortions are not permitted.

B. Stainless Steel Components: Complying with ASTM A666/A666M, Type 304 alloy.

1. Stainless Steel Tubing: ASTM A554, Type 304, 16 gauge, 0.0625 inch minimum metal thickness, 1-1/2 inch diameter.
2. Stainless Steel Bars, Shapes and Moldings: ASTM A276/A276M, Type 304.
3. Stainless Steel Finish: No. 4 Bright Polished finish, in accordance with ASTM A480/A480M.

C. Glazing Seals: Provide manufacturer's standard clear polycarbonate seal at jambs and door bottom for water-tight seal between glass and surrounding frame or construction.

D. Sealant: One-part mildew-resistant silicone sealant, complying with ASTM C920, clear.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated on shop drawings and comply with code requirements.

B. Do not begin installation until supports and adjacent substrates are complete.

C. 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 as recommended by the manufacturer.

3.03 INSTALLATION

A. Fit and align tub and shower enclosure level and plumb.

B. Install frames securely to adjacent structure using manufacturer’s recommended anchorage methods. Doors shall operate without binding or sticking. Caulk perimeter of framing with specified sealant.

C. Protect pre-finished surfaces and glass from damage or staining. Clean surfaces and polish glass both sides prior to Date of Substantial Completion.

3.04 FIELD QUALITY CONTROL

A. Verify enclosure does not leak while shower is running and door is fully closed and catch is engaged.

3.05 ADJUSTING

A. Adjust tub and shower enclosure doors to operate smoothly.

3.06 CLEANING

A. Remove protective film and temporary stickers from exposed metal and glass 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; do not use abrasive materials or chemicals, detergents or other substances that may damage the material or finish.

3.07 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

3.08 PROTECTION

A. Protect installed products until Date of Substantial Completion.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

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SECTION 10 41 16
EMERGENCY KEY CABINETS

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 SECTION INCLUDES

A. Fire Department Lock Boxes.
   1. Recessed Mounted
   2. Surface Mounted.

1.03 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittal procedures, project meetings, progress schedules and documentation, reports, coordination.

B. Division 26 and 27 Sections for Electrical and Low-voltage security interface.

1.04 DEFINITIONS

A. Emergency Key Cabinets: Fire Department lock boxes for exclusive access to the building by emergency response personnel..

1.05 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.

B. UL - United Laboratories;

1.06 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of Knox Box with location and installation of exterior finishes and structural frame to provide a securely fastened device, and with electrical and low voltage connections.

B. Preinstallation Meeting: Conduct a preinstallation meeting with the Fire Department prior to the start of the work of this section; require attendance by all affected installers.

C. Sequencing: Ensure that electrical and low voltage connections are achieved functioning properly with tamper switches.

1.07 SUBMITTALS

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

B. Product Data: Provide product data for each product specified, annotated specifically for this project.

C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project site in manufacturer's original unopened packaging..

B. Store products under cover and elevated above grade.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. In addition to the specific warranty requirements of the Contract, provide in the Owner's name the standard written manufacturer's warranty of all products furnished and installed under this Section where such warranties are offered in the manufacturer's published product data. All these warranties shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.
   1. Warranty period shall commence from the date of Substantial Completion.

PART 2 PRODUCTS

2.01 RECESSED FIRE DEPARTMENT LOCK BOXES

A. Basis of Design Manufacturer: Knox Company, Irvine, CA; www.knoxbox.com.

B. Description:
   1. Model: 3200 Series: Recessed Mounted #3275 with Mounting Kit (RMK).
      a. Dimensions: 7inches high x 7 inches wide x 3-7/8 inches deep.
   2. Heavy duty key box with stainless steel hinged door and recessed mounting kit.
      a. Provide UL Listed Knox Tamper Alert.
      b. Fully welded 1/4 inch plate steel housing.
      c. 1/2 inch thick steel door with weather resistant interior gasket seal.
   3. Lock
      a. UL Listed Lock with 1/8 inch thick stainless steel dust cover with tamper seal mounting.
      b. Double-action rotating tumblers and hardened steel pins accessed by a biased cut key.
   4. Color: Black or as indicated on Drawings.
   5. Key Capacity: 10 keys or access cards.
   6. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.
      a. Provide UL listed tamper switches as indicated and where located on Drawings.

2.02 SURFACE MOUNTED FIRE DEPARTMENT LOCK BOXES

A. Basis of Design Manufacturer: Knox Company, Irvine, CA; www.knoxbox.com.
   1. 1601 W. DEER VALLEY RD. PHOENIX, AZ 85027; T. 800-552-5669; info@knoxbox.com.

B. Substitutions: See Section 01 60 00 - Product Requirements, or as required by Authorities Having Jurisdiction.

C. Description:
   1. Model: 3200 Series: Surface Mounted #3262.
      a. Dimensions: 4 inches high x 5 inches wide x 3-7/8 inches deep
   2. Heavy duty key box with stainless steel hinged door.
      a. Provide UL Listed Knox Tamper Alert.
      b. Fully welded 1/4 inch plate steel housing.
      c. 1/2 inch thick steel door with weather resistant interior gasket seal.
   3. Lock
      a. UL Listed Lock with 1/8 inch thick stainless steel dust cover with tamper seal mounting.
      b. Double-action rotating tumblers and hardened steel pins accessed by a biased cut key.
   4. Color: Black, or as indicated on Drawings.
   5. Key Capacity: 10 keys or access cards.
   6. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.
      a. Provide UL listed tamper switches as indicated and where located on Drawings.

2.03 ACCESSORIES

A. Fasteners: 3/8 inch minimum Grade 5 or Grade 8, corrosion resistant with large washers; or as recommended by manufacturer.

B. Public Safety Labels.

C. Key tags and key rings; coordinate with Building security and Fire Department.

PART 3 EXECUTION

3.01 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Verify that field measurements are as indicated on reviewed and approved shop drawings.

B. Coordinate device mounting locations with authorities having jurisdiction and obtain approval in writing prior to installation.
   1. Exterior emergency key cabinets mounting locations shall be as directed and approved by the local Fire Department.

C. Proceed with installation only after unsatisfactory conditions have been corrected. Beginning of installation means acceptance of substrate.

3.02 PREPARATION

A. Coordinate with local AHJ.

3.03 INSTALLATION

A. Install in strict accordance with manufacturer's printed instructions and recommendations.

B. Provide neat and clean installation at interface with adjacent finishes. Coordinate with Division 07 Section “Joint Sealers” for joint sealant selection and installation.

C. Install specialties plumb, true and square, in a neat, rigid, and substantial manner.

D. After installation, clean surfaces

3.04 DEMONSTRATION

A. Coordinate keys and key turn over with local authorities having jurisdiction.

END OF SECTION

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SECTION 10 44 00
FIRE PROTECTION SPECIALTIES

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 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.03 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.

B. Section 09 21 16 - Gypsum Board Assemblies

C. Section 09 91 23 - Interior Painting: Field paint finish.

D. Section 10 14 00 - Signage: Directional signage to out-of-sight fire extinguishers and cabinets.

1.04 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.

B. FM (AG) - FM Approval Guide.

C. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems;.

D. NFPA 10 - Standard for Portable Fire Extinguishers.

E. UL (DIR) - Online Certifications Directory.

1.05 SUBMITTALS

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

B. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, color and finish, anchorage details, and accessory options.

C. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.06 QUALITY ASSURANCE

A. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA-10, “Portable Fire Extinguishers.”

C. Coordinate cabinet characteristics such that cabinets match the rating for the wall in which they are installed.

1.07 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: www.activarcpg.com.
   2. Ansul, a Tyco Business: www.ansul.com.
   3. J. L. Industries, Inc. (Activar Construction Products Group, Inc.): www.activarcpg.com.
   4. Kidde, a unit of United Technologies Corp: www.kidde.com.
   5. Larsen's Manufacturing Co.: www.larsenmfg.com
   6. Nystrom, Inc: www.nystrom.com.
   7. Oval Brand Fire Products: www.ovalfireproducts.com.

8. Potter-Roemer: www.potterroemer.com.
9. Substitutions: See Section 01 60 00 - Product Requirements.

B. Fire Extinguisher Cabinets and Accessories:
1. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com.
2. JL Industries, Inc: www.jlindustries.com.
3. Kidde, a unit of United Technologies Corp: www.kidde.com.
4. Larsen's Manufacturing Co: www.larsensmfg.com.
5. Nystrom, Inc: www.nystrom.com.
6. Oval Brand Fire Products: www.ovalfireproducts.com.
7. Modern Metal Products: www.modern-metal.com.
   a. Non-rated Cabinets: 100 Series.
   b. Fire-rated Cabinets: FSB Models.
8. Potter-Roemer: www.potterroemer.com.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
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: 5 pound in Living Units; 10 pound in corridors.
3. Size: 10 pound in Amenity and/or Common areas and Parking Deck.
4. Finish: Baked polyester powder coat, red color.
5. Temperature range: Minus 40 degrees F to 120 degrees F.

2.03 FIRE EXTINGUISHER CABINETS

A. Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.

B. Cabinet Construction: Non-fire rated.
1. Formed primed steel sheet; 0.036 inch thick base metal.

C. Fire Rated Cabinet Construction: Rated in accordance with wall rating.
1. Steel; double wall or outer and inner boxes fabricated from 0.0428-inch thick, cold-rolled steel sheet lined with minimum 5/8 inch thick fire barrier material.

D. Cabinet Configuration: Recessed and Surface Mounted as indicated on Drawings.
1. Recessed and Surface mounted at locations as indicated on Drawings.
2. Recessed at interior spaces with framed wall construction and Surface mounted at CMU and cast-in-place concrete construction at locations as indicated on Drawings.
3. Size to accommodate extinguisher and accessories.
4. Trimless type.

E. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with continuous piano hinge.

F. Door Hardware Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

G. Door Glazing: Tempered glass, clear, 1/8 inch thick, and set in resilient channel glazing gasket.

H. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

I. Fabrication: Weld, fill, and grind components smooth.

J. Finish of Cabinet Exterior Trim and Door: No.4 - Brushed stainless steel.

K. Finish of Cabinet Interior: White colored enamel.

2.04 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

B. Extinguisher Theft Alarm: Battery operated alarm, 10 second delay for disarming, activated by opening cabinet door.

C. Lettering: “FIRE EXTINGUISHER” decal, or vinyl self-adhering, prespaced black lettering in accordance with authorities having jurisdiction (AHJ).

D. Mounting Bracket: Manufacturer’s standard steel, designed to secure fire extinguisher to wall. Same as fire extinguisher.

2.05 FABRICATION

A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.

2.06 FINISHES REQUIREMENTS

A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning" or SSPC-SP 8, "Pickling".

B. Factory Prime Finish: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

C. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Verify rough openings for cabinet are correctly sized and located.

C. Examine walls and partitions for suitable framing depth and blocking where cabinets will be installed.

D. Examine fire extinguisher for proper charging.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets in locations and mounting height to comply with requirements of governing authorities; prepare recess in walls as required.

C. Secure to structure rigidly in place, square and plumb.
   1. Where exact location of extinguishers and cabinets extinguishers and cabinets is not shown, locate as directed by Architect.
   2. Unless otherwise indicated, provide recessed fire protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semi recessed fire protection cabinets.
   3. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.

D. Place extinguishers in cabinets.

E. Identification:
   1. After installation and finishing is completed, silk screen or apply decal letters spelling "FIRE EXTINGUISHER" as applicable.
   2. Letter size, style and location as selected by Architect.

3.03 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.

E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 10 55 00
POSTAL SPECIALTIES

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 SECTION INCLUDES

A. Central mail delivery boxes.

1.03 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete pedestal and anchor bolts for mail box.

B. Section 05 50 00 - Metal Fabrications: Fabricated metal pedestal and anchor bolts for mail box.

C. Section 06 10 00 - Rough Carpentry

1.04 REFERENCE STANDARDS

A. 39 CFR 111 - U.S. Postal Service Standard 4C.

1.05 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. Samples: Submit two sets of manufacturer's available colors.
   1. Six inch by six inch square.

D. Certificates: Products meet or exceed U.S. Postal Service requirements and are approved by postal authority.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing postal specialties and whose installations have been given final approval by local postmasters authorizing use by USPS.

B. Source Limitations for Each Type of Postal Specialty: Obtain from single source from single manufacturer. For USPS-approved products, use only those included on current lists of USPS manufacturers and models.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver lock keys to Owner by registered mail or overnight package service with a record of each corresponding lock and key number.

1.08 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. Manufacturers:
   1. Postal Products Unlimited, Inc: www.postalproducts.com.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Central Mail Delivery Boxes: Provide products approved for United States Postal Service (USPS) delivery.
   1. Materials: Aluminum with stainless steel hardware.
   2. Finish: Powder coat in color selected by Architect from manufacturer's standard colors.
   3. Unit Types and Sizes: As indicated on drawings.
   4. Configurations: See drawings for overall dimensions and layouts.

2.02 COMPONENTS

A. Locking - Front Loading Master Door: Three-point latching mechanism with USPS master lock furnished and installed by postmaster.
   1. Provide continuous stainless steel piano hinge on one side, and solid closure for back of mail compartments.
   2. Fabricate unit so door remains open while mail is deposited.
   3. Furnish with natural satin anodized finish, unless otherwise indicated.
   4. Locking: Construct unit to receive locking unit provided by local postmaster for use by letter carriers.

B. Locking - Customer Compartment Doors: USPS approved cam lock, 3 keys each lock.
   1. Key each compartment differently.

C. Locking - Parcel Compartment Doors: Double-lock arrangement with USPS approved cam lock for customer access, and USPS master lock furnished and installed by postmaster.

D. Snap-on Trim: fabricated from same material and finish as compartment doors.

E. Concealed Components and Mounting Frames: Aluminum or steel sheet with manufacturer's standard finish.

F. Identification - Customer and Parcel Compartments: Sequential numerical or alphabetic characters, top to bottom, left to right; factory-installed.
   1. Silver adhesive decals, 3/4 inch high black characters centered on 1-1/2 inch high by 1-3/4 inch long decal.
   2. Customer Name Marking: Name card holder, sized to hold 3/4 inch high by minimum 2-1/2 inch long name card; attach above or inside each compartment.

2.03 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Key Blanks: 50 for every 100 locks or fraction thereof, for each type of compartment-door lock installed.

2.04 FABRICATION

A. Form postal specialties to required shapes and sizes, with true lines and angles, square, rigid, and without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges and corners free of sharp edges and burrs and safe to touch. Fabricate doors of postal specialties to preclude binding, warping, or misalignment.

B. Preassemble postal specialties in shop to greatest extent possible to minimize field assembly.

C. Mill joints to a tight, hairline fit. Cope or miter corner joints. Form joints exposed to weather to exclude water penetration.

D. Drill or punch holes required for fasteners and remove burrs. Use security fasteners where fasteners are exposed. If used, seal external rivets before finishing.

E. Weld in concealed locations to greatest extent possible without distorting or discoloring exposed surfaces. Remove weld spatter and welding oxides from exposed surfaces.

F. Fabricate tubular and channel frame assemblies with manufacturer's standard welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support loads.

G. Retain first paragraph below only for rack-ladder horizontal mail receptacles and rack-ladder data distribution boxes.

H. Fabricate rack ladders to support indicated number of units to form a column of units.

I. Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with bituminous coating or by applying other permanent separation as recommended by manufacturers of dissimilar metals.

2.05 GENERAL FNISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that concrete base and anchor bolts are ready to receive pedestal-mounted units.

B. Verify that rough-openings are ready to receive wall-mounted units.

C. 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.

3.03 FIELD QUALITY CONTROL

A. Arrange for USPS personnel to examine and test postal specialties served by USPS after they have been installed according to USPS regulations.

B. Obtain written final approval of postal specialties to be served by USPS. Obtain this approval from USPS postmaster that authorizes mail collection for the served installation.

3.04 ADJUSTING, CLEANING, AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as postal specialties are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust doors, hardware, and moving parts to function smoothly, and lubricate as recommended by manufacturer. Verify that integral locking devices operate properly.

C. Touch up marred finishes or replace postal specialties that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by postal specialty manufacturer.

D. Replace postal specialties that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

E. On completion of postal specialty installation, clean interior and exterior surfaces as recommended by manufacturer.

END OF SECTION

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SECTION 10 57 23
CLOSET AND UTILITY SHELVING

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 SECTION INCLUDES

A. Wall mounted wire closet shelving.

B. Accessories.

1.03 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Blocking in walls for attachment of shelving or storage system.

B. Section 06 20 00 - Finish Carpentry: Wood shelving not inside units.

C. Section 09 21 16 - Gypsum Board Assemblies: Blocking in metal stud walls for attachment of standards or mounting rails.

1.04 REFERENCE STANDARDS

A. NEMA LD 3 - High-Pressure Decorative Laminates.

1.05 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, with installation instructions.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products under cover and elevated above grade.

C. Store flat to prevent warpage and bending.

1.08 FIELD CONDITIONS

A. Maintain temperature, humidity, and ventilation within limits recommended by manufacturer. Do not install products under environmental conditions outside manufacturer's limits.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer warranty for wire shelving systems from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wire Storage Shelving:
   1. ClosetMaid Corporation: www.closetmaidpro.com.
   2. Rubbermaid, Inc: www.rubbermaidpro.com.
   3. Other manufacturers meeting performance requirements listed in this Section.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 WIRE STORAGE SHELVING SYSTEMS

A. Applications:
   1. Shelf Depth: 16 inches, unless otherwise indicated.
   2. Bedroom Closets:

a. Wall-to-wall shelves with free sliding hanger rod.
b. Quantity and mounting height as indicated on Drawings.
c. Mount single row at 60" A.F.F. in typical units.
d. Mount double rows at 39" A.F.F. and 78" A.F.F., unless otherwise indicated on Drawings.
e. Mount single row at 45" A.F.F. in "ANSI Type A" unit bedrooms, unless otherwise indicated on Drawings.

3. Coat Closets:
a. Mount single row at 72" A.F.F. in typical units, wall-to-wall shelf with integral hanger rod.
b. Provide additional row in "ANSI Type A" units mounted at 45" A.F.F. for one-half the closet width.

4. Laundry Closets:
a. Single row, wall-to-wall shelf without integral hanger rod.
b. Single row at 45" A.F.F. in "ANSI Type A" uni, unless otherwise indicated on Drawings. Contractor coordinate location of brackets and suppports to not interfere with laundry equipment.

B. Wire Shelving: Factory-assembled coated wire mesh shelf assemblies for wall-mounting, with components and connections required to produce a rigid structure that is free of buckling and warping.
1. Construction: Cold-drawn steel wire with average tensile strength of 100,000 psi resistance welded into uniform mesh units, square, rigid, flat, and free of dents or other distortions, with wires trimmed smooth.
2. Coating: PVC or epoxy, applied after fabrication, covering surfaces.
3. PVC Coating: 9 to 11 mils thick.
4. Epoxy Coating: Nontoxic epoxy-polyester powder coating baked-on finish, 3 to 5 mils thick.
5. Standard Mesh Shelves: Cross deck wires spaced at 1 inch.
6. Close-Mesh Shelves: Cross deck wires spaced at 1/2 inch.
7. Free-Sliding Hanging Rod: Integral hanging rod that permits uninterrupted sliding of hangers the full width of the shelf.
8. Corner Units: Same wire spacing as standard mesh shelves; provide wherever shelves meet at right angles.

C. Mounting Hardware for Wire Shelving: Provide manufacturer's standard mounting hardware; include support braces, wall brackets, back clips, end clips, poles, and other accessories as required for complete and secure installation; factory finished to match shelving.

D. Fasteners: As recommended by manufacturer for mounting substrates.

PART 3 EXECUTION

3.01 EXAMINATION

A. Inspect areas to receive shelving or storage system, to verify that spaces are properly prepared to receive shelf units, and are of dimensions indicated on shop drawings.

B. Verify appropriate fastening hardware.

C. Do not begin installation until substrates have been properly prepared.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install wire shelving in accordance with manufacturer's instructions, with shelf surfaces level.

B. Cap exposed ends of cut wire shelving.

C. Install wire shelving back clips, end clips at side walls, and support braces at open ends. Install intermediate support braces as recommended by manufacturer.

D. Wire Shelving Mounting Heights:
   1. Refer to Architectural Drawings.

3.04 CLEANING

A. Clean soiled surfaces after installation.

3.05 PROTECTION

A. Protect installed work from damage.

B. Touch-up, repair, or replace damaged products before Substantial Completion in a manner that eliminates evidence of replacement.

END OF SECTION

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SECTION 10 73 16
CANOPIES

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 SECTION INCLUDES:

A. Building supported, pre-engineered metal canopies including fascia channels, decking, tension rods, drainage, and attachment hardware.

1.03 RELATED REQUIREMENTS:

A. Section 05 12 00 - Structural Steel Framing.

B. Section 05 50 00 - Metal Fabrications.

C. Section 09 91 13 - Exterior Painting.

D. Section 09 96 00 - High-Performance Coatings.

1.04 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

B. ASTM B429/B429M - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.

C. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

D. ASTM E2950 - Standard Specification for Metal Canopy Systems.

E. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

F. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

G. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

1.05 SYSTEM DESCRIPTION

A. Design Requirements: Design canopy system to withstand:
   1. Standards for wind pressure, snow load, and drifting snow load in accordance with current applicable Building Code and accepted requirements of local municipality.

1.06 SUBMITTALS

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

B. Product Data: Submit product data sheets, including material descriptions and finishes, and preparation instructions and recommendations.

C. Shop Drawings: Prior to commencement of fabrication, submit detailed shop drawings, showing system components, dimensions, profiles, sections of components, finishes, attachments and fastening details, and accessories.
   1. Drawings shall be signed and sealed by a Professional Engineer licensed in Louisiana.

D. Samples:
   1. 3 x 3 inch coating samples in specified color.
   2. 6 inch long fascia extrusion sample showing profile and standard finish.
   3. 6 inch decking samples showing profile and standard finish.

1.07 QUALITY ASSURANCE

A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in Louisiana.
   1. Conform to applicable code for submission of design calculations as required for acquiring permits.
   2. Cooperate with regulatory agency or authority and provide data as requested.

B. Perform work in accordance with AISC 303.

C. Manufacturer Qualifications: Company specializing in the manufacture of products similar to those required for this project.

D. Erector Qualifications: Company specializing in performing the work of this section.
   1. Not less than five years of documented experience and approved by canopy manufacturer.

1.08 MOCK-UP

A. Mock-up: Provide mock-up of canopy system including all framing members, supports, decking, hanger rods, and attachments at locations as indicated on drawings.

B. Locate where directed.

C. Mock-up may not remain as part of the Work.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site ready for erection.

B. Package using methods that prevent damage during shipping and storage on site.

C. Store materials under cover and elevated above grade.

1.10 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 10 year manufacturer warranty for finishes from Date of Substantial Completion.

D. Canopy installer warrants their installation and workmanship for a period of one (1) year from the date of substantial completion of the canopy and components.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers:
   1. Manufacturers must furnish full details of proposed product, engineering calculations on all sections involved, physical samples of all shapes and finishes, a list of installations similar in size and design, and must have a minimum of five years experience in manufacturing and installing canopy systems.
   2. Arcadia: www.arcadiainc.com.
   3. Awnings Above: www.awningsaboveus.com.
   4. Creative Engineered Architectural Systems: www.ceasplus.com.
   5. MAPES Architectural Canopies: www.mapescanopies.com.
   6. SENTENAL-FMC™ manufactured by InPro Fabrication: www.inproltd.com/sentenal-canopy.
   7. SKYSCAPE® Architectural Canopies: www.skyscapecanopies.com.
   8. Other Manufacturers capable of producing canopies meeting system description and paint finish requirements.

2.02 METAL CANOPIES

A. Shop Fabricated Metal Canopy
   1. Pre-engineered system complying with ASTM E2950
   2. Design and fabricate metal canopy system to resist wind, snow, live, and seismic loads without failure, damage, or permanent deflection in accordance with ASCE 7:
      a. Loads: As indicated on Drawings.
   3. Thermal Movement: Design canopy system to accommodate thermal movement caused by ambient temperature range of 120 degrees F and surface temperature range of 180 degrees F without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects on assembly components.

B. Configuration: Column layout, canopy clearance, fascia profile, and roof covering design as indicated on Drawings.

2.03 SYSTEM DESCRIPTION

A. Cantilevered canopy attached to building.
   1. Decking: Interlocking Extruded aluminum soffit decking: 2" x 16" Flat: 0.032 Aluminum
   2. Attachment: 1.050 inch diameter steel hanger rod, finished to match canopy.
   3. Welded construction/connnections.
   4. Fascia: C-12" Extruded as indicated on Architectural Drawings.
   5. Finish: 70% PVDF
   6. Drainage: Downspout, 3 inch x 4 inch; Placement: As indicated on Drawings.
   7. Escutcheon Plates: 6 inch x 6 inch x 0.375.

2.04 MATERIALS

A. Aluminum Extrusions: ASTM B221 & ASTM B429/B429M, 6063-T5 alloy and temper.

B. Fasteners: Stainless steel or zinc coated for corrosion resistance, appropriate for the type of connection to prevent galvanic action between fasteners and structure.

2.05 ACCESSORIES

A. Grout: ASTM C1107/C1107M: non-shrinking; premixed compound consisting of non-metallic aggregate, cement, water-reducing and plasticizing agents.

B. Fasteners, Non-Structural: ASTM F593 stainless steel.

C. Escutcheon plates, aluminum as detailed.

D. Lighting: As indicated on Drawings; Type with welded light dams, as selected by architect from manufacturer full range.

E. Downspouts: sized as indicated; 0.032 roll formed or 0.125 Heavy Extruded Aluminum. Finished to match canopy color.

F. Other Components: As indicated or as required for system attachment and performance.

2.06 FABRICATION

A. Provide a complete system ready for erection at project site.
   1. Shop fabricate to the greatest extent possible; disassemble if necessary for shipping.
   2. Fabricate canopy system in accordance with approved Shop Drawings.

B. Perform welding in accordance with AWS D1.1/D1.1M.

C. Drainage system to be concealed. Covered surfaces direct water to field drilled drain, to be coordinated at site.

D. Coordinate installation of electrical conduit, lighting, plumbing, sprinkler components, etc., for elements located within the decking and the concealed space above the decking, not visible from beneath the canopy.

E. Decking shall be designed with extruded components or interlocking roll-formed aluminum members.

2.07 FINISHES

A. 70% PVDF: meeting AAMA 2605 with colors selected by architect from manufacturer’s standard selection.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrates are ready to receive work.

B. Field verify dimensions of supporting structure at site of installation prior to fabrication.

C. Do not proceed with work until detrimental conditions have been corrected.

D. Furnish components to be installed in other work to installer of that other work, including but not limited to blocking, sleeves, inserts, anchor bolts, embedded plates and supports for attachment of anchors.

3.02 PREPARATION

A. Protect existing work.

B. Review approved Shop Drawings prior to installation.
   1. Coordinate diagrams, templates, instructions and directions for installation of anchorages and fasteners.
   2. Coordinate diagrams, templates, instructions and directions for installation of lighting and drainage systems.

3.03 INSTALLATION

A. Erection shall be performed by an approved installer and coordinated with Contractor's construction schedule for installation sequencing.

B. Install in accordance with manufacturer's instructions and approved Shop Drawings.

C. Install components plumb and level, in proper plane, free from warp and twist.

D. Anchor canopy system securely to structure; provide adequate clearance for movement caused by thermal expansion & contraction and wind loads.

E. Coordinate downspout locations with locations shown on shop drawings.

3.04 TOLERANCES

A. Maximum Variation from Level: Plus/Minus 1/8 inch.

3.05 CLEANING

A. Touch up minor scratches and abrasions on finished surfaces to match original finish.

B. Clean with mild, non-abrasive, non-acidic solution and a cotton cloth under low pressure, or as otherwise required in accordance with manufacturer recommendations; do not use abrasive materials or chemicals, detergents or other substances that may damage the material or finish.

3.06 PROTECTION

A. Protect installed components and finishes from damage before, during, and after installation.

B. Repair damage to exposed finishes to be indistinguishable from undamaged areas.
   1. If damage to finishes and components cannot be repaired to be indistinguishable from undamaged finishes and components, replace damaged items.

C. Warranty period begins on Date of Substantial Completion.

END OF SECTION

SECTION 10 82 13
EXTERIOR GRILLES AND SCREENS

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 SECTION INCLUDES

A. Exterior aluminum grilles and screens attached to structure.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

B. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes.

C. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

F. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.

G. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

1.04 SUBMITTALS

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

B. Shop Drawings: Submit detailed shop drawings, indicating component profiles, sections, finishes, fastening details, special details, and manufacturer's technical and descriptive data.

C. Design Data: Submit comprehensive structural analysis of design for the specified loads. Stamp and sign calculations by professional engineer.

D. 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. Designer Qualifications: Perform structural design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in Louisiana.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with minimum five years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in manufacturer's original, unopened packaging, with labels clearly identifying manufacturer and material.

B. Store materials indoors, protected from moisture, humidity, and extreme temperature fluctuations.

1.07 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. Finish Warranty: Provide manufacturer's ten year warranty on factory finish against cracking, peeling, and blistering.

PART 2 PRODUCTS

2.01 GRILLES

A. Aluminum Grilles: Provide shop fabricated, shop finished grilles assembled into panels.
   1. Panel Size and Configuration: As indicated on drawings.
   2. Frame/Support: Extruded aluminum tube or flat aluminum bar.

2.02 SCREENS

A. Aluminum Screens: Provide shop fabricated, shop finished screens assembled into panels.
   1. Screen Type: Perforated metal sheet.
   2. Screen Type: Laser-cut metal sheet.
   3. Panel Size and Configuration: As indicated on Drawings.
   4. Frame/Support: Extruded aluminum tube or flat aluminum bar.
   5. Wind Load Resistance: Design to resist positive and negative wind load, as indicated on Structural Drawings for Components and Cladding, without damage or permanent deformation.

2.03 MATERIALS

A. Aluminum Extrusions: ASTM B221 (ASTM B221M) alloy 6063, temper T5, 1/8 inch minimum wall thickness.

B. Concealed Structural Supports: Aluminum, or steel coated for corrosion resistance and dissimilar metal isolation.

C. Stainless Steel Tensioning Tubes: ASTM A276/A276M.

2.04 FABRICATION

A. Shop fabricate grilles and screens to the greatest extent possible.

B. Disassemble as necessary for shipping and handling, clearly mark units for proper reassembly.

C. Provide supports, anchorages, and accessories as required for complete assembled system.

D. Provide inserts as required for installation into concrete or masonry based support materials.

E. Fabricate grilles to ensure proper fit into openings of sizes indicated, with tolerances for installation.

F. Attach grille panels to each other by welding, unless otherwise indicated.

2.05 FINISHES

A. Superior Performing Organic Coatings: AAMA 2605; multiple coats, thermally cured polyvinylidene fluoride system.

2.06 ACCESSORIES

A. Fasteners: ASTM F593 stainless steel or ASTM A307 carbon steel, sizes to suit installation conditions.

B. Anchors and Inserts: Corrosion resistant; type, size, and material required for loading and installation as indicated.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that painting, roofing, masonry work, and other adjacent work that might damage grille finish have been completed prior to start of installation.

C. Verify that anchorage devices have been properly installed and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's written installation instructions.

B. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint, and allow paint to dry prior to installation of aluminum components.

C. Set grilles level, plumb, with uniform joints, and in alignment with adjacent work as indicated.

D. Mechanically secure grilles to supporting structure.

E. Do not cut or trim aluminum members without approval of manufacturer; do not install damaged members.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/8 inch.

B. Maximum Offset From True Alignment: 1/8 inch.

3.04 CLEANING

A. Clean finished surfaces as recommended by manufacturer and maintain clean condition until Date of Substantial Completion.

B. Touch-up damaged finish coating using material provided by manufacturer to match original coating.

C. Replace grilles that have been damaged beyond touch-up repair.

3.05 PROTECTION

A. Protect installed grilles to ensure grilles are without damage until Date of Substantial Completion.

END OF SECTION

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SECTION 11 12 00
PARKING CONTROL EQUIPMENT

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 SECTION INCLUDES

A. Parking access controls.
   1. Gate arm access control.

1.03 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Placement of anchors and components to be embedded in concrete and formed concrete curbs to support parking control equipment.

B. Section 09 91 13 - Exterior Painting: Exterior field applied finishes.

C. Division 26 Sections: Electrical characteristics and wiring connections.

D. Division 27 Sections: Coordination with Low Voltage & Security systems.

1.04 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

B. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

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

D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

F. IEC 60950-1 - Information Technology Equipment – Safety - Part 1: General Requirements.

G. ITS (DIR) - Directory of Listed Products.

H. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

I. NEMA MG 00001 - Motors and Generators.

J. NFPA 70 - National Electrical Code.

K. UL (DIR) - Online Certifications Directory.

L. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.

1.05 SUBMITTALS

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

B. Product Data: Provide data on operating equipment, characteristics, limitations, and temperature range of operation.

C. Shop Drawings: Indicate plan layout of equipment access lanes, curbing, mounting bolt dimensions, conduit and outlet locations, power requirements, and wiring diagrams.

D. Operation Data: Submit data for operating equipment, clock timer, and changing security access code.

E. Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

F. Record Documentation: Record and submit actual locations of concealed conduit.

1.06 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 and with at least five years of documented experience.

1.07 REGULATORY REQUIREMENTS

A. Conform to applicable code for emergency vehicle access.

B. Conform to applicable code for paint finish and marking on gate arm.

C. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

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. Provide five year manufacturer warranty for operating equipment.

PART 2 PRODUCTS

2.01 DESCRIPTION

A. Parking Control System: Automatic operation at entrance and automatic operation at exit.
   1. Provide protection against interference or damage by lightning or other electrical influences; include fuse, over-voltage protection, flash-over protection, and line filter.
   2. Entry: Automatic parking access control system is activated by device as identified on Drawings.
   3. Exit: Automatic parking access control system is activated upon detection of vehicle by sensing loop in pavement.
   4. Parking Control System: For the following types of parking management:
      a. Tenant Parking: Unlimited-duration parking, with free gate entry.

2.02 PERFORMANCE CRITERIA

A. Operating Temperature: Minus 20 to 140 degrees F.

B. Humidity: 15 to 95 percent RH noncondensing.

C. Agency Certifications: IEC 60950-1.

D. Rating: IEC 60950-1 under NEMA EN 10250.

2.03 PARKING ENTRY/EXIT COMPONENTS

A. Gate Arm - Entry and Exit Control: Provide equipment listed and labeled in compliance with UL 325 safety standards of gate operators.
   1. Classification: Class II - Commercial/General Access, vehicular gate operator with gate arm access control.
   2. Controls: Mechanism in compliance with UL 325 safety standards of gate operators, with cadmium coated steel components to raise and lower arm by instant reversing electric motor, enclosed speed reducer operated by self contained, plug-in replaceable controller with slip clutch to prevent breakage if arm is forced, and to permit manual operation and arm movement to stop and start at reduced speed if required.
      a. Activate automatic arm reversing switch if an obstacle is sensed when in downward motion.
      b. Maintain gate arm in raised position until vehicle clears control area.
   3. Control Cabinet: Steel, at least 14 gauge, 0.075 inch thick, with weather-tight seams and gaskets; thermally insulated to permit heater to maintain cabinet temperature to equipment operating minimum, flush access doors and panels, tamper proof hardware, master keyed locks, and concealed mounting bolts located inside of units.
   4. Gate Arm, Articulating: Aluminum, articulating arm with internal counterbalance, rubber bottom safety edge, and automatic arm reversing switch.
   5. Gate Arm Length: 12 feet; or as required to maintain security of entry.

6. Gate Arm Height: Locate top of gate arm in down position at not more than 35 inches above pavement.
7. Gate Arm Finish: Comply with applicable code for paint finish and markings on gate arm.
    a. In the absence of code defined provisions, two coats of reflective enamel based paint with black and yellow diagonal stripes on both sides of arm. Comply with applicable code for paint finish and markings on gate arm.
8. Gate Arm Clamp: Cast metal, quick change clamp and hub bracket, to permit rapid replacement of gate arm without fitting or drilling.
9. Pivot, Limit Stops, and Counterbalancing: Galvanized steel construction, enclosed in arm clamp, with oil impregnated bronze bearing.
10. Gate Arm Support Post: Steel section; 37 inches high, 6 inches square, with 10 gauge, 0.135 inch minimum wall thickness; with welded and sealed steel post cap and base plate.
11. Padlocking Feature: To lock gate arm in either open or closed position.

2.04 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Electrical Characteristics:
    1. Capacity, rated load, voltage and phase, amperage, and other characteristics as indicated on Drawings and as specified in Division 26.

B. Electrical Components: Self-contained, plug-in, and replaceable components that comply with NFPA 70 and are listed and labeled by UL (DIR) or ITS (DIR).
    1. Provide wiring for control units, zinc plated connection box, grounded convenience outlet, switch for automatic or manual operation, switch to disconnect power unit, thermostatically controlled with at least 250 watt heater strip, and thermally protected disconnect for motor.

C. Motor: NEMA MG 00001 compliant.

D. Backup Power Inverter: Provides electrical power to allow system to remain in operation upon loss of primary electrical power.

E. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized in compliance with NFPA 70.

F. Disconnect Switch: Factory mount disconnect switch in control panel.

2.05 CARD CONTROL

A. Control Unit: To activate gate arm by pass key.

B. Cabinet: 0.075 inch steel, weather tight seams; thermally insulated to permit heater to maintain cabinet temperature to equipment operating minimum, flush access doors and panels, tamper proof hardware, weather tight gaskets, master keyed locks. Conceal mounting bolts inside units.

C. Coded Cards: Laminated plastic with embossed coding for one month validation periods. Supply Owner directed quantity of cards for each time period. Include anti-pass-back card control.

2.06 VEHICLE DETECTION

A. Vehicle Detection: For use in temperature range of minus 40 to 160 degrees F; consisting of detection unit in conjunction with sensing loop to activate access control device when vehicle exits.

B. Sensing Loop: 14 gauge, 0.064 inch insulated wire; loop size of 48 by 72 inches, with loop extension cable and detector.

C. Loop Groove Fill: Cold poured rubberized asphalt emulsion.

2.07 MATERIALS

A. Aluminum: Extruded aluminum in compliance with ASTM B221 or ASTM B221M.

B. Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

C. Iron and Steel Hardware: Hot-dip zinc coating, ASTM A153/A153M.

D. Structural Steel Tubing: ASTM A500/A500M

2.08 ACCESSORIES

A. Curb Frames: Formed steel type, 6 inch high above pavement, 3/4 inch thick, galvanized finish for field painting.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that anchor bolts are ready to receive this work and dimensions are as required by manufacturer.

B. Verify that electric connections are properly located and have necessary characteristics.

3.02 INSTALLATION

A. Install parking control system and components in accordance with manufacturer's written instructions and in compliance with requirements.

B. Install curb frame as indicated and complying to requirements.

C. Cut grooves in pavement surface, install vehicle detection loops and lead-in wires, and fill grooves with loop filler.

D. Install internal electrical wiring, conduit, junction boxes, transformers, circuit breakers, and auxiliary components as required.

3.03 ADJUSTING

A. Adjust system components for smooth operation.

END OF SECTION

SECTION 11 30 13
RESIDENTIAL APPLIANCES

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 SECTION INCLUDES

A. Kitchen appliances.

B. Laundry appliances.

1.03 RELATED REQUIREMENTS

A. Section 06 41 00 - Architectural Wood Casework: Appliances in Amenity area.

B. Section 12 35 30 - Residential Casework: Appliances in Unit Interior.

C. Section 12 36 00 - Countertops: Clearance under countertops for appliances.

D. Division 23 Heating, Ventilating, and Air Conditioning (HVAC)

1.04 REFERENCE STANDARDS

A. ICC (IMC)-2021 - International Mechanical Code.

B. ICC (IRC)-2021 - International Residential Code for One- and Two-Family Dwellings.

C. UL (DIR) - Online Certifications Directory.

D. UL 2158A - Clothes Dryer Transition Duct.

1.05 SUBMITTALS

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

B. Product Data: Manufacturer's data indicating dimensions, capacity, and operating features of each piece of residential equipment specified.

C. Copies of Warranties: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Electric Appliances: Listed and labeled by UL (DIR) and complying with NEMA Standards (National Electrical Manufacturers Association).

C. Coordinate dimensions of selected appliances with kitchen cabinets.

1.07 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.

C. Provide ten (10) year manufacturer warranty on magnetron tube of microwave ovens.

D. Provide ten (10) year manufacturer warranty on tub and door liner of dishwashers.

PART 2 PRODUCTS

2.01 KITCHEN APPLIANCES

A. Basis of Design Kitchen Appliances by Basis of Design product; as indicated on Drawings.

2.02 LAUNDRY APPLIANCES

A. Basis of Design Laundry Appliances by Basis of Design product; as indicated on Drawings.

2.03 ACCESSORIES

A. All washer hoses shall be braided, stainless steel hoses.

B. Coordinate hose diameter and threaded end types with installed equipment.

C. Dryer Vent Assembly: Comply with ICC (IMC)-2021 and ICC (IRC)-2021.
   1. Exhaust Duct: Aluminum ribbon, 4-inch diameter, comply with UL 2158A.
      a. Elbows: 26-gauge, 0.018-inch aluminized steel; 45 degree angle, nonsectioned curve; 4-inch diameter.
      b. Clamps: Stainless steel, 3-1/2 to 4-3/4-inch diameter range.
   2. Wall Termination: 26-gauge, 0.018-inch aluminized steel with rain drip edge, rubber magnetic bumpers, angled damper, and removable backing plate; 6-1/2 inches wide by 6.45 inches tall.
   3. Label: Where exhaust duct length exceeds 35 feet, provide label or tag identifying duct length. Locate label or tag within 6 feet of duct connection.
   4. Finish for Exposed Metals: Match adjacent wall color unless otherwise noted on Drawings.

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 written instructions.

B. Exhaust pipe for wall terminations shall slope with positive drainage away from interior equipment towards exterior wall.

C. 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 82 26
FACILITY WASTE COMPACTORS

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 SECTION INCLUDES

A. Packaged waste compactor for separate container.

B. Discharge containers.

C. Chute intake door interlock controls.

1.03 RELATED REQUIREMENTS

A. Section 14 91 00 - Facility Chutes: Chute intake door locking mechanism and interlocking requirements.

1.04 REFERENCE STANDARDS

A. ANSI Z245.2 - American National Standard for Equipment Technology and Operations for Wastes and Recyclable Materials — Stationary Compactors - Safety Requirements for Installation, Maintenance, Operation, Modification and Repair.

B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

C. NEMA MG 00001 - Motors and Generators.

D. UL (DIR) - Online Certifications Directory.

E. WASTEC (SCRG) - WASTEC Listing of Rated Stationary Compactors.

1.05 SUBMITTALS

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

B. Product Data: Provide unit capacities, physical dimensions, utility requirements and locations, point loads.

C. Test Reports: Indicate WASTEC (SCRG) ratings accompanied with certified test results.

D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

1.07 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.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Compactor in Trash Chute Room: Apartment type, chute and side intakes.
   1. Service Conditions: Exterior under cover.
   2. Container Size: 2.0 cubic yard capacity.

B. Storage Containers: Heavy duty steel; factory-finished for outdoor use; manufacturer's standard type unless otherwise indicated
   1. Size 2 cu. yds.
   2. Quantity: 6 for non-recycle, 2 for non-sorted recycle.
   3. Wheels: Poly-Clad casters.

2.02 COMPACTORS - GENERAL

A. Compactors: Rated by WASTEC (SCRG) in accordance with ANSI Z245.2.
   1. Provide certificate of compliance from authorities having jurisdiction indicating approval of unit.
   2. Electrically Operated Equipment and Components: Individually UL (DIR) listed.
   3. Finish: Factory primed and painted.
   4. Color: As selected from manufacturer's standard colors.

B. Motors: NEMA MG 00001.

C. Control Panels and Remote Equipment Enclosures: NEMA EN 10250 Type 4 enclosures; factory finished; wall-mounted unless otherwise indicated.

D. Anchors and Fasteners: Galvanized steel; where embedded in concrete, provide to concrete installer for installation.

2.03 APARTMENT COMPACTORS

A. Apartment Compactors: Small footprint; heavy duty steel body consisting of a charge box over a compactor unit that compresses horizontally into separate container; hydraulically driven compaction ram.
   1. Configuration: As indicated on drawings.
   2. Power Unit: Hydraulic pump and oil reservoir; located inside compactor room; provide hydraulic piping and electrical connections.
   3. Controls and Safeties:
      a. "On/Off" key switch.
      b. Automatic photoelectric sensor start and stop.
      c. Emergency stop button.
      d. "Container-Full" indicator light.
      e. Cycle selector.
      f. Magnetic door and container interlock.
      g. Chute interlock controls, for conditions specified in chutes section.
      h. Container removal safety signal.
      i. Built-in container stops.

B. Chute Extension: Provide extension of chute to fit compactor, as indicated on drawings.

C. Discharge Container: Roll-off type.
   1. Provide two per compactor.

D. Basis of Design: Wastequip, Inc; Model C-33X-APT (www.wastequip.com/#sle).
   1. Characteristics: WASTEC (SCRG) Rating 0.23 cubic yards; 18 second cycle; 5 HP electric motor; 208/230/460 V, 3 phase, 60 Hz; 5.0 gallons per minute fixed gear pump; 25 gallon oil tank reservoir; 28.8 pounds per square inch ram force; 22 inch long by 29.75 inch wide clear top opening.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that anchors are correctly positioned.

3.02 INSTALLATION

A. Install unit and inlet hopper in accordance with manufacturer's written instructions and with standards required by authorities having jurisdiction.

B. Coordinate with waste chute discharge.

C. Anchor unit securely in place.

D. Touch-up minor damaged surfaces caused during installation, and replace damaged components.

E. Adjust unit mechanism to achieve specified requirements.

3.03 CLOSEOUT ACTIVITIES

A. Demonstrate and instruct Owner on unit operation, and describe unit limitations.

END OF SECTION

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SECTION 12 24 00
WINDOW SHADES - MECHOSHADE SYSTEMS

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 SECTION INCLUDES

A. Roller shades.

B. Shade fabric.

C. Intelligent coded electronic drive system.

D. Motor controls and interfaces.

1.03 RELATED REQUIREMENTS

A. Section 01 23 00 - Alternates; Mechoshade control system.

B. Section 08 43 13 - Aluminum-Framed Storefronts: attachment of shade system.

1.04 REFERENCE STANDARDS

A. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

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

C. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.

D. WCMA A100.1 - Standard for Safety of Window Covering Products.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Where motorized shades are to be controlled by control systems provided under other sections, coordinate the work with other trades to provide compatible products.
   2. Coordinate work to ensure areas with wiring remain accessible until completion of wiring installation.
   3. Coordinate the work with other trades to provide concealed rough-in of electrical wiring as required for installation of hardwired motorized shades.

B. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of all affected installers.

C. Sequencing:
   1. Do not fabricate shades until field dimensions for each opening have been taken with finished conditions in place. "Hold to" dimensions are not acceptable.
   2. Do not install shades until final surface finishes and painting are complete.

1.06 SUBMITTALS

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

B. Product Data: Manufacturer's catalog pages and data sheets for each product, including the following:
   1. Materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories
   2. Styles, material descriptions, dimensions of individual components, profiles, features, finishes, accessories, and operating instructions.
   3. Mounting details and installation methods.
   4. Motorized Shades: Include power requirements, standard wiring diagrams, integration of EDU controllers with building management systems, audiovisual systems, lighting control systems, and PoE motor integration.

C. Shop Drawings: Include plans, elevations, sections, product details, installation details, operational clearances, and wiring diagrams.

D. Verification Samples: Submit 3 sets of fabric samples, minimum size 6 inches square, representing actual materials, specified color, and pattern.

E. Manufacturer's qualification statement.

F. Installer's qualification statement.

G. Operation and Maintenance Data: List shade components with part numbers. Include operation and maintenance instructions.

H. Executed warranty.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with minimum ten years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with minimum ten years of documented experience and approved by manufacturer.

1.08 MOCK-UPS

A. Mock-Up: Provide minimum 3 feet wide by 3 feet high mock-up of window shade system complete with selected shade fabric including example of seams and batten pockets or as required to simulate jobsite conditions when applicable.
   1. Obtain Architect's approval of light and privacy characteristics of fabric prior to fabrication.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in factory-labeled packages marked with manufacturer's name and product name, fire-test response characteristics, and location of installation using room designation indicated on drawings.

B. Handle and store shades in accordance with manufacturer's recommendations.

1.10 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.11 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Manufacturer's Warranty: Provide manufacturer's warranty for interior shading. Complete forms in Owner's name and register with manufacturer. Ensure warranty covers the following:
   1. Shade Hardware: 10 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: MechoShade Systems LLC; www.mechoshade.com.

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ROLLER SHADES

A. General:
   1. Provide shade system components capable of being removed or adjusted without removing mounted shade brackets or cassette support channel.
   2. Provide shade system that operates smoothly when shades are raised or lowered.
   3. Electrical Components: Listed, classified, and labeled as suitable for intended purpose. Individual component testing not acceptable in place of system testing.

B. Roller Shades - Basis of Design: MechoShade Systems LLC; Mecho/5 System; www.mechoshade.com.
   1. Description: Single roller, manually operated fabric window shades.
      a. Provide universal drive capability to offset drive chain.
      b. Drop Position: Regular roll.
      c. Mounting: As indicated on Drawings.
      d. Size: As indicated on Drawings.
      e. Fabric: As indicated on Drawings.

2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated. Accommodate shade fabric roll-up size and weight.
    a. Material: As indicated on Drawings.
    b. Finish: As indicated on Drawings.
3. Roller Tubes:
    a. Material: Extruded aluminum.
    b. Size: As recommended by manufacturer for installation conditions, span, and weight of shades.
    c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge.
        1) Shade Band: Removable and replaceable without removing roller tube from brackets or inserting spline from side of roller tube.
    d. Capable of removal and reinstallation without affecting roller shade limit adjustments.
4. Hembars: Designed to maintain bottom of shade straight and flat.
    a. Style: As indicated on Drawings.
5. Clutch Operator: Manufacturer's standard material and design integrated with bracket and brake assembly.
    a. Heavy-duty, 1/8 inch steel mounting bracket and integrated steel brake. Clutch and sprocket assembly affix shade support and user control to structure independently of roller tube components.
    b. Provide permanently lubricated brake assembly mounted on oil-impregnated hub with wrapped spring clutch.
    c. Provide brake capable of withstanding minimum pull force of 50 pounds in stopped position.
    d. Mount clutch and brake assembly on support brackets, fully independent of roller tube components.
    e. Shade Hanging Weight: Maximum 50 lb.
6. Drive Chain: Continuous loop, stainless steel beaded ball chain, 100 pounds minimum breaking strength. Provide upper and lower limit stops.
    a. Chain Retainer: Chain tensioning device complying with WCMA A100.1.
    b. Limit Stops: Bead stops affixed to chain and traveling across multiple shades to maintain consistent shade band alignment at top and bottom of shade and prevent damage.
7. Accessories: As indicated on Drawings.

C. Roller Shades - Basis of Design: MechoShade Systems LLC; ElectroShade with WhisperShade IQ2 EDU, line voltage (120 VAC); www.mechoshade.com.
1. Brackets and Mounting Hardware: As recommended by manufacturer. Accommodate shade fabric roll-up size and weight.
    a. Material: Steel, 1/8 inch thick, minimum. Ensure steel is thick enough to support 150 percent of each shade's weight.
    b. Double Roller Brackets: Configured for light-filtering and room-darkening shades in one opening.
        1) Light-Filtering Fabric: Room-side of opening.
        2) Room-Darkening Fabric: Room-side of opening.
2. Roller Tubes:
    a. Material: Extruded aluminum.
    b. Size: As recommended by manufacturer for installation conditions, span, and weight of shades.
    c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge.
        1) Shade Band: Removable and replaceable without removing roller tube from brackets or inserting spline from side of roller tube.
3. Hembars: Designed to maintain bottom of shade straight and flat.
    a. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.
    b. Room-Darkening Shades: Provide slot in bottom bar with wool-pile light seal.
4. Accessories:

a. Fascia: Removable extruded aluminum fascia; size to conceal shade mounting, attachable to brackets without exposed fasteners.
    1) Provide fascia capable of installation across two or more shade bands in one piece.
    2) Color: As indicated on Drawings.
    3) Profile: As indicated on Drawings.
    4) Configuration: Captured, fascia stops at captured bracket end.
    5) Finish: Baked enamel.
b. Room-Darkening Channels, Standard: Extruded aluminum side and center channels with brush pile edge seals, SnapLoc mounting base, and concealed fasteners.
    1) Provide channels capable of accepting one-piece exposed blackout hembar to assure side light and sill light control.
c. ShadeLoc Channels: Extruded aluminum side and center channels consisting of mounting base, SnapLoc channel for capturing zippered edges of shade band, and rubber foam cushions to adjust for field conditions.

2.03 SHADE FABRIC

A. Fabricat all other locations: Non-flammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
    1. Single shade with fabric indicated below.
    2. Material Composition:
        a. As required by Basis of Design Fabric listed on Drawings.
    3. Performance Requirements:
        a. Flammability: Pass NFPA 701 large or small scale test.
        b. Fungal Resistance: No growth when tested according to ASTM G21.
    4. Color: As indicated on Drawings.
    5. Fabrication:
        a. Fabric Orientation: Railroaded, fabric is turned 90 degrees off the roll.
            1) Seams for Railroaded Fabric: Manufacturer's standard sewn seam; locate as indicated on drawings.
        b. Provide welded zipper edge full height on both sides of fabric to ensure smooth operation within ShadeLoc channels.
    6. Products:
        a. As indicated on Drawings.
        b. Substitutions: Not permitted.

2.04 INTELLIGENT ENCODED ELECTRONIC DRIVE SYSTEM

A. Electronic Drive Unit (EDU) System - General Requirements:
    1. Provide system complying with UL 325. Do not accept component certification in place of system testing. Provide listing label and motor rating visible for inspection without requiring dismounting shade assembly or removing EDU from shade roller tube.
    2. Size and Configuration: As recommended by manufacturer for type, size, and arrangement of shades to be operated.
    3. Conceal EDU inside shade roller tube.
    4. Use EDUs rated at same nominal speed for shades in same room.
    5. Shade Band Hanging Weight: 80 percent of rated lifting capacity of EDU and tube assembly.
    6. Capable of upgrading firmware from anywhere on network without touching motor.
B. Line-Voltage EDU, 120 VAC:
    1. Basis of Design: MechoShade Systems LLC; WhisperShadeIQ2 System; www.mechoshade.com.
    2. Description: Tubular, asynchronous, with integral AC motor and reversible capacitor, single phase, 60 Hz. Temperature Class B, thermally protected, totally enclosed, and maintenance-free. Powered by line-voltage power supply connection equipped with locking disconnect plug assembly.
    3. Audible Noise: Maximum 46 dBA, measured 3 feet from motor unit.
    4. Nominal Speed: Minimum 34 rpm; ensure speed does not vary due to load or lift capacity.

5. Provide isolated, low-voltage power supply for external accessories connected to dry contact port or network port.

C. Modes of Operation:
   1. Uniform Mode: Move shades only to defined intermediate stop positions to maintain aesthetic uniformity.
   2. Normal Mode: Move shades to defined intermediate stop positions, and positions between upper and lower limits
   3. Maintenance Mode: Prevent shade from moving to newly commanded positions via dry contact or network control commands until EDU has been serviced or Maintenance Mode has been cleared or disabled.

D. Control Methods:
   1. Local Isolated Dry Contact Inputs:
      a. Support local switch control and third-party system integration without separate interface.
      b. Support moving EDU and associated shade to upper and lower limits and to local switch preset positions.
      c. Support configuration of upper and lower limits, custom presets, and key modes of operation without requiring PC or similar microprocessor-based tools.
      d. Support configuration under protected sequences to prevent changes by unauthorized user.
      e. Switch Personalities: Support configuration of dry contact control port over network such that dry contact keypads and other interfaces, maintained or momentary action, are compatible for shade operation.
      f. Dry Contact Control Connection: One-button.
      g. Network Control: Allowing for command of groups of shades over common backbone, through bidirectional network communication.
         1) Provide the Following for Each EDU:
            (a) Support eight network addresses for group control.
            (b) Dry Contact Ports: Support group control with unique local switch address for each EDU, capable of matching by other EDUs within eight network addresses.
            (c) Receiving EDU capable of configuration to operate based on commands from input port.
            (d) Independent unique identifier address enabling EDU control and configuration via handheld configurator or PC controller.
         2) Network Communication Card: Integral with tubular EDU assembly.
         3) Support configuration of upper and lower limits using handheld, removable program configurator or local switch.
         4) Support address configuration using handheld, removable program configurator.

E. Alignment Positions: Repeatable, aligned shade positions and limits.
   1. Support positioning commands from 0 to 100 percent in 1 percent increments.
      a. Include 32 customizable presets and three intermediate dry contact presets.
   2. Shades on same switch circuit or with same network group address and with same opening height, align at each intermediate stopping position when traveling up or down.
   3. Shades of differing heights capable of custom, aligned intermediate stop positions when traveling up or down.
   4. Do not allow alignment of shades on same motor to exceed plus or minus 1/8 inch when in same alignment position.
   5. Do not allow alignment of shades on adjacent motors to exceed plus or minus 1/2 inch when in same alignment position.

F. Local Switch Presets:
   1. Provide minimum of three customizable preset positions accessible over local dry contact control inputs and over network connection.
   2. Preset positions customizable to any position between and including defined upper and lower limits, initially defaulting to 25, 50, and 75 percent of shade travel.

3. Support configuration of custom preset positions using handheld removable program configurator, or local switch.

G. Network Presets:
1. Provide minimum of 32 customizable preset positions, including three local switch presets, accessible via network commands.
2. Preset positions customizable to any position between and including defined upper and lower limits, initially defaulting to defined lower limit.
3. Support configuration of custom preset positions using handheld removable program configurator.

2.05 MOTOR CONTROLS AND INTERFACES

A. Provide equipment necessary for complete operating system providing control intent as indicated on drawings.

B. Provide components and connections necessary to interface with other systems as indicated.

C. Low-Voltage Wall Controls; IQ Switch: (Base Bid)
1. Momentary dry contact switch enables manual local control or network control of individual shade motors, shade groups, or shade subgroups on MechoNet network.
2. Control Functions:
a. Open: Automatically open controlled shades to fully open position when button is pressed.
b. Close: Automatically close controlled shades to fully closed position when button is pressed.
c. Presets: For selection of predetermined shade positions.
3. Finish: White.
4. Products:

D. Wireless Controls: (Bid Alternate)
1. MechoNet Wireless Controllers:
a. Serve as gateway, router, and controller between EnOcean wireless devices and MechoNet network.
b. Communicate with EnOcean wireless devices via 902 MHz RF; support wireless daylight sensors, wireless occupancy and vacancy sensors, and wireless switches.
c. Each controller manages up to 16 EnOcean wireless devices.
d. Each controller can be configured to support one of two modes of operation:
1) SolarTrac Mode: Relays EnOcean wireless sensor and control information to SolarTrac automatic solar-evaluation control system.
2) Solar Activated Control Mode: Utilize EnOcean wireless sensor and control information for internal automation algorithms to adjust shade positions.
(a) Adjust shade positions based on input from daylight sensors to optimize visual comfort; enable up to five shade positions - full-up, full-down, and up to three configurable intermediate preset stop positions, with default of three positions - full-up, full-down, and preset number two.
(b) Provide configurable daylight thresholds for each shade position; includes configurable hysteresis setting, with default of 20 percent, to prevent frequent cycling of shades during fluctuating daylight conditions.
(c) Provide configurable delay timers to inhibit shade position changes due to short duration changes in daylight conditions, with default of 300-second delay for up and 60-second delay for down.
(d) Night Mode: Provide configurable nighttime shade position to support light pollution, privacy, and energy conservation requirements; configurable daylight threshold, with default of 18.6 fc, and duration, with default of 60 minutes to enter night mode and 30 minutes to exit night mode.
(e) Occupancy/Vacancy: Where wireless occupancy and vacancy sensors are specified, enable configurable unoccupied mode shade position, with default of full-down, to optimize energy conservation; provide configurable timers for detection of both unoccupied and occupied states.

(f) Manual Override: Where local switches are specified, enable manual temporary override of shade positions for configurable duration, with default of 60 minutes.

(g) Retract Mode: Manage changes to light level based on shade position for comfort and increasing exposure of occupant to daylight. Move shades up in stepped one-position increments as daylight levels drop. Maintain each step for one minute while controller retests daylight conditions before authorizing next step until target is reached.

e. Capable of being powered by dedicated low-voltage power supply or through certain MechoNet devices without additional power supplies.

f. Multiple sensors can be configured to automate same shade control zone in order to ensure operation based on worst-case comfort conditions across zone.

g. Each sensor can be configured to automate multiple shade control zones.

h. Maintain circular log of previous 48 hours of data received from each of 16 possible wireless devices, capable of being downloaded and stored for record keeping, performance optimization, or troubleshooting purposes.

2.06 ROLLER SHADE FABRICATION

A. Field measure finished openings prior to ordering or fabrication.

B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.

1. Vertical Dimensions: Fill openings from head to sill with 1/2-inch space between bottom bar and window sill.

C. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine finished openings for deficiencies that may preclude satisfactory installation.

B. Do not begin installation before preparing substrates.

C. Verification of Conditions: Notify Architect of conditions preventing proper and timely completion of work. Do not proceed without correcting unsatisfactory conditions. Starting installation constitutes acceptance of conditions.

3.02 PREPARATION

A. Clean surfaces before installation.

B. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.

C. Inspect mounting conditions to ensure compliance with approved shop drawings.

D. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings.

1. Install roller shades level, plumb, square, and true in accordance with manufacturer's instructions. Install blocking plumb, level, and fitted to window mullion.
2. Locate shade band no closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.
3. Set upper, lower, and intermediate stop positions of motorized shade bands. Ensure alignment in accordance with dimensional requirements.

B. Replace shades that exceed specified dimensional tolerances at no extra cost to Owner.

3.04 SYSTEM STARTUP

A. Motorized Shade System: Provide services of a manufacturer's authorized representative to perform system startup.

3.05 CLEANING

A. Clean roller shade surfaces and exposed components in accordance with manufacturer's instructions.

B. Replace shades that cannot be cleaned to "like new" condition.

3.06 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. Training: Train Owner's personnel on system adjustment, operation, and maintenance.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours training by manufacturer's authorized personnel at location designated by the Owner.

3.07 PROTECTION

A. Protect installed products and finished surfaces from damage during phases of installation including preparation, testing, cleanup, and subsequent construction operations.

B. Touch up, repair, or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 12 24 00
WINDOW SHADES

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 SECTION INCLUDES

A. Interior manual roller shades.

B. Interior motorized roller shades.

C. Motor controls.

1.03 RELATED REQUIREMENTS

1.04 REFERENCE STANDARDS

A. ASTM E2180 - Standard Test Method for Determining the Activity of Incorporated Antimicrobial Agent(s) in Polymeric or Hydrophobic Materials.

B. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

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

D. WCMA A100.1 - Standard for Safety of Window Covering Products.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Where motorized shades are to be controlled by control systems provided under other sections, coordinate the work with other trades to provide compatible products.

B. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of affected installers.

1.06 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
   1. Motorized Shades: Include power requirements and standard wiring diagrams for specified products.

C. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.
   1. Motorized Shades: Provide schematic system riser diagram indicating component interconnections. Include requirements for interface with other systems.

D. Certificates: Manufacturer's documentation that line voltage components are UL listed or UL recognized.

E. Source Quality Control Submittals: Provide test reports indicating compliance with specified fabric properties.

F. Selection Samples: Include fabric samples in full range of available colors and patterns.
   1. Motorized Shades: Include finish selections for controls.

G. Verification Samples: Minimum size 6 inches square, representing actual materials, color and pattern.

H. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

I. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.

J. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.07 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 this type with minimum five years of documented experience with shading systems of similar size and type.
   1. Manufacturer's authorized representative.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.

B. Handle and store shades in accordance with manufacturer's recommendations.

1.09 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.10 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
   1. Shade Hardware: Ten years.
   2. Electric Motors: Ten years.
   3. Electronic Control Equipment: Ten years.
   4. Fabric: Ten years.
   5. Aluminum and Steel Coatings: Ten years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Interior Manually Operated Roller Shades:
   1. Draper, Inc; Clutch Operated FlexShade NEXD: www.draperinc.com.
   2. Hunter Douglas Architectural; RB500 Manual Roller Shades: www.hunterdouglasarchitectural.com.
   3. MechoShade Systems LLC; Mecho/7 System: www.mechoshade.com.
   4. Rollease Acmeda Contract; Contract Series Easy Spring Air: www.rolleaseacmedacontract.com.
   5. SWFcontract, a division of Springs Window Fashions, LLC.; Pro Series Manual Solar Shade System: www.swfcontract.com.
   6. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ROLLER SHADES

A. General:
   1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
   2. Provide shade system that operates smoothly when shades are raised or lowered.

B. Interior Roller Shades - Basis of Design: Draper, Inc; Clutch Operated FlexShade NEXD: www.draperinc.com.
   1. Description: Single roller, manually operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and other components necessary for complete installation.
      a. Mounting: Wall mounted.
   2. Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
   3. Roller Tubes: As required for type of shade operation; designed for removal without removing mounting hardware.
      a. Material: Extruded aluminum or steel, with wall thickness and material selected by manufacturer.

b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.

4. Hembars: Designed to maintain bottom of shade straight and flat, selected from manufacturer's standard options.
5. Manual Operation:
   a. Clutch Operator: Manufacturer's standard material and design, permanently lubricated.
   b. Drive Chain: Continuous loop, stainless steel, beaded ball chain, 95 lb minimum breaking strength; comply with WCMA A100.1. Provide upper and lower limit stops.

2.03 SHADE FABRIC

A. Fabric: Nonflammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
   1. Material: Vinyl coated polyester.
   2. Performance Requirements:
      a. Flammability: Pass NFPA 701 large and small tests.
      b. Fungal Resistance: No growth when tested in accordance with ASTM G21.
      c. Antimicrobial Resistance: Greater than 95 percent reduction of bacteria when tested in accordance with ASTM E2180.
   3. Roll Width: 72 inches.
   4. Color: As selected by Architect from manufacturer’s full range of colors.
   5. Fabrication:
      a. Fabric Orientation: Railroaded, fabric is turned 90 degrees off the roll.
      b. If height of opening requires multiple panels of railroaded fabric, use battens at seams.
      c. Battens: Full width of shade, enclose in welded shade fabric pocket.

2.04 ROLLER SHADE FABRICATION

A. Field measure finished openings prior to ordering or fabrication.

B. Dimensional Tolerances: As recommended in writing by manufacturer.

C. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine finished openings for deficiencies that may preclude satisfactory installation.

B. Start of installation shall be considered acceptance of substrates.

3.02 PREPARATION

A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.

B. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.

B. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.04 SYSTEM STARTUP

A. Motorized Shade System: Provide services of a manufacturer's authorized representative to perform system startup.

3.05 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.

B. Replace shades that cannot be cleaned to "like new" condition.

3.06 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

3.07 PROTECTION

A. Protect installed products from subsequent construction operations.

B. Touch-up, repair, or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 12 35 30
RESIDENTIAL CASEWORK

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 SECTION INCLUDES

A. Kitchen cabinets.

B. Vanity cabinets.

C. Other locations as indicated on Drawings for Residential Living Units.

1.03 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Concealed blocking for casework support.

B. Section 06 41 00 - Architectural Wood Casework: Amenity Millwork.

C. Section 07 92 00 - Joint Sealants: Sealing joints between casework and countertops and adjacent walls, floors, and ceilings.

D. Section 12 36 00 - Countertops.

1.04 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard.

B. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications.

C. BHMA A156.9 - Cabinet Hardware.

D. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood.

E. KCMA A161.1 - Performance and Construction Standard for Kitchen and Vanity Cabinets.

F. NEMA LD 3 - High-Pressure Decorative Laminates.

1.05 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 conformance with KCMA A161.1.

D. Shop Drawings: Indicate casework locations, elevations, clearances required, rough-in and anchor placement dimensions and tolerances, and adjacent construction.

E. Cabinet Door and Drawer Sample: Of sufficient size to show each cabinet style and finish, with selected hardware for Owner review at Construction Office.
   1. Submit two 12 x 18 inch face panels, illustrating each color of finish.

F. Manufacturer's Qualification Statement.

G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Products: Complying with KCMA A161.1 and KCMA Certified.

B. Manufacturer: Company specializing in manufacturing the type of products specified in this section, with minimum 5 years of documented experience.

C. Coordinate casework with kitchen appliance dimensions and clearances.

D. Provide removable base cabinets for locations indicated on Drawings.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install casework until building is enclosed, wet work is complete and dry, and temporary HVAC system is operating and maintaining temperature and humidity conditions at occupancy levels during the remainder of the construction period.

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.

PART 2 PRODUCTS

2.01 CABINETS

A. Kitchen and Vanity Cabinets: Premanufactured and factory-finished, complying with construction and testing requirements in KCMA A161.1.

B. Cabinet Box: Framed construction.
   1. Side Panels: Plywood.
      a. Exposed Side Panel Finish: Thermally fused laminate, coordinate with cabinet door and drawer color/finish.
   2. Back Panel: Particle board.
   3. Bottom (and Top) Panel: Plywood.
   4. Face Frame: Solid wood.
   5. Interior Cabinet Finish: Thermally fused laminate.
   6. Exposed Panel Edges: Finish with manufacturer's standard edge banding, color coordinated with other exposed finishes.

C. Cabinet Door/Drawer Configuration: Full overlay.

D. Cabinet Doors:
   1. Medium density fiberboard (MDF), thermoformed vinyl "thermofoil" overlay finish.
   2. Color/Pattern: As selected by Interior Designer.

E. Drawers:
   1. Solid wood sides with dovetail joints, plywood bottom panel.
   2. Drawer Front: To match cabinet doors in style, material, and finish.
   3. Interior Finish: Manufacturer's standard.

F. Shelves: Manufacturer's standard adjustable shelves and metal shelf supports.

G. Cabinet Hardware: As selected from manufacturer's standard types, styles and finishes.
   1. Comply with BHMA A156.9.
   2. Drawer and Cabinet Pulls: As selected by Interior Designer.
   3. Drawer and Cabinet Knobs: As selected by Interior Designer.
   4. Hinges: Manufacturer's standard self-closing concealed hinges.
   5. Drawer Slides: Manufacturer's standard self-closing drawer slides.

H. Countertops: As specified in Section 12 36 00.

2.02 MATERIALS

A. Adhesives Used for Assembly: Comply with VOC requirements for adhesives and sealants as specified in Section 01 61 16.

B. Wood-Based Materials:
   1. Solid Wood: Air-dried to 4.5 percent moisture content, then tempered to 6 percent moisture content before use.

C. Solid Wood: Clear, dry, sound, plain sawn, selected for species grain and color, no defects.

D. Hardwood Plywood: Veneer core; HPVA HP-1 Grade as indicated; same species as exposed solid wood, clear, compatible grain and color, no defects. Band exposed edges with solid wood of same species as veneer.

E. Particleboard: Composed of wood chips, medium density, with waterproof resin binders; of grade to suit application; sanded faces; complying with ANSI A208.1.

F. Medium Density Fiberboard (MDF): Composed of cellulosic fibers and resin cured under heat and pressure; grade to suite application; complying with ANSI A208.2.

G. Thermally Fused Laminate (TFL): Melamine resin, NEMA LD 3, Type VGL laminate panels.

2.03 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. Provide cutouts for plumbing fixtures and appliances. Prime paint contact surfaces of cut edges.

E. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

F. Fabricate insider corners with minimum 3 inch filler panel each face.

2.04 FINISHES

A. As selected by Owner or Owner's Interior Designer.

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 written 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 1/32 inch. Do not use additional overlay trim to conceal larger gaps. Refinish and seal cuts as recommended by Manufacturer

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

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SECTION 12 36 00
COUNTERTOPS

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 SECTION INCLUDES

A. Natural Stone Countertops.

B. Stainless Steel Countertops.

C. Natural Quartz and Resin Composite Countertops.

D. Natural Quartz and Resin Composite Wall Panels.

1.03 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Supports for countertops.

B. Section 06 41 00 - Architectural Wood Casework.

C. Section 12 35 30 - Residential Casework.

1.04 REFERENCE STANDARDS

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

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition.

C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards.

D. ISFA 3-01 - Classification and Standards for Quartz Surfacing Material.

E. NEMA LD 3 - High-Pressure Decorative Laminates.

F. NSI (DSDM) - Dimensional Stone Design Manual, Version VIII.

G. PS 1 - Structural Plywood.

1.05 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 and installation; combine with shop drawings of cabinets and casework specified in other sections.

D. Submit Samples for Owner Review: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

F. Installation Instructions: Manufacturer's written installation instructions and recommendations.

G. Maintenance Data: Manufacturer's written instructions and recommendations for maintenance and repair of countertop surfaces.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than five years of documented experience.

1.07 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.

1.08 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. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Natural Stone Countertops: Stone slabs bonded to substrate; use as large pieces as possible with inconspicuous adhesive joints.
   1. Stone: Granite without cracks, voids, or pin holes ; filling with matching epoxy resin is acceptable.
   2. Color: As indicated on Drawings and finish schedules.
   3. Stone Thickness: As indicated on Drawings.
   4. Surface Finish: Polished.
   5. Exposed Edge Treatment: As detailed on Drawings.
   6. Back and End Splashes (where detailed): Same material, same thickness; for field attachment.

C. Natural Quartz and Resin Composite Countertops: Sheet or slab of natural quartz and plastic resin over continuous substrate.
   1. Flat Sheet Thickness at Public Spaces/Amenity: As indicated on Interior Design Drawings.
   2. Flat Sheet Thickness: 1-1/4 inch, minimum.
   3. Natural Quartz and Resin Composite Sheets, Slabs and Castings: Complying with ISFA 3-01 and NEMA LD 3; orthophthalic polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard stone fabrication tools; no surface coating; color and pattern consistent throughout thickness.
      a. Manufacturers:
         1) As indicated on Drawings.
         2) Substitutions: Not permitted.
      b. Factory fabricate components to the greatest extent practical in sizes and shapes indicated; comply with NSI (DSDM).
      c. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
      d. NSF approved for food contact.
      e. Finish on Exposed Surfaces: Polished.
   4. Other Components Thickness: 3/4 inch, minimum.
   5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.

D. Natural Quartz and Resin Composite Wall Panels: Sheet or slab of natural quartz and plastic resin over continuous substrate.
   1. Flat Sheet Thickness at Public Spaces/Amenity: As indicated on Interior Design Drawings.
   2. Natural Quartz and Resin Composite Sheets, Slabs and Castings: Complying with ISFA 3-01 and NEMA LD 3; orthopthalic polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard stone fabrication tools; no surface coating; color and pattern consistent throughout thickness.
      a. Manufacturers:
         1) As indicated on Drawings.
         2) Substitutions: Not permitted.
      b. Factory fabricate components to the greatest extent practical in sizes and shapes indicated; comply with NSI (DSDM).
      c. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
      d. NSF approved for food contact.
      e. Finish on Exposed Surfaces: Polished.
      f. Color and Pattern: As indicated on Drawings.

2.02 MATERIALS

A. 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.

B. Adhesives: Chemical resistant, low VOC, waterproof adhesive as recommended in writing by manufacturer of materials being joined.

C. Joint Sealant: Mildew-resistant silicone sealant, clear.

D. Setting Shims: Resilient plastic shims, nonstaining to stone, sized to suit joint thicknesses.

E. Cleaner: Provide stone cleaners specifically formulated for stone varieties, finishes, and applications indicated as recommended by stone producer. Do not use cleaning compounds containing acids, caustics, harsh fillers, or abrasives.

F. Stone Sealer: Colorless, stain-resistant sealer that does not affect color or physical properties of stone surfaces, as recommended by stone producer for application indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Bostik, Inc.
      b. Custom Building Products.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 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.

C. Stone Countertops:
   1. Select stone for intended use to prevent fabricated units from containing cracks, seams, and starts that could impair structural integrity or function.
   2. Carefully inspect finished stone units at fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units
   3. Comply with recommendations in MIA's "Dimension Stone - Design Manual."
   4. Nominal Thickness: Provide thickness indicated, but not less than 3/4 inch (20 mm). Gage backs to provide units of identical thickness.
   5. Edge Detail: 3/8-inch (10-mm) bevel as indicated.
   6. Splashes: Provide 3/4-inch- (20-mm-) thick backsplashes and end splashes, unless otherwise indicated.
      a. Height: 4 inches (100 mm).
      b. Top-Edge Detail: Straight, slightly eased at corner.
   7. Cutouts and Holes:
      a. Undercounter Fixtures: Make cutouts for undercounter fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
      b. Counter-Mounted Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
      c. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

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. Seal joint between back/end splashes and vertical surfaces.

C. Stone Countertop Special Requirements:
   1. General: Install countertops over plywood subtops with a full spread of water-cleanable epoxy adhesive.
   2. Bond seams with stone seam adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to seams to prevent adhesive smears. Use clamps to ensure countertop units are properly aligned and seams are minimum width.
   3. Space seams with 1/16-inch (1.5-mm) gap for filling with sealant. Use temporary shims to ensure uniform spacing and use clamps to eliminate lipping.
   4. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts while cutting to prevent damage.
   5. Install back and end splashes by adhering to wall with water-cleanable epoxy adhesive. Leave 1/16-inch (1.5-mm) gap between countertop and splash for filling with sealant. Use temporary shims to ensure uniform spacing.

D. Install countertops to comply with requirements indicated on Drawings and Shop Drawings. Install anchors, supports, fasteners, adhesives, and other attachments indicated or necessary to secure countertops in place. Shim and adjust anchors, supports, and accessories to install countertops in locations indicated with uniform joints of widths indicated and with edges and faces aligned according to established relationships and indicated tolerances.

3.04 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.

B. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/16 inch in 48 inches (1.5 mm in 1200 mm).

C. Variation from Level: Do not exceed 1/8 inch in 96 inches (3 mm in 2400 mm), 1/4 inch (6 mm) maximum.

D. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.

E. Field Joints: 1/8 inch wide, maximum.

F. Remove and replace stone countertops of the following description:
   1. Broken, chipped, stained, or otherwise damaged stone.
   2. Defective joints, including misaligned joints.

3.05 CLEANING

A. Clean countertops surfaces thoroughly.

B. Sealer Application: Apply stone sealer to comply with stone producer's and sealer manufacturer's written instructions.

3.06 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

C. Before inspection for Substantial Completion, remove protective covering and clean surfaces.

3.07 SCHEDULE - SEE FINISH SCHEDULES

END OF SECTION

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SECTION 12 48 13
ENTRANCE FLOOR MATS AND FRAMES

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 SECTION INCLUDES

A. Entrance mat system consisting of grille and recessed frame inserts set in an aluminum profile with spacers, allowing for pass-thru of dirt and debris.

1.03 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Substrate to receive entrance mats.

1.04 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

1.05 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, recessed frame characteristics, and methods of installation with substrate preparation for each type of substrate.

C. Shop Drawings: Indicate dimensions and details for recessed frame.
   1. For recessed frames located within a dimensionally restricted area, show dimensions of space within which the frame will be installed.

D. Samples: Submit two samples, aproximately 6 by 6 inch in size illustrating pattern, color, finish, insert material, and edging. Minimum 2 segments of entrance mat strips.

E. Cleaning & Maintenance Data: Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section, with not less than 10 years of documented experience.

B. Installer Qualifications: Company specializing in installation of products specified in this Section with not less than 5 years of documented experience with system of similar size, type, and complexity.

C. Source Quality Control: Obtain grating, perimeter framing, and installation hardware from a single manufacturer.

D. Install in accordance with ASTM F710 for floor flatness rating of FF 35.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original, unopened packaging, with labels intact to identify each component.

B. Handle and store materials in accordance with manufacturer's written requirements to provide a fully warranted installation.

1.08 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Ambient Conditions: Do not install matting until substantial completion of project. Do not install perimeter framing until installation areas are enclosed and weatherproof. HVAC system must be operational and maintaining temperature at 65°-75°F (18°-24°C) for at least 72 hours prior to installation.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer's non-depreciating warranty, for interior entrance mats and frames for time period: 2 years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Entrance Floor Grilles and Gratings:
   1. Construction Specialties, Inc; Pedigrid G1: www.c-sgroup.com. (Basis of Design)
   2. Mats Inc.: www.matsinc.com.
   3. Nystrom, Inc: www.nystrom.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Aluminum: ASTM B221, alloy 6105-T5 for rail extrusions and 6061-T6 for key lock bars.

2.03 ENTRANCE FLOOR GRILLES AND GRATINGS

A. Floor Grid:
   1. G1 Pedigrid: Extruded 6105-T5 aluminum alloy tread rails joined mechanically by extruded 6106-T6 aluminum alloy key lock bars. (welding or bolting shall not be permitted.)
   2. Finish: Mill, anodized.
      a. Mill finish frames in contact with wet concrete to be primer coated.

B. Grid Frame:
   1. LB - Level Base Frame: 6063-T5 aluminum alloy with 1/2 inch exposed surface and a depth of 1-13/16 inches. These assemblies receive 1/4 inch thick heavy gauge TPE support cushions 1 inch long mounted to each continuous foot at 20 inches on center.
   2. Finish: Mill, anodized.
      a. Mill finish frames in contact with wet concrete to be primer coated.

C. Tread Insert:
   1. HD – MonoTuft HD™ Carpet shall meet CRI standard for good indoor air quality. Fibers shall include a minimum of 100, 12 mil monofilament fibers per square inch. Each carpet fiber and monofilament shall be fusion-bonded to a rigid two-ply backing to prevent fraying and supplied in continuous splice-free lengths. Anti-static carpet fibers shall contain antimicrobial additive and be treated with Scotchgard® to reduce soiling. Carpet weight shall be 33-oz./yd².
   2. Color: As indicated on Drawings.

D. Mounting: Top of non-resilient members level with adjacent floor.

E. Structural Capacity: Capable of supporting a rolling load of 500 pounds without permanent deformation or noticeable deflection.

F. Vibration Resistant Fabrication: All members welded, riveted, or bolted; no snap or friction connections.

G. Exposed hinge rail connectors shall be vinyl hinge only complete with perforations for drainage. Tread rails shall be manufactured from aluminum, complete with co-extruded soft-durometer cushions, supplied in mill finish.

2.04 ACCESSORIES

A. Drain Pan.

2.05 FABRICATION

A. Construct recessed mat frames square, tight joints at corners, rigid. Coat surfaces with protective coating where in contact with cementitious materials.

B. Fabricate mats in single unit sizes; fabricate multiple mats where indicated on Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that floor opening and substrates for mats are ready to receive work.

B. Do not proceed with installation until unsatisfactory conditions are corrected.

C. Sub floor shall be clean and dry, and comply with floor flatness tolerances.

3.02 PREPARATION

A. Coordinate with Division 03 Section for concrete slabs to receive recessed entrance matts and frames.

B. Mats: Verify size of floor recess before fabricating mats.

C. Vacuum clean floor recess.

3.03 INSTALLATION

A. Acclimate materials to building conditions for at least 24 hours prior to installation.

B. Install frames to achieve flush plane with finished floor surface.

C. Install walk-off surface in floor recess flush with finish floor after cleaning of finish flooring.
   1. Defer installation of matting until Substantial Completion.

D. Coordinate finished height of mat and frame with surrounding floor surfaces. Provide adequate clearance for swinging doors.

3.04 TOLERANCES

A. Maximum Gap Formed at Recessed Frame From Mat Size: 1/8 inch.

3.05 PROTECTION

A. General Cleaning: Refer to Manufacturer’s Cleaning and Maintenance Instructions

B. After completing required frame installation and concrete work, provide temporary filler of plywood or fiberboard in recess, and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and project is near time of Substantial Completion.

C. Protect installed matting and frame from damage by other trades. Use materials that will not mark, stain, or leave residue on the product.
   1. Defer installation of matting until Substantial Completion.

END OF SECTION

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SECTION 12 93 13
BICYCLE RACKS

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 SECTION INCLUDES

A. Indoor bicycle storage system.

B. Bicycle repair and maintenance station.

1.03 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Mounting surface for bicycle racks.

B. Section 04 20 00 - Unit Masonry: Mounting surface for bicycle racks.

C. Section 32 33 13 - Site Bicycle Racks: Outdoor bicycle storage racks.

D. Section 32 33 14 - Site Bicycle Lockers: Outside bicysle storage lockers.

1.04 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

B. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.

1.05 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.

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.

1.06 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 MANUFACTURERS

A. Indoor Bicycle Racks:
   1. Dero; Dero Duplex: www.dero.com
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Repair and maintenance station
   1. Dero; Fixit: www.dero.com
   2. Parl Tools; Single Arm Professional Work Stand: www.parktool.com
   3. Saris Cycling Group; Cycle Aid Station: www.sarisparking.com. (Basis of Design)
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 BICYCLE RACKS AND ACCESSORIES

A. 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. Style: Indoor, wall mounted, floor mounted, and freestanding, two level, horizontal storage rack with fixed arms and locking loops.
2. Style: Custom configuration as indicated on drawings.
3. Style: Dero Duplex; Stretch Rack, Locking.
4. Capacity: Number of and location ofbicycles in configuration shown on drawings.
5. Finish: Powder coat, maintenance-free and weather-resistant.
6. Color: Black.

B. Materials:
1. Bar, Round and Flat, Carbon Steel: ASTM A36/A36M.
a. 11 gauge steel frame.
2. Locking bar: 3/8 in zinc coated solid steel.

2.03 REPAIR AND MAINTENANCE STATION

A. Product Details
1. Universal bike mounting – hang by seat or tube.
2. Eight common bicycle tools tethered by stainless steel aircraft cable.
3. Unique I-beam design eliminates possibility of locking a bike to the station.
4. ADA-compliant design.
5. QR code link to maintenance instructions for viewing from smart phone.

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 and approved shop drawings.

B. Install bicycle racks and accessories level, plumb, square, and correctly located as indicated on drawings.

C. Post-Installed Anchors: Comply with ICC-ES AC308.

D. Surface Flange Installation: Anchor bicycle racks and accessories securely in place with 1/2 inch by 4 inch anchor bolts through flange holes.

E. Freestanding installation: Place in location indicated on drawings.

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 14 21 00
ELECTRIC TRACTION ELEVATORS

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 SECTION INCLUDES

A. Electric traction elevator systems.

B. Maintenance contract.

1.03 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Includes elevator machine foundation, enclosed hoistway, elevator pit, grouting thresholds, and grouting hoistway entrance frames.

B. Section 04 20 00 - Unit Masonry: Masonry hoistway enclosure; building-in and grouting hoistway door frames.

C. Section 05 12 00 - Structural Steel Framing: Includes divider beams and overhead hoist beams.

D. Section 05 50 00 - Metal Fabrications: Includes sill supports and miscellaneous metals inside the pit and hoistway, including but not limited to guide rails and sump pit covers.

E. Section 05 51 33 - Metal Ladders: Includes elevator pit ladder.

F. Section 07 13 00-Sheet Waterproofing: Waterproofing of elevator pit walls and foundation.

G. Section 07 16 16 - Crystalline Waterproofing: Waterproofing admixture in elevator pit walls, slab, footings, and sump pits.

H. Section 07 81 00 - Applied Fire Protection: Fireproofing of guide rail brackets where attached to building structural members.

I. Section 07 84 00 - Firestopping: Fire rated sealant in hoistway.

J. Section 08 31 00 - Access Doors and Panels: Fire rated access doors into hoistway.

K. Section 09 30 00 - Tiling: Floor finish in car.

L. Division 21 - Fire Suppression: Sprinkler heads in hoistway.

M. Division 22 - Plumbing: Sump and piping for submersible pump in elevator pit.

N. Division 23 - Heating, Ventilating, and Air-Conditioning (HVAC): Ventilation and temperature control of elevator equipment room.

O. Division 26 - Electrical: Conduit for electrical systems, wiring, and other electrical components.

P. Division 27 - Communications: Interface with Low Voltage System, including but not limited to wireless, data, telephone, and security controls.

Q. Division 28 - Electronic Safety and Security: Fire alarm, smoke detecturs, and fire sprinkler systems.

1.04 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.

B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

C. ADA Standards - 2010 ADA Standards for Accessible Design.

D. AISC 360 - Specification for Structural Steel Buildings.

E. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.

F. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

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.

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, Dumbwaiters, and Material Lifts.

I. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

J. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

K. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

L. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.

M. AWS D1.1/D1.1M - Structural Welding Code - Steel.

N. ITS (DIR) - Directory of Listed Products.

O. NEMA MG 00001 - Motors and Generators.

P. NFPA 13 - Standard for the Installation of Sprinkler Systems.

Q. NFPA 70 - National Electrical Code.

R. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.

S. UL (DIR) - Online Certifications Directory.

1.05 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. Remote group automatic panel from controller cabinet.
      c. Telephone service for machine room.
      d. Elevator pit for lighting, sump pump, and low voltage.
      e. Automatic transfer switch from controller cabinet.
      f. Fire alarm panel from controller cabinet.

B. Preinstallation Meeting: Convene meeting at least one week prior to start of this work.
   1. Review schedule of installation, proper procedures and conditions, and coordination with related work.

C. Construction Use of Elevator: Not permitted.

1.06 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. Individual weight of principal components; load reaction at points of support.
5. Loads on hoisting beams.
6. Clearances and over-travel of car and counterweight.
7. Locations in hoistway and machine room of traveling cables and connections for car lighting, telephone, and low voltage.
8. Location and sizes of hoistway and car doors and frames.
9. Applicable seismic design data; certified by a licensed Professional Structural Engineer.
10. Interface with building security system.
11. Electrical characteristics and connection requirements.
12. Indicate arrangement of elevator equipment and allow for clear passage of equipment through access openings.

D. Initial maintenance contract.

E. Maintenance Contract: Submit proposal to Owner for standard one year continuing maintenance contract agreement in accordance with ASME A17.1 and requirements as indicated, starting on date initial maintenance contract is scheduled to expire.
1. Indicate in proposal the services, obligations, conditions, and terms for agreement period and for renewal options.

F. 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.

G. Specimen warranty.

H. Executed warranty.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum ten years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

C. Products Requiring Fire Resistance Rating: Listed and classified by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.

D. Products Requiring Electrical Connection: Listed and classified by UL (DIR) or testing agency acceptable to authorities having jurisdiction as suitable for the purpose indicated in construction documents.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 1-year manufacturer warranty for elevator operating equipment and devices. Complete forms in Owner's name and register with manufacturer.

C. Provide manufacturer's warranty for elevator operating equipment and devices for one year from Date of Substantial Completion.
1. Provide and coordinate warranty provisions with Maintenance Agreement period identified in Part 3. Service is to be provided at no additional cost to the Owner.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Electric Traction Elevators:
1. Fujitec America: www.fujitecamerica.com.
2. KONE; KONE MonoSpace 500 DX: www.kone.us.
3. Otis Elevator Company; Gen3 Peak: www.otis.com.
4. Schindler Elevator Corporation: www.us.schindler.com.

5. TK Elevator; Evolution 200: www.tkelevator.com.

B. Substitutions: See Section 01 60 00 - Product Requirements.
   1. For any product not identified as Basis of Design, submit information as specified for substitutions.

C. Products other than Basis of Design are subject to compliance with specified requirements and prior approval of Architect. By using products other than Basis of Design, the Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

D. Source Limitations: Provide elevator and associated equipment and components produced by the same manufacturer as the other elevator equipment used for this project and obtained from a single supplier.

2.02 ELECTRIC TRACTION ELEVATORS

A. Electric Traction Passenger Elevator, No. EEL-1A and EEL-1B:
   1. Electric Traction Elevator Equipment: Gearless traction elevator with Machine Room-less application.
   2. Drive System:
      a. Regenerative.
   3. Operation Control Type:
      a. Two-Car Selective Collective Automatic (Duplex Collective Automatic) Operation Control.
   4. Service Control Type: Provide standard service control for elevators.
   5. Interior Car Height: (9 feet) 108 inches clear ceiling height.
   6. Electrical Power: 480 volts; alternating current (AC); three phase; 120 Hz.
   7. Rated Net Capacity: 4000 pounds.
   8. Rated Speed: 200 feet per minute.
   9. Hoistway Size: As indicated on Drawings.
   10. Interior Car Platform Size: As indicated on Drawings.
   11. Elevator Pit Depth: 66 inch.
   12. Overhead Clearance at Top Floor: As indicated on Drawings.
   13. Travel Distance: As indicated on Drawings.
   14. Number of Stops: As indicated on Drawings.
   15. Number of Openings: 6 Front; 0 Rear.
   16. Traction Machine Location: N/A - Machine Room-less with Integral Control Solution.

B. Electric Traction Passenger Elevator, No. EL-1A, EL-1B, and EL-1C:
   1. Electric Traction Elevator Equipment: Gearless traction elevator with Machine Room-less application.
   2. Drive System:
      a. Regenerative.
   3. Operation Control Type:
      a. Selective Collective Automatic Operation Control.
   4. Service Control Type: Provide standard service control for elevators.
   5. Interior Car Height: (9 feet) 108 inches clear ceiling height.
   6. Electrical Power: 480 volts; alternating current (AC); three phase; 120 Hz.
   7. Rated Net Capacity: 4000 pounds.
   8. Rated Speed: 200 feet per minute.
   9. Hoistway Size: As indicated on Drawings.
   10. Interior Car Platform Size: As indicated on Drawings.
   11. Elevator Pit Depth: 66 inch.
   12. Overhead Clearance at Top Floor: As indicated on Drawings.
   13. Travel Distance: As indicated on Drawings.
   14. Number of Stops: As indicated on Drawings.
   15. Number of Openings: 7 Front; 0 Rear.
   16. Traction Machine Location: N/A - Machine Room-less with Integral Control Solution.

C. Electric Traction Passenger Elevator, No. WEL-1A:

1. Electric Traction Elevator Equipment: Gearless traction elevator with Machine Room application and Separate Controls Closet.
2. Drive System:
    a. Regenerative.
3. Operation Control Type:
    a. Single Automatic (Push Button) Operation Control.
4. Service Control Type: Provide standard service control for elevators, in addition to the following.
    a. Restricted Access service control.
5. Interior Car Height: 96 inch.
6. Electrical Power: 480 volts; alternating current (AC); three phase; 120 Hz.
7. Rated Net Capacity: 3500 pounds.
8. Rated Speed: 200 feet per minute.
9. Hoistway Size: As indicated on Drawings.
10. Interior Car Platform Size: As indicated on Drawings.
11. Elevator Pit Depth: 66 inch.
12. Overhead Clearance at Top Floor: 15'-9".
13. Travel Distance: As indicated on Drawings.
14. Number of Stops: As indicated on Drawings.
15. Number of Openings: 6 Front; 0 Rear.
16. Traction Machine Location: N/A - Machine Room-less with Integral Control Solution.

2.03 COMPONENTS

A. Elevator Equipment:
    1. Motors, Controllers, Controls, Buttons, Wiring, Devices, and Indicators: Comply with NFPA 70 requirements, and refer to Division 26 Sections 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.
        b. Oil type for elevators with speed greater than 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. Sump Pump in Pit: Refer to Plumbing Drawings.
    3. Spare Conductors: Provide ten percent in extra conductors and two pairs of shielded audio cables in traveling cables.

C. Low Voltage Equipment:
    1. Boxes, Conduit, Wiring, and Devices: Complying with NFPA 70 and in accordance with Division 26 Sections.
    2. Include wiring and connections to elevator devices remote from hoistway and between elevator machine room. Coordiante with Division 27 - Communication.

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.
   a. Project Seismic Risk: As indicated on Drawings.
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. Conform to fire protection sprinkler system of hoistway design in accordance with NFPA 13 requirements and authorities having jurisdiction.

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. Mount panel in console as indicated on Drawings.
3. Coordinate size and style of panel with console manufacturer.
4. Etch face plate markings in panel, and fill with paint of contrasting color.
5. Include direction indicator displaying landing "Up" and "Down" calls registered at each landing floor.
6. 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.
7. 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).
1. Designated Landing: Main Lobby.

2.06 OPERATION CONTROL TYPE

A. Single Automatic (Push Button) Operation Control: Applies to car in single elevator shaft.
1. Refer to description provided in ASME A17.1.
2. Set system operation so that momentary pressure of landing button dispatches car from other landing to that landing.
3. Allow call registered by momentary pressure of landing button at any time to remain registered until car stops in response to that landing call.
4. If elevator car door is not opened within predetermined period of time after car has stopped at terminal landing, allow car to respond to call registered from other landing.

B. 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 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.

C. Two-Car Selective Collective Automatic (Duplex Collective Automatic) Operation Control: Applies to cars in two elevator shafts.
1. Park one car at main floor and designate other as free car at landing last served or at a predetermined upper floor landing.
2. Arrange free car to answer landing calls either above or below landing where car is standing except main floor and basement landing calls.
3. When free car is answering calls, automatically start an alternate car to answer landing calls under any of the following conditions:
   a. Registration of up calls from landings below the free car while it is traveling up by alternate car below.
   b. Registration of up or down calls from landings above the free car while it is traveling down by alternate car.
   c. Free car fails to clear registered landing calls within 40 seconds or to move alternate car in response to registered landing calls within this time frame.
4. Register and answer calls by momentary pressure on one or more car buttons; cause car to respond.
5. Once started, either in response to car button calls or to landing button calls, respond to calls registered for the direction of the traveling car in the order that landings are reached, regardless of sequence that calls were registered.
6. Allow only one car to stop in response to any one landing call.
7. Return first free car to main floor after answering landing calls.
8. Should both cars finish their calls at main floor, designate one car as the free car.
9. If no car buttons are pressed and car starts up in response to several landing down calls, proceed first to the highest landing down call, then reverse to collect other landing down calls. Collect up calls similarly when car starts down in response to such calls.
10. If a car stops for a landing call, and car button matching direction the car was traveling is pressed within a predetermined time interval after a landing stop, proceed in the same direction regardless of other landing calls that are registered.
11. If down landing buttons are pressed while car is traveling up, do not stop at those landings, but allow those calls to remain registered for answering by the next down traveling car.
12. After the highest car has responded to up landing calls, reverse car automatically, and respond to down landing calls.
13. When traveling down, a car will not respond to up calls. Allow those up calls to remain registered to be answered by next available car on an up trip.
14. Include a time delay to hold car for an adjustable time interval at landings where stops are made to enable passengers to enter or leave the car. Cancel the time interval upon registration of a car call or pressure on the car door close button.
15. Permit a registered car call to establish the direction of travel when a car has answered the farthest car call, even if other landing calls are registered.
16. Answer calls to the basement landing with the car that is normally parked at the main floor unless the free car is at the basement.
17. If a car is removed from service, the other car shall answer landing calls.

2.07 EMERGENCY POWER

A. Set-up elevator operation to run with building emergency power supply when the normal building power supply fails, and in compliance with ASME A17.1 requirements.

B. Building Emergency Power Supply: Supplied by backup generator; provide elevator system components as required for emergency power characteristics with phase rotation the same as for normal power.
   1. Provide transfer switches and auxiliary contacts.
   2. Install connections to power feeders.

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. After the transfer of emergency power and advancement of elevators to landings have completed one cycle, operate one preselected elevator in normal operation using the emergency power supply.
   1. If the preselected car fails to operate, automatically select another car to operate.
   2. Provide manual switch to override the automatic selection process.

2.08 MATERIALS

A. Stainless Steel Sheet: ASTM A666/A666M, Type 304; No. 4 Brushed finish unless otherwise indicated.

B. Extruded Aluminum: ASTM B221 (ASTM B221M), natural anodized finish unless otherwise indicated.

C. 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.

D. Tile Flooring: As indicated on Drawings and installed per TCNA method.

2.09 CAR AND HOISTWAY ENTRANCES

A. Elevator, No. EEL-1A, EEL-1B:
   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: Center opening, single speed.
      h. Door Width: 48 inch.
      i. Door Height: As indicated on Drawings.
      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: Brushed stainless steel.
      d. Car Door Material: To match hoistway entrance doors, with rigid sandwich panel construction.
      e. Hoistway Door Material: To match cab entrance doors, with rigid sandwich panel construction.
      f. Door Type: Double leaf.
      g. Door Operation: Center opening, single speed.
      h. Door Width: 48 inch.
      i. Door Height: As indicated on Drawings.
      j. Sills: Extruded aluminum.

B. Elevator, No. EL-1A, EL-1B, EL-1C:
   1. Car and Hoistway Entrances, Each Elevator Floor Lobby:
      a. Hoistway Fire Rating: As indicated on Drawings.
      b. Elevator Door Fire Rating: As indicated on Drawings.
      c. Framed Opening Finish and Material: Baked enamel on steel 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: As indicated on Drawings.
i. Door Height: As indicated on Drawings.
j. Sills: Extruded aluminum.

C. Elevator, No. WEL-1A:
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: As indicated on Drawings.
i. Door Height: As indicated on Drawings.
j. Sills: Extruded aluminum.
2. Car and Hoistway Entrances, Upper Floor Elevator Lobbies:
a. Framed Opening Finish and Material: Brushed stainless steel.
b. Car Door Material: To match hoistway entrance doors, with rigid sandwich panel construction.
c. Hoistway Door Material: To match cab entrance doors, with rigid sandwich panel construction.
d. Door Type: Double leaf.
e. Door Operation: Side opening, two speed.
f. Door Width: As indicated on Drawings.
g. Door Height: As indicated on Drawings.
h. Sills: Extruded aluminum.

D. Sills/Thresholds: Configure to align with frame return and coordinate with floor finish.

E. Noise and Vibration Control:
1. Airborne Noise: Measured noise level of elevator equipment and its operation shall not exceed 60 dBA inside car under any condition including door operation and car ventilation exhaust blower on its highest speed. Limit noise level in the control space relating to elevator equipment and its operation to no more than 80 dBA. All dBA readings to be taken 3'-0" off the floor and 3'-0" from the equipment using the “A” weighted scale.
2. Vibration Control: All elevator equipment shall be mechanically isolated from the building structure and other components to minimize the possibility of objectionable noise and vibrations being transmitted to occupied areas of the building.
3. Gasketing: Provide acoustic type gasketing at hoistway doors and frames to minimize audible noise due to car activities in the hoistway, and air pressure differential between hoistway and landing floors.

2.10 CAR EQUIPMENT AND MATERIALS

A. Elevator Car, No. EEL-1A, EEL-1B, EL-1A, EL-1B, EL-1C, WEL-1A:
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: Stainless steel; 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 matching service cabinet integral with front return panel, with hinged door and keyed lock in each car.
e. Provide following within service cabinet as part of car operating panel:
1) Switch for each auxiliary operational control.

2) Switches for fan, light, and inspection control.
3) Emergency light.
4) Telephone cabinet and hard-wired connection with telephone.
5) Control for each other special feature specified.
6) Convenience outlet receptacle; 110 VAC, 15 amps.

f. Coordinate with Owner's low voltage access control system.

2. Ventilation: Single-speed fan with grille in ceiling.
3. Wall Base (Skirting): , Recessed stainless steel, 4 inch high, .
   a. Stainless Steel Finish: No. 4 Brushed, Grade 441.
4. Front Return Panel: Stainless steel, .
5. Door Wall: Stainless steel, .
6. Side Walls: Stainless steel, .
7. Rear Wall: Stainless steel, vertical panel orientation, .
8. Reveal Strips: Stainless Steel Finish: No. 4 Brushed, Grade 441.
9. Ceiling:
   a. Canopy Ceiling: Stainless steel.
   b. Lighting: 9 light LED.
10. Signalization: ; Left or right to match lobby layout.
11. Provide emergency access panel for egress from car at ceiling.
12. Provide Vandal-resistant fixtures.

B. Car Accessories: Provide and install in each car.
   1. Certificate Frame: Stainless steel frame glazed with clear tempered glass, and attached with tamper-proof screws.
   2. Protective Pads: Heavy-Duty 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: Grey.
      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.
   1. Standard Polyester Powder Finish: Two-coat powder coating system, including zinc rich powder primer followed by a Standard Polyester powder complying with AAMA 2603 and containing 100 percent standard polyester resin. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

B. Baked Enamel on Steel: Clean and degrease metal surface; apply one coat of primer sprayed and baked; two coats of enamel sprayed and baked.

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 for additional requirements.

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, motors, and other equipment as required by elevator manufacturer for this seismic region, 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. Bolt brackets to inserts placed in concrete form work.

I. Install hoistway door sills, frames, and headers in hoistway walls; grout sills in place, set hoistway floor entrances in alignment with car openings, and align plumb with hoistway.

J. Fill hoistway door frames solid with grout; see Section 04 20 00 for additional information.

K. Structural Metal Surfaces: Clean surfaces of rust, oil, or grease; wipe clean with solvent; prime with two coats.

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. Operational Tests:
   1. Perform operational tests in the presence of Owner.
   2. Test each elevator system by transporting at least 4 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.
   4. Set period of time elevator takes to travel between typical floor landings at not more than the number of seconds commensurate with elevator speed rating.
      a. Measure time from moment doors start to close until car has stopped level at next floor landing and doors are opening.

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 closeout submittals.

B. See Section 01 79 00 - Demonstration and Training for additional requirements.

C. Demonstrate proper operation of equipment to Owner's designated representative.

D. Demonstration: Demonstrate operation of system to Owner's personnel.
   1. Use operation and maintenance data as reference during demonstration.
   2. Conduct walking tour of project.
   3. Briefly describe function, operation, cleaning, and maintenance of each component.

E. Training: Train Owner's personnel on cleaning and operation 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 training personnel.
   4. Location: At project site, unless otherwise indicated.

3.09 PROTECTION

A. Do not permit construction traffic within car after cleaning.

B. Protect installed products until Date of Substantial Completion.

C. Touch up, repair, or replace damaged products and materials before Date of Substantial Completion.

3.10 MAINTENANCE

A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements relating to initial maintenance service.

B. Provide Initial Maintenance Contract of elevator system and components in accordance with ASME A17.1 and requirements as indicated for twelve months from Date of Substantial Completion.

C. Submit proposal for continuation of Maintenance Contract in accordance with ASME A17.1 and requirements as indicated for installed elevator equipment.

D. Maintenance contract services shall not be assigned or transferred to any agent or other entity without prior written consent of Owner.

E. Examine system components as appropriate for the system specified and for the component rating.

F. Include systematic examination, adjustment, and lubrication of elevator equipment.

G. Maintain and repair or replace parts whenever required using parts produced by original equipment manufacturer.

H. Replace wire ropes when necessary to maintain the required factor of safety.

I. Perform work without removing cars from use during peak traffic periods.

J. Provide emergency call back service for 24 hours a day/7 days a week throughout period of this maintenance contract.

END OF SECTION

SECTION 14 91 00
FACILITY CHUTES

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 SECTION INCLUDES

A. Trash chutes.

B. Chute maintenance.

1.03 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Support frames attached to the Work of this Section.

B. Section 07 21 00 - Thermal Insulation: Insulation between chute and enclosure.

C. Section 07 54 23 - Thermoplastic-Polyolefin (TPO) Membrane Roofing: and roofing flashing at chute roof vent.

D. Section 07 62 00 - Sheet Metal Flashing and Trim: Counterflashing at chute roof vent.

E. Section 11 82 26 - Facility Waste Compactors: Compactors and chute interlock controls.

F. Division 21 Section for building fire sprinklers and piping inside chute.

G. Division 22 Sections for plumbing connections:
   1. Water piping connections to spray cleaning equipment.
   2. Connection of hopper discharge drain to sanitary drain.

H. Division 26 Sections for electrical-service connections:
   1. Connection of control panels to 110 VAC electrical power.
   2. Wiring and conduit between control panels and controlled components.
   3. Wiring and conduit between discharge room spray cleaning switch and flushing spray head.

1.04 PRICE AND PAYMENT PROCEDURES

A. Alternates:
   1. See Section 01 23 00 - Alternates for product alternates affecting this section.
   2. This section includes base bid and alternate item(s).
      a. Chute Construction:
         1) Base Bid: Sheet metal thickness;16 gauge, 0.06 inch.
         2) Alternate: Sheet metal thickness; 14 gauge, 0.075 inch.
      b. Sound Isolation:
         1) Base Bid: Blown insulation between chute and enclosure.
         2) Alternate: Factory applied sprayed-on sound-dampening material.

1.05 REFERENCE STANDARDS

A. ITS (DIR) - Directory of Listed Products.

B. NFPA 13 - Standard for the Installation of Sprinkler Systems.

C. NFPA 70 - National Electrical Code.

D. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.

E. NFPA 82 - Standard on Incinerators and Waste and Linen Handling Systems and Equipment.

F. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

G. UL (DIR) - Online Certifications Directory.

H. UL 10B - Standard for Fire Tests of Door Assemblies.

1.06 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene seven days before start of installation to review local building code requirements, manufacturer's recommendations, and related work.

1.07 SUBMITTALS

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.

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.

D. Test Reports: Submit for each test/inspection.

E. Certificates: Certify that chute assembly meets or exceeds NFPA 82 and other specified requirements.

F. Maintenance Contract.

G. Operation and Maintenance Data: Manufacturer's operation instructions.
   1. Include control wiring diagrams.

H. Maintenance Materials: Provide the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements for additional provisions.

1.08 QUALITY ASSURANCE

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

B. Products Requiring Electrical Connection: Listed and classified by UL (DIR), ITS (DIR), or testing agency acceptable to authorities having jurisdiction as suitable for indicated purpose being specified.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.
   1. With similar installations having satisfactory service for at least one year.
   2. With a full time service organization maintained or trained by manufacturer, and providing service within 12 hours of receiving notice that service is required.

D. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

E. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated.
   1. Test Pressure: Test at atmospheric (neutral) pressure according to NFPA 252 or UL 10B.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional requirements.

B. Include written instructions for all preventative maintenance and service requirements necessary to maintain Warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Facility Chutes:
   1. CHUTES International: www.chutes.com.
   2. Valiant Products, Inc: www.valiantproductsinc.com.
   3. Wilkinson Hi-Rise: www.whrise.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FACILITY CHUTES

A. Waste Materials and Recyclables 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; complying with requirements of NFPA 82, and the local building code and authorities having jurisdiction.
   1. Chute Diameter: 30 inches inside.
   2. Intake Door Size: 15 inch wide by 18 inch high, nominal.
   3. Intake Door Operator: Lever handle that unlatches and opens door, meeting accessibility requirements.
      a. Locate highest component used for door operation lower than 48 inches above finished floor.
      b. Provide latch handle with shape that is easy to grasp with one hand, does not require tight grasping or pinching, or twisting of wrist to operate.
      c. Highest portion of door operation controls shall be lower than 48" above finished floor.
      d. Latch handle style shall have a shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist to operate.
   4. 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.
      d. Opening chute intake doors when compactor is not ready to accept additional trash is not permitted.
      e. Opening any intake door when compactor is operating.
   5. Provide recycling material selection controls.
   6. 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. Sheet Metal Thickness: 16 gauge, 0.06 inch.
      a. Provide Bid Alternate for 14 gage, 0.075 inch.
   2. Fire Rating: In compliance with local building code requirements.
   3. Throat Sections: Provide sloped throat sections for chute intake doors, of same material and construction as chute.
   4. Fabricate 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. Isolator Pad: Equivalent to 1/4-inch top and bottom waffle design, oil resistant, neoprene with 3/8 inch close grained cork core.
      c. Provide floor retainer flange at base of chute.
   5. Horizontal Outlets: Provide painted steel leg braces to floor to withstand impact of material on bottom of chute.

B. Chute Intake Doors: Factory-assembled, UL (DIR) listed and labeled door and frame, with self- or automatic-closing and positive latching; frame designed for chase construction, and flush-mounted.
   1. Material: Stainless steel, brushed or satin finish.
   2. Fire Rating: As indicated on Drawings.
   3. Pneumatic Intake Door opens to the FULL-OPEN position.
      a. Door shall remain open typically for 10 seconds or any other time selected.
      b. Door then closes automatically releasing the pneumatic interlock valve.

c. Air Regulator/Dump Valve Control System: Control system with air regulator and manual dump valve to de-energize chute intake doors during shut-down hours and/or service operations, including manual override switch to bypass interlock system.

4. Fully Pneumatic Interlocks: Interlock system that is energized by opening one intake door; interlock valve shuts off air pressure to the remaining doors automatically locking them out until the door in use closes.
5. Pulls: Door Hardware must be operable without pinching or twisting and cannot be two action; polished stainless steel.
6. Signs: Provide markings on frame or face of door that indicates purpose of chute; use engravings, integral raised lettering, or other permanent notation markings.

C. Chute Discharge Doors: Factory-assembled, UL (DIR) listed and labeled door and frame, with self- or automatic-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: In compliance with local building code requirements.
3. Horizontal Discharge Style: Top-hinged, drop-down, self-latching, in horizontal housing with 2-inch NPS piped drain connection in bottom.

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.
1. Chute Intake Doors: Provide four keys for each door.
2. Chute Intake Doors: Provide magnetic interlock so that intake doors cannot be opened during compaction operation.
3. Chute Access Doors: Provide two keys for each door.

F. Through-Wall Chute Intake Door: Provide matching intake door at first floor level, for access to bin.

G. 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. Top Unit: Screened vent.

H. Fire Suppression Sprinklers: Comply with requirements of NFPA 82, NFPA 13, and all other applicable provisions of Division 21; 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.

I. Spray Cleaning Equipment: Manufactured by Ecolo.
1. Flushing Spray Unit: Solenoid controlled 3/4-inch NPS spray head mounted above top intake door. Refer to Division 22 for water piping connections and Division 26 for electrical wiring connections.
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.

J. 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.

K. Electrical Controls: 110 VAC. Refer to Division 26 for electrical wiring connections.

L. Factory-coat outside of chute with sprayed-on sound-dampening material.

M. Insulation: At floor retainer flange at base of shaft, provide Mineral wool insulation, minimum 6 inch thick, installed between chute and enclosure at discharge door level as fire stop.

2.04 FABRICATION

A. Factory fabricate chute sections with fully welded vertical seams, and locate sleeve inside each lower section without bolts, clips, or other projections to inside of chute that could snag on materials; spiral shaped sections within chute are not permitted.
   1. Provide prepositioned support clips to ensure proper intake levels.
   2. Provide expansion joint in chute between support joints.
   3. Reinforce discharge offsets, where allowed, with 11-gauge, 0.090-inch-thick aluminum sheet material at area of impact.

B. Vent: Matching diameter aluminum chute vent, 12 gauge, 0.080 inch-thick, and extending at least 48 inches above roof surface with aluminum hinged metal safety cap in accordance with NFPA 82.

C. Floor Frames: Corrosion resistant, industrial grade enamel painted, 1-1/2 by 1-1/2 by 3/16-inch thick steel angles.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that slab penetrations are sized properly at diameter of chute plus 4 inches, and are aligned, plumb, and clear of obstructions at chute location.

B. Verify that floor to floor and other applicable dimensions are in accordance with approved shop drawings.

3.02 INTERFACE WITH OTHER WORK

A. Complete installation and testing of facility chutes and equipment prior to completion of enclosing construction.

B. Ensure that sprinkler and spray cleaning devices are coordinated with size, location, and installation of related service utilities.

C. Schedule installation of components to ensure that utility connections are provided in an orderly and expeditious manner.

3.03 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 where indicated on Drawings.

D. Securely anchor chute components as required to withstand impact and weight of materials placed within chute.

E. Wrap chute and intake throats with insulation, securing without compressing insulation.

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.

3.04 FIELD QUALITY CONTROL

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

B. Notify Owner at least seven days prior to testing.

C. Place bagged material of expected size in chute to verify free fall.

D. 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.

3.05 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.

3.06 MAINTENANCE

A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements relating to maintenance service.

B. Provide a separate maintenance contract for specified maintenance service.

C. Provide service and maintenance of facility chute and equipment for one year from Date of Substantial Completion.

END OF SECTION

SECTION 26 05 00
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings, the provisions of the Contract including the General and Supplementary Conditions, and the General Requirements apply to the Work of this Section.

B. The following sections have been specifically referenced in this specification: General Conditions, Division 00, Division 01 and Division 26.

1.02 SCOPE

A. This Section covers basic electrical requirements for providing labor, materials, equipment, and services necessary for the proper completion of all electrical work as shown on the drawings and specified herein. Electrical work shall be complete with all documentation, wiring, conduit, fittings, equipment, and connections as hereinafter specified or required. In general, the work consists of labor, materials, equipment, and services for any of the following as indicated on the plan drawings and noted in these specifications:
   1. Power distribution system including switchgear, switchboards, panelboards, motor control centers, motor controllers, and equipment.
   2. Lighting system(s) including luminaires, lamps, mounting hardware, poles, bases, and lighting controls.
   3. Control system(s) including final design, drawings, control panels, equipment, instrumentation, devices, configuration, programming, and startup.
   4. Signal System(s) including final layout, drawings, and installation as required of the Phone/Data, Audio/Visual, Fire Alarm, and Security systems.

B. These electrical specifications are general in nature and contain descriptions and references to products, equipment, and/or devices that may not be applicable to this specific Project; therefore, the specifications, drawings, drawing notes, and contract documents shall be consulted to determine which product specifications are applicable.
   1. Where products are noted by direct reference in the original drawings, or added by reference in the Addenda or Revisions, and/or required as a result of the need to provide a complete system, these specifications shall be used to determine the product quality and installation requirements.
   2. Those equipment and installation requirements set forth by the product manufacturer, cited reference standards, and applicable Federal, State, and Local codes shall also be included as part of these specifications.
   3. The Project construction document set shall be comprised of the specifications, drawings, drawing notes, Addenda, and Revision releases and shall not be separated for purposes of bidding, submittals, installation, compliance testing, startup, or closeout work, since the installation and product performance requirements for any task, equipment, or system may be located in any or all portions of the Project construction document set. It is the responsibility of the Contractor to convey all of the pertinent bidding information to his Sub-Consultants, Sub-Contractors and Suppliers.

C. The omission of express reference to any items or work necessary for, or reasonably incidental to, a complete installation shall not be construed as releasing the Contractor from providing such items or work.

1.03 DEFINITIONS/ABBREVIATIONS

A. The terms listed below are defined as follows.
   1. Furnish: Obtain, coordinate, submit the necessary drawings, deliver to the job site in new condition and guarantee.
   2. Install: Receive at the job site, unload, store, set in place, connect, place in operation and guarantee.
   3. Provide: Furnish and install.
   4. Connect: Bring service to the equipment and make final attachment including necessary switches, outlets, connections, etc.

5. Conduit: Includes, in addition to conduit, all raceway types, fittings, pull boxes, hangers, and other supports and accessories related to such conduit.
6. Concealed: Hidden from sight in chases, furred spaces, shafts, hung ceilings, embedded in construction, in crawl spaces or buried.
7. Exposed: Not installed underground or concealed as defined above.
8. Remove/Demo: Disconnection of existing equipment and associated devices, conduit, wire, and support hardware for salvage, recycle, or disposal.
9. Relocate: Disconnection of existing equipment and associated devices, conduit, wire, and support hardware for re-installation of the existing equipment in alternate location. Work includes cleaning, repair, wiring, utilities, careful handling, structural supports, and mounting pads as needed to maintain the functionality of the equipment as operating in the original location.
10. Replace: Removal of existing equipment as defined above and installation of new equipment with enhanced features as noted and associated devices, conduit, structural supports, and mounting pads installed in approximately the same location as the original existing equipment.

B. Provide Electrical work that is finished work, tested and ready for operation.
1. Apparatus, appliances, material or work not indicated or any incidental accessories necessary to make the work complete and ready for operation, even though not specified nor shown on the drawings, are to be provided.
2. Should there be any discrepancies or a question of intent, refer the matter to the Engineer for decision before ordering equipment or materials and before starting any related work.
3. Where work connects to that of another trade, or to wiring or equipment in place, take measurements in the field to accomplish the connecting work and to line up with the item being connected.

C. Standards: These standards shall be used where referenced by the following abbreviations:

1.	ADA:	Americans with Disabilities Act
2.	AIA:	American Insurance Association
3.	AIA:	American Institute of Architects
4.	ANSI:	American National Standards Institute
5.	ASTM:	American Society of Testing and Materials
6.	AWG:	American Wire Gauge
7.	CSA:	Canadian Standards Association (Standard Council of Canada Certify)
8.	EPA:	Environmental Protection Agency
9.	ETL:	Intertek Electrical Testing Laboratories Listed Mark
10.	FM:	Factory Mutual Insurance Association
11.	IEEE:	Institute of Electrical and Electronic Engineers
12.	IES:	Illuminating Engineering Society of North America
13.	NBS:	National Bureau of Standards
14.	NECA:	National Electrical Contractors Association
15.	NEMA:	National Electrical Manufacturers Association
16.	NFPA:	National Fire Protection Association
17.	NEIS:	National Electrical Installation Standards
18.	NRTL	Nationally Recognized Testing Laboratory (UL, CSA, ETL)
19.	NSC:	National Safety Council
20.	OSHA:	Occupational Safety and Health Act
21.	TIA/EIA	Telecommunications Electronic Industry/Electronic Industry Association
22.	UL:	Underwriter's Laboratories, Inc.

1.04 SUBMITTALS

A. Bid. Provide the following with the bid documents.
1. None required for this Specification section.

B. Manufacture. Provide the following prior to release for manufacture and/or purchase.
1. Shop Drawings shall be submitted for approval for equipment listed in the Division 26 sections as requested.

2. Data sheets submitted to convey the specifications for a proposed product may be submitted, even if the sheet contains other unrelated products. However, the proposed product and its pertinent specifications must be outlined with red box(s) to clearly identify the proposed product. Unmarked or yellow highlighted sheets will not be permitted.
3. Wiring diagrams, intra and inter-system, shall be submitted for approval as requested.
4. Samples of equipment or system components shall be submitted for examination/approval as requested.
5. Test Reports. Reports shall be submitted outlining the results of factory testing in the respective equipment section.

C. Construction. Provide the following during construction.
1. Test Reports. Reports shall be submitted outlining the results of testing performed for the installed equipment as described in the applicable Specification section.
2. The Contractor shall supply all necessary information, receipts, testing, commissioning, manufacturer's test reports, or affidavits necessary to confirm compliance with LEED registration requirements.
3. Closeout. Provide the following to complete the project.
4. All Warranty information.
5. As-Built Drawings. Maintain red-line markups of all drawings on the job site, noting all changes made during construction. The markings shall be accurate, concise, legible, and organized for use by the Engineer for the Record drawings. Drawings not meeting these requirements may be rejected by the Engineer and returned to the Contractor for correction at no additional cost to the Owner. The As-Built drawings shall be available for inspection by the Engineer at any time to verify markups are clear and up to date. At completion of the project, this set of as-built drawings shall be submitted as described herein.
6. On Site Training. Provide copies of all required training session materials and DVDs of the training sessions used.
7. Operation and Maintenance Manuals. Provide record of on-site training, copies of manufacturer equipment operation and maintenance manuals, proposed maintenance schedules, recommended spare parts inventory, contact information for equipment repair replacement, and warranty certificates and information.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications. The equipment Manufacturer and/or Vendor shall be regularly engaged in the manufacture of equipment and provision of services of the types, capabilities, and capacities required, and Installer Qualifications. An employer of workers qualified and trained in electrical safety as required by NFPA 70E. All Work on each system complying with these Specifications shall be carried out and/or managed by a competent firm. The respective Contractor(s) shall be regularly engaged in the installation and testing of the system that is their responsibility. If requested, the Contractor shall furnish evidence of its qualifications to perform the Work specified. Evidence shall include major projects of similar scope and size for which the Contractor's directly employed crews performed the actual installation of the Project equipment, i.e., the major work was not sub contracted to another firm. This evidence shall include a list of names of contacts and phone numbers for each listed Project. Good workmanship shall be evidenced in the installation of all electrical materials and equipment. The latest edition of the National Electrical Contractors Association Installation and Maintenance Standards series are hereby identified to define such workmanship and the application of electrical equipment and materials. See the Standard Practice of Good Workmanship in Electrical Construction NECA 1 and Recommended Practice for Installing and Maintaining Temporary Electric Power at Construction Sites NECA 200.

B. Codes/Standards. Materials and workmanship shall comply with the most recently adopted applicable codes and standards. As a minimum, codes include: All State and Federal laws, local ordinances, utility company regulations and requirements and recommendations of the following:
1. State and Local Building codes
2. Life Safety Code
3. International Building Code

4. Energy Code (Current ASHRAE 90.1 – with State Amendments)
5. US Department of Energy
6. State Industrial Commission Regulations
7. State and Local Fire Codes and Regulations
8. International Fire Code
9. NFPA 70 National Electrical Code
10. State and Local Electrical Codes
11. NFPA 70E Standard for Electrical Safety in the Workplace
12. Occupational Safety and Health Administration Regulations
13. Federal and State Environmental Protection Agency
14. If these specifications with accompanying drawings are in any way at variance with these codes, the above cited codes shall govern and the Contractor shall make this installation accordingly, except where the drawings or specifications call for a higher quality of work than required by the Code.

C. Equipment Quality. Electrical products shall be ”Listed” or “Labeled” as defined in NFPA 70, Article 100, by a National Recognized Testing Laboratory acceptable to authorities having jurisdiction, and marked for the intended location and use. Any electrical products certified by the NRTL as only “Recognized” (and not listed or labeled) shall be noted and submitted to the Engineer for approval. This Submittal shall include general ratings of the equipment and specific ratings as it relates to the product being classified as “Recognized.” This Special submittal is intended to verify that the limited NRTL equipment rating is adequate for the electrical product to be applied in this Project.

1.06 PLAN INTERPRETATION

A. The plans are diagrammatic and indicate the arrangement of systems and equipment unless indicated otherwise by dimensions or detail plans. Refer to dimensioned plans for exact locations of building elements. However, field measurements take precedence over dimensioned plans. Report any differences discovered between electrical plans and the plans for other divisions. The installation of all systems and equipment is subject to clarification as indicated in reviewed shop drawings.

1.07 INSPECTION OF SITE BEFORE BIDDING

A. Before submitting a proposal on the work contemplated, bidder shall examine the site of the proposed work and thoroughly familiarize himself/herself with existing conditions and limitations affecting the performance of the work. No extra compensation will be allowed because of misunderstanding as to the amount of work involved or the bidder’s failure to verify existing conditions, which he could have discovered or reasonably anticipated prior to bidding. Contractor shall be responsible for any additional cutting, patching, mounting or installation modifications, etc., not called out on the drawings, but required for the successful completion of the job.

B. This includes any additional work required due to any existing jobsite condition (i.e., the construction of walls, ceiling spaces, clearances, available voltages, mounting requirements, existing equipment coordination, hazardous materials, etc.) that the Contractor had an opportunity to determine in the pre-bid walk-through and could have reasonably determined before the bid by visual inspection or by asking the Engineer or Owner. No additional money shall be awarded for additional work incurred caused by existing jobsite conditions that could have been verified by the Contractor prior to bid. In addition, no additional money shall be awarded for failure to properly coordinate with other trades.

PART 2 PRODUCTS

2.01 GENERAL INFORMATION

A. All materials and equipment shall be new unless otherwise specified in the drawings and associated notes. The type of equipment and/or material shall be approved for its planned use and environment and is so defined by NEMA/NFPA 70 standards and NRTL certifications

B. Materials and equipment shall be of current production by a manufacturer regularly engaged in the manufacture of such items from which replacement parts shall be available. When items are specified by manufacturer's name or catalog designation, it shall be understood that this is to

establish the class, features, quality rating, duty and, similar appearance in the case of visible building elements, such as lighting fixtures, service fittings, control panels, etc.

C. Specific material sizes, styles, functionality, and options shall be as described in the construction documents. Specification sections may contain sizes, styles, functionality, and options that are not required for the project.

2.02 ACCEPTABLE MANUFACTURERS.

Duly authorized distributors shall represent equipment and systems to be used on this project with service departments regularly engaged in the maintenance and installation of these systems and equipment. Such service departments shall regularly stock standard replacement parts and equipment and shall be located within a reasonable distance from the installation site.

2.03 APPROVAL/SUBSTITUTION OF MATERIALS

A. Refer to General conditions and Division 01 for approval requirements.

B. Refer to General conditions and Division 01 for substitution requirements.
   1. Where approved substitutes are used, the Contractor assumes responsibility for physical dimensions and other resulting changes. This responsibility extends to include extra work required by other trades as result of the substitution. Substituted equipment that requires additional costs by other trades in its application shall have such costs borne by the Contractor furnishing the equipment.
   2. The Contractor shall assume any costs associated with the replacement of a non-specified product, unapproved by the Engineer, with an as-specified product.

C. Equipment manufacturers, where indicated on construction documents (drawings and specifications), are the basis for design (size, weight, performance, layout, phase, voltage, current, etc.). The Contractor assumes responsibility for all required alterations to shown design conditions when providing equipment other than the design basis.

2.04 MATERIAL PROTECTION

Material and equipment shall be protected during shipment and storage against physical damage, dirt, moisture, cold, and rain. During installation, enclosures, equipment, controls, controllers, circuit protective devices, and other like items shall be protected against entry of foreign matter and be vacuum cleaned both inside and outside before testing and operating and repainting, if required. Damaged equipment shall be, as determined by the Engineer, placed in first class operating condition or be returned to the source of supply for repair or replacement. Damaged paint on equipment and materials shall be refinished to the satisfaction of the Engineer.

2.05 OWNER'S RIGHT OF RETENTION

Firmware, hardware, and software that is necessary to run the Project systems and/or equipment provided hereunder, shall become the property of the Owner. Such firmware, hardware, and software shall be upgradable and/or editable by the Owner to facilitate future functional changes and/or additions or deletions without cost or the need for second party software.

PART 3 EXECUTION

3.01 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Material, equipment, or systems as shown and/or specified shall be new and installed in accordance with manufacturer's recommendations and industry standards as applicable. Electrical Work shall be installed in a professional, neat, workmanlike manner, as per NECA/NEIS. Electrical equipment shall be adequately and securely mounted and supported.
   1. Outdoor/Underground/Wet. All electrical Work installed where subject to the elements and/or water and wash down areas shall be rated for such areas.
   2. Penetrations. Locate holes in advance where they are proposed in the structural sections such as ribs or beams. Obtain the approval of the Owner's Staff Engineer or a Structural Engineer approved by the Owner prior to drilling through structural sections. Electrical Work installed between different environments shall be sealed to prevent moisture or contaminants from traveling from one area to another.
   3. Grounding/Bonding. Electrical equipment and materials shall be grounded and bonded in accordance with NEC Article 250 and as specified herein or on the drawings.

4. Fireproofing. Electrical materials and equipment shall be installed so as to prohibit the spread of fire. Fire-stop wall, floor, and ceiling penetrations shall be installed to the same fire-rating as the penetrated wall, floor, or ceiling.
5. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
6. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
7. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
8. Give right of way to piping systems installed at a required slope.

B. Cutting and Patching
1. Perform and provide all cutting and patching of building materials as required for the installation of the work. No structural members shall be cut without the written approval of the Architect/Engineer and any such cutting shall be done in a manner satisfactory to the Architect/Engineer.
2. All patching of or repair of damage to work in place shall be done in a neat and workmanlike manner with the approval of the Architect/Engineer. The Contractor whose operations require cutting of work in place, or who cause damage that entails repairs of such work shall employ mechanics of the particular trade whose work must be cut or which is damaged, and shall pay all costs of such patching or repair.
3. All holes through pre-cast concrete shall be drilled. Coordinate all pre-cast locations on the architectural and structural drawings.
4. Contractor shall be responsible for any additional cutting, patching, mounting/installation modifications, etc., not called out on the drawings but required for the successful completion of the job. This would include additional work required due to any existing jobsite condition (i.e., the construction of walls, ceiling spaces, clearances, available voltages, mounting requirements, existing equipment coordination, hazardous materials, etc.) that the Contractor had an opportunity to determine in the pre-bid walk-through and could have reasonably determined before the bid by visual inspection or by asking the Engineer or Owner. No additional money shall be awarded for additional work incurred caused by existing jobsite conditions that could have been verified by the Contractor prior to bid. In addition, no additional money shall be awarded for failure to properly coordinate with other trades.
5. Grout - Non-metallic, shrinkage resistant grout: ASTM C 1107, factory packaged, non-metallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

C. Excavation, Backfill, and Concrete
1. Provide trenching, excavation, and backfill required for the electrical work. Repair all streets, sidewalks, lawns, curbs or paved areas damaged during/due to work. Sub-surfaces and finished surfaces shall be constructed equal to existing conditions of adjacent materials.
2. Where concrete work is provided by the Contractor, concrete shall have compression strength of 4000-psi at 28 days and shall contain 4% to 6% air entrainment.

3.02 SUBMITTALS

A. The Contractor shall submit the following information to the Engineer.
1. Shop Drawings shall be first checked by the Electrical Contractor for space/dimensional considerations, performance characteristics, and general conformance to these plans and/or specifications, and shall be so stamped.
a. Shop drawings not stamped as specified will be returned to the Contractor without action at the discretion of the Engineer. The Contractor's stamp shall include his corporate name and address, the name of the checker, and the date. They shall then be sent to the General Contractor (as applicable) who will stamp them and forward to the Engineer.

b. One copy of the shop drawings for any item shall be submitted to the Engineer for approval. Drawing size shall be no larger than 17”x22”.
c. Submittals shall be grouped according to specification Section or categories and shall be labeled with the proper name of the project and specification Section. Partial submittals of a group or category will not be reviewed (e.g., submit all panels, all lighting fixtures, etc.).
d. Data sheets containing more than one product or including features not provided with the selected product shall be clearly marked to indicate the proposed product and selected features. Unmarked documents shall be returned without action at the discretion of the Engineer.

B. Test Report. Copy of test report(s), as requested, detailed above, or as indicated in the following specification(s) shall be submitted for review, acknowledgement, and/or approval as applicable.

C. As-Built Documents. A set of construction documents shall be continuously marked during progress of construction to show actual circuit routing and makeup, equipment location changes, and variations between the project work, construction drawings, and the Contract documents. Such markings shall be made neatly and legibly with red pen. Submit As-Built documents during Engineer’s final site inspection or as specified by the Engineer.

D. Installation and Maintenance Manuals. Copies of Installation Instructions and Operation, Maintenance and Warranty Data Instruction Manuals shall be furnished for electrical equipment furnished. These Manuals shall include parts lists, troubleshooting methods, lubrication recommendations, and calibration instructions. Manuals shall be made up with hard cover post type binders. Large sheets shall be neatly folded and installed with posthole reinforcements such that the sheets will unfold without need to open binder posts. Manuals shall include index, section tabs, approved shop drawings, installation, operation, maintenance and warranty data instructions packed with equipment, parts lists, and any other data as necessary and/or appropriate for the Owner’s Engineering and Maintenance staff.

E. Software. Prior to project completion, and before final payment is made, the Contractor shall provide the Owner a hard copy printout of any PLC code and electronic media copies of PLC code, Instrumentation configuration, motor controller (VFD, softstart) settings, and SCADA software, etc.

3.03 DELIVERY, STORAGE, AND HANDLING

A. Store and protect products to be installed or returned to the Owner for reuse or salvage.

B. Store material and products in a clean and dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect products from dirt, water, construction debris, and traffic. Material and equipment shall be protected during shipment and storage against physical damage, dirt, moisture, cold, and rain. During installation, enclosures, equipment, controls, controllers, circuit protective devices, and other like items shall be protected against entry of foreign matter and be vacuum cleaned both inside and outside before testing and operating and repainting if required. Damaged equipment shall be, as determined by the Engineer, placed in first class operating condition or be returned to the source of supply for repair or replacement. Damaged paint on equipment and materials shall be refinished to the satisfaction of the Architect/Engineer.

C. Painting. Refinish all electrical equipment damaged during shipping and/or installation to its original condition. Remove all rust, prime, and paint per manufacturer's recommendations for finish equal to original.

3.04 CORRELATION/COORDINATION OF WORK

A. Consult the complete Project plan set drawings and specifications of Architectural, Structural, Mechanical, Civil and other trades for correlating information and lay-out work so that it will coordinate with other trades. Verify dimensions and conditions (i.e. finished ceiling heights, footing and foundation elevations, beam depths, etc.) with the Architectural and Structural drawings. If conflicts occur such that resolution is not possible by the affected trades on the job, the Architect/Engineer shall be notified so that the proper changes can be made to avoid extra cost to the Owner.

B. Where work must be replaced due to the failure of the Contractor to verify the conditions existing on the job, such replacement must be accomplished at no cost to the Owner. This shall apply to factory-manufactured, shop-built, and field-fabricated equipment.

C. Throughout the course of the work, minor changes and adjustments to the installation may be requested by the Engineer. The Contractor shall make adjustments without additional cost to the Owner, where such adjustments are necessary to the proper installation and operation within the intent of the Contract Documents. This does not include work already completed.

D. Coordinate arrangement, mounting, and support of electrical equipment, so that connecting raceways, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

E. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

F. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed.

G. Coordinate electrical service connections to components furnished by utility companies. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electric-metering components and additional disconnects (hot/cold sequence) where required by the utility. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.

H. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface. Where acoustical ceilings and similar finishes will conceal electrical identification markings and devices, coordinate installation of these items before ceiling installation.

3.05 TEMPORARY CONSTRUCTION LIGHTING AND POWER SYSTEM

A. Common Requirements
   1. See General Conditions and plan set for further temporary power and lighting requirements.
   2. Electrical energy costs shall be paid by the Owner.
   3. Provide and maintain lighting and receptacle outlets throughout the construction area in accordance with the following:
      a. Provide temporary power and lighting in accordance with NEC and OSHA requirements.
   4. Overload protection for circuits and equipment of the temporary light and power system shall comply with the applicable codes relating to permanent work. Panelboards and other protective equipment shall be furnished and installed as required.
   5. Materials furnished by the Electrical Contractor for the system shall remain his property and shall be removed when there is no longer any need for temporary light and power or when so ordered by the Architect/Engineer.

B. New Building
   1. Contractor is responsible for arrangements with the Utility for a temporary site service.
   2. Contractor shall provide temporary service and distribution equipment suitable for use by all trades during the construction process.

C. Existing Building
   1. Contractor is responsible for separate sub metering equipment if required by the Owner to track energy costs.
   2. Existing building distribution systems shall be used to derive power for temporary construction electrical power distribution system.
   3. Contractor shall provide distribution equipment suitable for use by all trades during the construction process.
   4. Contractor shall replace all receptacles, switches, cover plates, etc., damaged by any Contractor during the course of construction.

3.06 PERMITS, LICENSES AND FEES

A. The Contractor shall secure all permits and licenses, both temporary and permanent required for his work. The Contractor shall pay all fees and expenses required for the permits and licenses.
   1. The Contractor shall make all arrangements with each utility company (power, phone, cable, internet, etc.) and pay all service charges associated with new services or modifications to existing services.
   2. The Contractor shall request inspections as required by regulating agencies and/or regulations. The Contractor shall pay all charges for inspections.
   3. Contractor shall furnish the Owner with a certificate of final inspection and approval by enforcement authorities.

B. Comply with requirements of Division 00.

3.07 CLEAN UP

A. Contractor shall at all times keep the premises free from accumulation of waste material or rubbish caused by his employees or work. Upon completion of the work he shall remove his rubbish, tools, scaffolding, and surplus materials from and about the building, and shall leave his work areas "broom clean" or its equivalent. Electrical equipment shall be cleaned with temporary identification removed. In case of dispute the Owner will remove the rubbish and charge the cost to the Contractor.

B. After tests have been made and accepted, the Electrical Contractor shall go over the whole job and clean light fixtures, panels and other equipment installed by him/her, leaving the entire area in a clean and complete working order.

3.08 FIELD TESTS AND ADJUSTMENTS

A. Work shall, upon completion, be subjected to such tests as are required under industry standards and/or specified herein. Acceptance of the Work by the Engineer shall be contingent upon satisfactory completion of these tests. Actual tests required shall be specified under their respective sections.

B. Prior to completion, the Work shall be subjected to a careful and thorough visual inspection to detect erroneous or loose connections, presence of foreign objects or materials, poor workmanship, incorrect ratings of overcurrent protective devices or equipment, compliance with drawings, or other abnormal conditions.

C. Tests shall be scheduled in advance so that a representative of the Engineer may be present. Test Reports shall be tabulated by the Contractor including the pertinent readings or observations, as well as a statement of the method and specific equipment employed, and shall be filed with the Engineer as part of the permanent Project record. The documents shall also include an explanation, listing, or notation of the pass/fail threshold value(s) and/or the range of acceptable/failed test result values as appropriate. In cases of test failure, it shall be agreed that the corrective measures proposed are adequate before making repairs. A second test shall be conducted upon completion of repairs, adjustments, or replacements.

D. The Contractor shall provide recently calibrated, traceable National Testing Lab certified, test equipment and temporary energy sources as required for tests.

3.09 COMPLETION OF INSTALLATION

A. System Acceptance. System optimization shall be performed to make sure that each electrical system is properly installed and that all components are working properly. This shall include, but not be limited to the following.
   1. Equipment is functioning properly.
   2. Equipment is mounted in the correct location.
   3. Equipment is rigidly and securely mounted.
   4. Equipment is installed in a neat and visually professional manner.
   5. Equipment is clean.
   6. The training of operations personnel is complete.
   7. Final Inspection. Upon completion of the work, notify the Engineer that the Project is complete and ready for inspection. The Engineer will schedule an inspection and generate a list of items to be corrected or completed before contract closeout. If the Engineer is requested to make a final inspection by the Contractor, and the Engineer finds work is not

complete enough to perform that inspection, the Contractor will compensate the Engineer for their time. The Contractor will then perform the necessary work to complete the project and again request a Final Inspection.

B. Training. The Contractor shall furnish training for the operating and maintenance personnel of the Owner of the recommended and proper operation and maintenance of electrical systems. Training shall be both of the classroom type and the hands-on type, and shall cover all areas of maintenance and operation. Training shall be coordinated with the Engineer and Owner, if requested by Owner.
   1. The training period may be either concurrent with the system start-up or follow the start-up period at the Contractor's option; however, if it is given concurrent to the start-up, then the instructing personnel shall be furnished in addition to the start-up personnel and one shall not interfere with the other.
   2. Actual training periods and their scopes shall be specified under their respective Section. Scheduling of the Owner's personnel shall be mutually agreed upon between the Contractor and the Project Engineer.

C. Cleanup. Keep the premises free from accumulation of waste material and rubbish. Remove debris from the job site weekly and leave work areas broom clean upon completion of each work day.

D. Spare Parts shall be turned over to the Owner at the completion of the Project. The spare parts shall not be used during start-up or warranty. Package spare parts for protection against dirt and moisture.

3.10 CORRECTIVE PERIOD

A. The Contractor shall guarantee and maintain the stability of work and materials and keep same in perfect repair and condition for the period of one (1) year after the Date of Substantial Completion of the Project.

B. Defects of any kind due to faulty work or materials appearing during the above mentioned period must be immediately made good by the Contractor at his own expense to the entire satisfaction of the Owner, Architect and Engineer. Such reconstruction and repairs shall include damage to the finish or the building resulting from the original defect or repairs thereto.

C. This guarantee shall not apply to injuries occurring after final acceptance and due to wind, fire, violence, abuse or carelessness or other Contractors or their employees or the agents of the Owner.

D. This guarantee shall not apply where other guarantees for different lengths of time are specifically called for in other Specification sections

3.11 GUARANTEE (WARRANTY)

The Contractor shall guarantee the equipment and systems to be free of defects in design, equipment, and workmanship for a minimum period of one year from the date of acceptance as issued by the Architect/Engineer’s certificate of completion. The Contractor shall replace, redesign, and correct any equipment that fails within the specified warranty period. Consult the other sections and drawing notes for additional warranty requirements and extended warranty periods.

END OF SECTION

SECTION 26 05 03
DEMOLITION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings, the provisions of the Contract including the General and Supplementary Conditions, and the General Requirements apply to the Work of this Section.

B. The following sections have been specifically referenced in this specification:
   1. Section 26 05 00 Common Work Results for Electrical.

1.02 SCOPE

This Section includes all labor, material, equipment, and services necessary and incidental to complete all the demolition and removal of all electrical systems as noted on the plan drawings and associated notes.

1.03 DEFINITIONS/ABBREVIATIONS

A. No additional definitions/abbreviations provided.

1.04 SUBMITTALS

A. Bid. Provide the following with the bid documents.
   1. No additional submittals required; see Specification Section 26 05 00.

B. Manufacture. Provide the following prior to release for manufacture and/or purchase.
   1. No additional submittals required; see Specification Section 26 05 00.

C. Construction. Provide the following during construction.
   1. Provide list of items not working, broken, or unusable that were planned for reuse or to be returned to the Owner for salvage.
   2. Notify the Owner in writing of any suspicious conditions, liquids, materials, assemblies or environments deemed potentially hazardous for evaluation prior to beginning demolition or disturbing the area.
   3. See also Specification Section 26 05 00.

D. Closeout. Provide the following to complete the project.
   1. Provide documentation of hazardous waste being turned over to a certified hazardous waste disposal company. Documentation shall include all tracking numbers and proof of proper disposal.
   2. See also Specification Section 26 05 00.

1.05 QUALITY ASSURANCE

A. Manufacturer. No additional qualifications specified.

B. Installer Qualifications. No additional qualifications specified.

C. Codes/Standards. No additional codes/standards specified.

D. Equipment Quality. Any electrical products used to complete the demolition work shall be “Listed” or “Labeled” as defined in NFPA 70, Article 100, by a Nationally Recognized Testing Laboratory acceptable to authorities having jurisdiction, and marked for the intended location and use.

1.06 EXAMINATION

A. Examine the building to determine actual conditions and report any major discrepancies with the Engineer for clarification. These examinations should include verifying field measurements, circuiting arrangements, and wiring that will be abandoned and that serves only abandoned equipment. Where new additions or penthouses are being constructed by this project that create openings in floors, ceilings, or roof areas, visit the site to determine extent of field equipment, conduit, wire, devices, and associated mounting hardware removal and relocation work. Include this work in the Bid.

B. Contractor shall assume in his bid that existing equipment and fixtures to be reused are in good working condition and can be installed without any repairs. If certain items are found to be in need of repair or in unusable condition, Contractor shall notify the Engineer for decision.

However, Contractor shall be responsible for any damage caused by him to equipment in removal or handling.

C. The Contractor shall review the electrical equipment in and around the areas in which demolition work is to be performed. The Contractor shall submit a written list to the Engineer of items not working or broken. Upon completion of work, any electrical items not working or broken shall be the Contractor's responsibility to repair, unless noted on a list submitted prior to the start of demolition. If no such list is submitted to the Engineer prior to the start of demolition, the Contractor shall be made responsible to provide all equipment in working order at the end of the remodeling.

D. Contractor shall be responsible for any additional demolition not called out on the drawings but which is required for the successful completion of the job. This is work required due to an existing jobsite condition (i.e., the construction of walls, ceiling spaces, hazardous materials, etc.) that the contractor had an opportunity to determine in the pre-bid walk-through and could have reasonably determined before the bid by visual inspection or by asking the Engineer or Owner. No additional money shall be awarded for work caused by existing conditions that could have been verified prior to bid.

PART 2 PRODUCTS

2.01 GENERAL INFORMATION

Materials and equipment for patching and extending work shall be as specified in individual Sections or as approved herein or directly by the Owner. The type of equipment and/or material shall be approved for its planned use and environment and is so defined by NEMA/NFPA 70 standards and NRTL certifications.

2.02 ACCEPTABLE MANUFACTURERS

A. None specified in this section.

PART 3 EXECUTION

3.01 GENERAL INFORMATION

A. Provide demolition of all existing electrical facilities as shown on the drawings and as required to complete the work. This includes, but is not limited to, lighting, power, and signal equipment. Existing electrical equipment to be reused or returned to the Owner is noted on the drawings.

B. If the Owner will be occupying the existing building during construction, provide any temporary connections necessary to maintain services to the existing systems. Prior approval required for all outages. Provide advance notice of a minimum of three weeks to the Owner of any temporary service outages. Advance notice shall be in writing with copies to the Owner and Engineer.

C. Coordinate service outages with the Utility Company.

D. Provide temporary wiring and connections to maintain continuity to existing systems in service during construction. Work must not be performed on energized equipment or circuits.

1. Existing systems includes electrical service, power distribution, generation, and uninterruptible power systems; lighting and control systems; signal systems like fire alarm, security (card access, intrusion, cameras, etc.), phone/data; and control systems (like building management, process supervisory control and data acquisition, and process programmable logic controllers) shall remain in service until new or modified system is complete and ready for service. Disable system(s) only to make switchovers and/or connections. Obtain permission from Owner and Engineer at least 24 hours before partially or completely disabling system(s). Minimize outage duration. Provide generation and/or temporary connections to maintain service in areas requiring continued operation during the outage, at no additional cost to the Owner.
2. Meet with Owner and workers affected by any outage to determine the scope of equipment and/or systems requiring temporary power to maintain operation during the outage. Following approval by the Owner and completion of planning for an outage, meet with the Owner and affected workers to review outage plans at least one week before the outage.

3.02 DEMOLITION AND REMODEL WORK

A. Demolish and extend existing electrical work as indicated on the Drawings and associated notes. The Owner shall be offered materials and equipment slated for demolition. Legally dispose of all demolition material and equipment that the Owner has been offered but has not accepted.

B. Coordinate the demolition and/or installation of items by other trades where applicable to minimize the effect on existing electrical items to remain. Contractor shall relocate, reroute and/or replace materials needed to maintain existing electrical continuity and/or to maintain accessibility to junction boxes and other access points required by Code. Where modifications require new access panels, the Contractor shall provide them and coordinate size and location with other trades.

C. When existing light fixtures, switches, or other outlets are removed, remove all unused wire and raceway, where accessible, back to last active outlet or source. Extend existing circuiting, if required, to continue circuiting to other areas.
   1. Devices. Remove all devices in areas that will be remodeled as shown on the drawings and associated notes. Replace all devices and cover plates in outlets that shall remain. When outlets in walls, ceilings, or floors are being relocated to locations that are essential for the operation of other remaining outlets, provide new wiring devices in the relocated outlets. Disconnect abandoned flush outlets, remove devices, and provide blank covers.
   2. Lighting. Remove all abandoned lighting fixtures in areas that are to be remodeled as shown on the drawings and associated notes.
      a. Temporarily remove fixtures that are to be reconnected as shown on the drawings associated notes. These fixtures shall be cleaned and reinstalled with new ballasts and lamps. If conduit and wiring serving these fixtures must be removed to permit demolition work, provide new conduit and wire to obtain the same circuiting arrangement as originally existed.
      b. Wiring. Remove all wire wherever existing circuits are abandoned or modified. Install new conductors for all altered or remodeled circuits.
   3. Raceways. Remove abandoned raceways and boxes when exposed or when they interfere with new work of any trades, unless indicated or approved otherwise. When electrical materials are removed, patch and finish building surfaces to match existing finishes.

D. The Contractor shall remove/protect existing low-voltage cables in areas affected by the demolition. When remodeling is complete, the Contractor shall reinstall/remove protection of low-voltage cables and confirm all electrical devices and cables are restored to their original working conditions.

E. Permission. Obtain permission in writing from the Owner before interrupting services, branch circuits, communications, or other systems.

3.03 DISPOSITION OF EXISTING MATERIAL AND EQUIPMENT

A. All material and equipment that are noted, specified, or required by the Owner to be salvaged, and are not scheduled to be reused or relocated shall be carefully removed, delivered to the Owner, and stored where directed on site.
   1. Carefully remove and store on site all material and equipment noted or specified to be reused or relocated. Thoroughly clean this equipment prior to installation.
   2. Remove and properly dispose of all other materials or debris resulting from demolition operations from the site.

3.04 LAMP AND LIGHT BALLAST DISPOSAL PROCEDURE

A. The Contractor shall be responsible for disposing of the existing ballasts and lamps slated for demolition. Ballasts and lamps removed under this contract for demolition shall be kept intact, boxed and delivered to a certified hazardous waste disposal services and lamps to a certified hazardous lamp recycle service. Provide Owner with proper documentation for this work.

B. It is anticipated that no hazardous material, PCB ballasts, will be encountered; however, if some are found, they shall be packaged for disposal and handled as described by Federal, State, or Local Authorities having jurisdiction.

3.05 DISPOSITION OF HAZARDOUS MATERIAL AND EQUIPMENT

A. Comply with all current Federal, State, and Local requirements and as a minimum all hazardous waste generators are to have in place an Environmental Protection Agency (EPA) Identification Number prior to pick up and disposal of any hazardous waste, including PCB ballasts, fluorescent and HID lamps. Generators that need to apply for an EPA I.D. number shall contact the responsible Pollution Control Agency and request an application form and the instructions for completing the form.

B. Packaging. The U.S. Department of Transportation and most State Department of Transportation agencies require all hazardous wastes to be properly packaged in D.O.T. approved shipping containers for storage and transport. For PCB light ballasts, fluorescent and HID lamps this container is typically a 55-gallon, open-top steel drum with lid and bolting ring. The drums are designated as D.O.T. 17C or D.O.T. 17H drums (new D.O.T. designation #1A2/Y1.5) and are generally available from any drum distributor.

C. Manifest and Labeling. All appropriate labels required by Federal, State, and Local regulations and Hazardous Waste Manifests shall be obtained from the disposal service.

D. Transport. All regulated mercury wastes (fluorescent and HID lamps) must be transported on DOT hazardous waste licensed vehicles. A lamp recycling facility has all necessary licenses and permits to transport hazardous waste.

E. Disposal. The Contractor shall utilize the lamp recycling facility for lamp disposal, which has EPA approval for lamp recycling.

F. The lamp recycling facility shall routinely conduct TCLP tests on all recovered materials (glass, phosphor powder, and metal end caps) from fluorescent lamps. TCLP test results for glass, metal end caps, and phosphor powder must always comply with the regulatory level for mercury at 0.2 mg/liter.
   1. The lamp recycling facility's process shall recovery a minimum of 98.5+% of the mercury from fluorescent lamps.
   2. The lamp recycling facility's process shall generate a minimum of 99+% pure free flowing liquid mercury.
   3. The lamp recycling facility shall have procedures and equipment (i.e., a central vacuum system with a sulphurated carbon filter) to properly clean out containers and, if necessary, trucks in the event of broken lamps.
   4. The lamp recycling facility's processing area shall contain and use air pollution control technology (i.e., a double sulphurated carbon filter system, a baghouse, and cyclone filters) to ensure worker safety and protect the environment.
   5. The lamp recycling facility shall have and use on-site equipment to process used sulphurated carbon filters (i.e., eliminate the need to transport and landfill mercury bearing filters).
   6. Cost of Disposal. The cost of disposal service will vary greatly depending on three variables; location of pick-up, quantity, and method of disposal.
   7. Contact State Pollution Control Agency for additional information.

3.06 CLEANING AND REPAIR

A. All patching or repair of damage to work in place shall be done in a neat and workmanlike manner with the approval of the Engineer. The Contractor whose operations require cutting of work in place, or who cause damage that entails repairs of such work, including wall/paint finish, shall employ mechanics of the particular trade whose work must be cut or which is damaged, and shall pay all costs of such patching or repair.

B. Panelboards. Clean exposed surfaces and check tightness of electrical connections. Replace any damaged circuit breakers and provide closure plates for any vacant positions. Operate all molded case circuit breakers or switches to verify successful open/close operation and to re-lubricate moving parts. Provide typed circuit directory showing revised circuiting arrangement.

C. Switchgear, Switchboards, Motor Controllers, and Motor Control Centers. Consult Engineer for scope of cleaning and testing required, where applicable. As a minimum tighten all lugs, clean all exposed surfaces, remove any accumulated dust, dirt, and debris. Operate all molded case circuit breakers or switches. Provide injection test and verify trip settings of all molded case circuit breakers above 400 amp and all insulated case circuit breakers, power circuit breakers,

and protective relays. Report any observed deficiencies or concerns to the Owner and Engineer.

D. Motor Controllers and Motor Control Centers. Consult Engineer for scope of cleaning and testing required, where applicable. As a minimum tighten all lugs, clean all exposed surfaces, remove any accumulated dust, dirt, and debris. Operate all molded case circuit breakers or switches. Report any observed deficiencies or concerns to the Owner and Engineer.

E. Luminaires. Clean existing luminaires on all exterior and interior surfaces, and replace all lamps, ballasts, and broken electrical parts, in areas of remodeling.

3.07 INSTALLATION

Reinstall relocated equipment and materials as noted on drawings, associated notes, and according to provisions of applicable Specification Sections for similar new equipment.

3.08 GUARANTEE (WARRANTY)

No additional material and/or labor warranty beyond that specified in Section 26 05 00 “Common Work Results for Electrical.”

END OF SECTION

SECTION 26 05 13
MEDIUM VOLTAGE CABLES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

The Drawings, the provisions of the Contract including the General and Supplementary Conditions and the General Requirements apply to the Work of this Section.

1.02 SCOPE

This Section includes cables and related splices, terminations, and accessories for medium-voltage electrical distribution systems.

1.03 DEFINITIONS

A. NETA ATS. Acceptance Testing Specification.

1.04 SUBMITTALS

A. Product Data. For each type of cable indicated. Include splices and terminations for cables and cable accessories.

B. Qualification Data. For Installer.

C. Material Certificates. For each cable and accessory type, signed by manufacturers.

D. Field Quality-Control Test Reports.

1.05 QUALITY ASSURANCE

A. Installer. Engage a cable splicer, trained and certified by splice material manufacturer, to install, splice, and terminate medium-voltage cable.

B. Testing Agency Qualifications. An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor. Person currently certified by the International Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

C. Source Limitations. Obtain cables and accessories through one source from a single manufacturer.

D. Electrical Components, Devices, and Accessories. Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for the intended use.

E. Comply with IEEE C2, NFPA 70, and other applicable Standards.

1.06 PROJECT CONDITIONS

A. Interruption of Existing Electric Service. Do not interrupt electric service to facilities occupied by Owner or others until requested, approved, planned, reviewed, and scheduled with Owner and effected facilities. Contractor to secure written permission for interruption(s) and outage plan(s) from Owner and all affected facilities.

1.07 STANDARDS

A. NFPA 70. National Electrical Code

B. IEEE C2. National Electrical Safety Code

C. IEEE 48. Standard Test Procedures and Requirements for Alternating Current Cable

D. IEEE 386. Standard for Separable Insulated Connector Systems for Power Distribution Systems Above 600 Volt

E. IEEE 404. Standard for Extruded and Laminated Dielectric Shielded Cable Joints Rated 2500V to 500000V

F. IEEE 576. Recommended Practice for Installation, Termination, and Testing of Insulated Power Cables as Used in Industrial and Commercial Applications

G. UL 1072. Standard for Safety Medium Voltage Power Cables

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following in the articles below.

B. Manufacturers. Subject to compliance with requirements, provide products by one of the following or an approved manufacturer:
   1. Cables
      a. American Insulated Wire Corp.; a Leviton Company.
      b. General Cable Technologies Corporation.
      c. Kerite Co. (The); Hubbell Incorporated.
      d. Okonite Company (The).
      e. Southwire Company.
   2. Cable Splicing and Terminating Products and Accessories:
      a. Engineered Products Company.
      b. MPHusky.
      c. Raychem Corp.; Telephone Energy and Industrial Division; Tyco International Ltd.
      d. RTE Components; Cooper Power Systems, Inc.
      e. Thomas & Betts Corporation.
      f. 3M; Electrical Products Division.

2.02 CABLES

A. Cable Type. 15KV, Single Aluminum Shielded Conductor, MV105.

B. Comply with: UL 1072, AEIC CS 8, ICEA S-93-639, and ICEA S-97-682.

C. Conductor. Aluminum.

D. Conductor Stranding. Concentric lay, Class B.

E. Strand Filling. Conductor interstices are filled with impermeable compound.

F. Conductor Insulation. Ethylene-propylene rubber (EPR).
   1. Voltage Rating. 15 kV.
   2. Insulation Thickness. 133 percent insulation level.

G. Shielding. Solid copper wires, helically applied over semiconducting insulation shield.

H. Shielding and Jacket. Corrugated copper drain wires embedded in extruded, chlorinated, polyethylene jacket.

I. Cable Jacket. Sunlight-resistant PVC.

J. UL Labeled for application and particular environment

2.03 SPLICE KITS

A. Connectors and Splice Kits. Comply with IEEE 404; type as sized for and recommended by cable or splicing kit manufacturer for the application.

B. Splicing Products. As recommended, in writing, by splicing kit manufacturer for specific sizes, ratings, and configurations of cable conductors. Include all components required for complete splice, with detailed instructions.
   1. Combination tape and cold-shrink-rubber sleeve kit with rejacketing by cast-epoxy-resin encasement or other waterproof, abrasion-resistant material.
   2. Heat-shrink splicing kit of uniform, cross-section, polymeric construction with outer heat-shrink jacket.
   3. Premolded, cold-shrink-rubber, in-line splicing kit.
   4. Premolded EPDM splicing body kit with cable joint sealed by interference fit of mating parts and cable.

2.04 SOLID TERMINATIONS

A. Shielded-Cable Terminations. Comply with the following classes of IEEE 48. Insulation class is equivalent to that of cable. Include shield ground strap for shielded cable terminations.
   1. Class 1 Terminations. Modular type, furnished as a kit, with stress-relief tube; multiple, molded-silicone rubber, insulator modules; shield ground strap; and compression-type connector.
   2. Class 2 Terminations, Indoors. Kit with stress-relief tube, nontracking insulator tube, shield ground strap, and compression-type connector. Include silicone-rubber tape, cold-shrink-rubber sleeve, or heat-shrink plastic-sleeve moisture seal for end of insulation whether or not supplied with kits.

2.05 SEPARABLE INSULATED CONNECTORS

A. Description. Modular system, complying with IEEE 386, with disconnecting, single-pole, cable terminators and with matching, stationary, plug-in, dead-front terminals designed for cable voltage and for sealing against moisture.

B. Load-Break Cable Terminators. Elbow-type units with 200-A load make/break and continuous-current rating; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.

C. Dead-Front Terminal Junctions. Modular bracket-mounted groups of dead-front stationary terminals that mate and match with above cable terminators. Two-, three-, or four-terminal units as indicated, with fully rated, insulated, watertight conductor connection between terminals and complete with grounding lug, manufacturer's standard accessory stands, stainless-steel mounting brackets, and attaching hardware.
   1. Protective Cap. Insulating, electrostatic-shielding, water-sealing cap with drain wire.
   2. Portable Feed-Through Accessory. Two-terminal, dead-front junction arranged for removable mounting on accessory stand of stationary terminal junction.
   3. Grounding Kit. Jumpered elbows, portable feed-through accessory units, protective caps, test rods suitable for concurrently grounding three phases of feeders, and carrying case.
   4. Standoff Insulator. Portable, single dead-front terminal for removable mounting on accessory stand of stationary terminal junction. Insulators suitable for fully insulated isolation of energized cable-elbow terminator.

D. Test-Point Fault Indicators. Applicable current-trip ratings and arranged for installation in test points of load-break separable connectors, and complete with self-resetting indicators capable of being installed with shotgun hot stick and tested with test tool.

E. Tool Set. Shotgun hot stick with energized terminal indicator, fault-indicator test tool, and carrying case.

2.06 ARC-PROOFING MATERIALS

A. Tape for First Course on Metal Objects. 10-mil thick, corrosion-protective, moisture-resistant, PVC pipe-wrapping tape.

B. Arc-Proofing Tape. Fireproof tape, flexible, conformable, intumescent to 0.3 inch thick, compatible with cable jacket.

C. Glass-Cloth Tape. Pressure-sensitive adhesive type, 1/2 inch wide.

2.07 FAULT INDICATORS

A. Indicators. Manually reset fault indicator, arranged to clamp to cable sheath and provide a display after a fault has occurred in cable. Instrument shall not be affected by heat, moisture, and corrosive conditions and shall be recommended by manufacturer for installation conditions.

B. Resetting Tool. Designed for use with fault indicators, with moisture-resistant storage and carrying case.

2.08 SOURCE QUALITY CONTROL

A. Test and Inspect Cables according to ICEA S-97-682 before shipping.

B. Test Strand-Filled Cables for water-penetration resistance according to ICEA T-31-610, using a test pressure of 5 psig.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install Cables according to IEEE 576. Cable shall be protected from construction damage by proper storage and handling, from moisture intrusion by sealing ends, from insulation damage by preventing excessive pulling tension and by observing minimum cable bending radius. Consult manufacturer for minimum bending radius determined by cable insulation type, number of conductors, size of conductors, and type of shielding.

B. Low Voltage power, instrument, and control circuits are to be segregated from medium voltage power cables.

C. Pull Conductors. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
   1. Where necessary, use manufacturer-approved pulling compound or lubricant that will not deteriorate conductor or insulation.
   2. Use pulling means, including fish tape, cable, rope, and basket-weave cable grips that will not damage cables and raceways. Do not use rope hitches for pulling attachment to cable.

D. Install Exposed Cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.

E. Install "Buried-Cable" Warning Tape 12 inches above cables.

F. In Manholes, handholes, pull boxes, junction boxes, and cable vaults, train cables around walls by the longest route from entry to exit and support cables at intervals adequate to prevent sag.

G. Install Cable Splices, at approved locations only, using prefabricated standard kits matching cable in size and components to provide continuation of each cable component to minimize cable voltage stresses.

H. Install Terminations at ends of conductors and seal multi-conductor cable ends with standard prefabricated kits matching cable in size and components. Indoor cable terminations require stress relief cone only. Outdoor cable terminations require stress relief cone with skirting to increase creepage distance to reduce potential flashover from conductive and/or corrosive contaminants.

I. Install Separable insulated-connector components as follows:
   1. Protective Cap. At each terminal junction, with one on each terminal to which no feeder is indicated to be connected.
   2. Portable Feed-Through Accessory. Three.
   3. Standoff Insulator. Three.

J. Arc Proofing. Unless otherwise indicated, arc proof medium-voltage cable at locations not protected by conduit, cable tray, direct burial, or termination materials. In addition to arc-proofing tape manufacturer's written instructions, apply arc proofing as follows:
   1. Clean cable sheath.
   2. Wrap metallic cable components with 10-mil pipe-wrapping tape.
   3. Smooth surface contours with electrical insulation putty.
   4. Apply arc-proofing tape in one half-lapped layer with coated side toward cable.
   5. Band arc-proofing tape with 1-inch wide bands of half-lapped, adhesive, glass-cloth tape 2 inches o.c.

K. Seal Around Cables passing through fire-rated elements with rated firestopping material.

L. Install Fault Indicators on each phase where indicated.

M. Ground Shields of shielded cable at terminations, splices, and separable insulated connectors. Ground metal bodies of terminators, splices, cable and separable insulated-connector fittings, and hardware.

3.02 CABLE ACCEPTANCE TESTS (AS PER NETA ACCEPTANCE TESTING SPECIFICATION)

Do not perform any test while any portion of switchgear is energized and in accordance with the Contractor’s electrical safety policies and procedures. Perform successful tests before cables are energized.

A. Visual and Mechanical Inspections
   1. Compare cable data with drawings and specifications.

2. Inspect exposed section for physical damage.
3. Verify cable is supplied and connected in accordance with single line diagram.
4. Verify bolted electrical connections to manufacturer’s published data with calibrated torque wrench.
5. Inspect for shield grounding, cable support, and termination.
6. Visible cable bends shall be checked against ICEA or manufacturer's minimum allowable bending radius.
7. Verify fireproofing in common cable areas.

B. Continuity. Contractor shall perform a simple continuity test on the conductors the system.
1. Perform a conductor continuity check measuring resistance of cable and connection. Measure resistance of each cable connection to ground with the other cable end connection grounded (for testing purposes only) and all switches open. Cable identity (MV3-1, Phase A) and respective ohmic value to be recorded for each cable on Testing Report.
2. Perform a shield continuity test by ohm meter method. Results shall be recorded on Testing Report.

C. Cable Insulation Testing: Select one of the following three methods:
1. VLF Withstand: NEW Cable Testing.
   a. Perform test per Cable and Test Equipment Manufacturer recommendations.
   b. Review all test planning with Engineer for approval. Include proposed test procedure and form.
   c. Request typical test procedure from Engineer.
2. VLF Insulation Losses: EXISTING Cable Maintenance Testing.
   a. Perform test per Cable and Test Equipment Manufacturer recommendations.
   b. Review all test planning with Engineer for approval. Include proposed test procedure and form.
   c. Request typical test procedure from Engineer.
3. High Potential VDC. NEW Cable Testing.
   a. Perform test per Cable and Test Equipment Manufacturer recommendations.
   b. Review planned testing procedure and test form(s) with Engineer for approval.
   c. Typical D.C. Hi-potential Test procedure is as follows:
      1) Each conductor shall be individually tested with all other conductors grounded. All shields shall be grounded.
      2) Terminations shall be properly corona-suppressed by guard ring, field reduction sphere, or other suitable methods.
      3) A D.C. hi-potential shall be applied in at least eight (8) equal increments until maximum test voltage is reached. D.C. leakage current shall be recorded at each step after a constant stabilization time consistent with system charging current decay.
      4) A graphic plot shall be made of leakage current (Y axis) versus voltage (X axis) at each increment.
      5) The test conductor shall be raised to a maximum test voltage and held for a total of ten (10) minutes. Readings of leakage current (Y axis) versus time (X axis) shall be recorded and plotted on thirty (30) second intervals for the first two (2) minutes and every minute thereafter.
      6) The conductor test potential shall be reduced to zero (0) and grounds applied for at least ten (10) minutes.
      7) Test cable to manufacturer’s recommended test voltage levels. In no case shall the voltage levels exceed the maximum test values listed in the following table. The listed maximum test voltages are in accordance with ICEA S-93-639.

Rated KV	DC Test 100% Insulation	DC Test 133% Insulation
5	28	36
15	56	64
25	80	96
35	100	124

D. All Tests shall be recorded and submitted with final documentation.

3.03 WARRANTY

All cable, cable splices, and cable terminations shall be free from defects and installed according to the manufacturer's requirements and acceptable professional practice as set forth in recognized industry standards. The Contractor will warrant both labor and materials for a period of one year from the point of acceptance by the Owner of the Project against failure of the installation due to a manufacturer defect or improper installation.

END OF SECTION

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings, the provisions of the Contract including the General and Supplementary Conditions, and the General Requirements apply to the Work of this Section.

B. The following sections have been specifically referenced in this specification and Division 03 “Concrete:
   1. Section 26 05 00 Common Work Results for Electrical.

1.02 SCOPE

A. This Section covers basic electrical requirements for providing labor, materials, equipment, and services necessary for the selection and installation of hangers and supports as shown on the drawings and specified herein. In general, this consists of:
   1. Providing and designing supports for single and multiple raceway installations.
   2. Construction requirements for concrete bases.

1.03 DEFINITIONS/ABBREVIATIONS

A. No additional definitions/abbreviations provided.

1.04 SUBMITTALS

A. Bid. Provide the following with the bid documents.
   1. No additional submittals required; see Specification Section 26 05 00.

B. Manufacture. Provide the following prior to release for manufacture and/or purchase.
   1. Shop Drawings/Data Sheets shall be submitted for approval for the following equipment (confirm list with Engineer):
      a. Shop Drawing for trapeze hangers and Data Sheets for assembly components.
      b. Data sheets for steel slotted channel system components.
      c. Shop drawings for equipment supports.
   2. Welding Certificates where welding required for the Project.
   3. Concrete materials, reinforcement, and placement requirements where concrete work is required on drawings.
   4. No samples requested.
   5. Submit Seismic Guides and Certification to verify that the specified equipment and installation meet all requirements to withstand potential seismic forces, where required.
   6. See also Specification Section 26 05 00.

C. Construction. Provide the following during construction.
   1. Test reports as specified herein.
   2. See also Specification Section 26 05 00.

D. Closeout. Provide the following to complete the project.
   1. No additional submittals required; see Specification Section 26 05 00.

1.05 QUALITY ASSURANCE

A. Manufacturer: The equipment manufacturer shall be regularly engaged in the manufacture of hangers, supports, and accessories of the types, capabilities, and capacities required, and whose products have been in satisfactory use in similar service for not less than ten years.

B. Installer Qualifications: In addition to qualifications stated in Specification Section 26 05 00:
   1. Welder Qualifications: Certified procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code – Steel."

C. Codes/Standards: The products provided by this section shall comply with the latest editions of the following references:
   1. ASTM A 36/A 36M: Standard Specification for Carbon Structural Steel
   2. ASTM A 780 Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
   3. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

4. MFMA: 4 Metal Framing Manufacturer's Association.
5. MSS SP-58: Manufacturers Standardization Society of the Valve and Fittings Industry.
6. SSPC-PA 1 Shop, Field, and Maintenance Painting of Steel

D. Equipment Quality: Electrical hangers, supports, and accessories shall be "Listed" or "Labeled" as defined in NFPA 70, Article 100, by a National Recognized Testing Laboratory acceptable to authorities having jurisdiction, and marked for the intended location and use.

PART 3 PRODUCTS

2.01 GENERAL INFORMATION

A. All hangers, supports, accessories, and materials shall be new unless otherwise specified on the plan drawings and associated notes. The type of equipment and/or material shall be approved for its planned use and environment and is so defined by NEMA/NFPA 70 standards and NRTL certifications.

2.02 ACCEPTABLE MANUFACTURERS

A. None Specified.

2.03 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems, MFMA-4, with manufacturer recognized fittings and accessories. 12 gauge "U" section, 1-1/2-inch square nominal.
   1. Metallic Coatings.
      a. Hot-dip galvanized after fabrication and applied according to MFMA-4.
   2. Nonmetallic Coatings.
      a. Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
   3. Painted Coatings.
      a. Manufacturer's standard painted coating applied according to MFMA-4.
   4. Channel Dimensions.
      a. Selected for applicable load criteria.

B. 4 Sided Steel Strut System
   1. B-Line 4 Dimension Series
   2. Galvanized steel finish.
   3. Modular design
   4. Slotted Holes

C. Raceway Supports. As described in NECA 1 and NECA 101.
   1. Trapeze type supports may use strut type horizontal members with conduit clamps, or
   2. B-Line BCTS series Z shape galvanized steel member with holes to align conduits.

D. Conduit Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway to be supported.

E. Support for Conductors in Vertical Conduit. Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for electrical conductors in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors supported. Body shall be malleable iron.

F. Structural Steel for Fabricated Supports and Restraints.
   1. ASTM A 36/A 36M, steel plates, shapes, and bars
   2. Black and galvanized

G. Mounting, Anchoring, and Attachment Components. Items for fastening electrical items or their supports to building surfaces include the following:
   1. Mechanical-Expansion Anchors.
      a. Insert-wedge-type, steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
   2. Concrete Inserts.
      a. Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

3. Clamps for Attachment to Steel Structural Elements.
    a. MSS SP-58, type suitable for attached structural element.
4. Through Bolts.
    a. Structural type, hex head, and high strength. Comply with ASTM A 325.
5. Cable Style Hanger.
    a. Galvanized steel cable sized for load.
    b. 5:1 safety factor
    c. Cable locking fastener specifically designed for attachment to strut.
    d. Corrosion resistant hardware, stainless steel screws, stainless steel spring.
    e. Gripple or similar
6. Hanger Rods.
    a. Zinc plated threaded steel, diameter minimum sized to support load with safety factor of 2.
7. Provide stainless steel in corrosive atmospheres.

2.04 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Welded or bolted construction, structural-steel shapes, fabricated to fit dimensions of supported equipment.

B. Materials and proposed installation procedures shall be submitted to the Engineer for approval.

PART 1 - EXECUTION

2.05 GENERAL INFORMATION

A. Provide all labor and hangers, supports, pads and associated materials required for the installation of a complete and operating system in accordance with applicable local, state, national codes, and the manufacturers' recommendations, except where the plan set drawings, associated notes, schedules, and/or specifications are stricter.

B. Hanger, Support, and Assembly Performance Requirements
    1. Provide final design for proper application of hangers, supports, and assemblies.
    2. Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
    3. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
    4. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
    5. Rated Strength. Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five (5) times the applied force.

C. Submit shop drawings of design elements for evaluation and approval.

2.06 INSTALLATION OF HANGER, SUPPORT, AND ASSEMBLIES

A. Strength of Support Assemblies. Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

B. Mounting and Anchorage of raceways and equipment: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
    1. To Wood.
        a. Fasten with lag screws or through-bolts.
    2. To New Concrete.
        a. Bolt to concrete inserts. Drill holes for anchors in concrete at locations and to depths that avoid reinforcing bars.
    3. To Masonry

a. Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.

4. To Existing Concrete
   a. Expansion anchor fasteners. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.
   b. Alternate: Powder-actuated driven threaded studs provided with lock-washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater if approved by the Owner.
5. To Steel
   a. RC or PC clamps
   b. Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
   c. Alternate: Beam clamps complying with MSS SP-69 or spring-tension clamps (for up to 1-1/2 inches) may be used if approved by the Owner/Engineer.
6. To Light Gauge Steel
   a. Sheet metal screws
7. To Hollow Walls and Nonstructural Building Surfaces
   a. Slotted-channel racks attached to substrate for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other similar devices.
8. To Open Areas
   a. Free standing slotted-channel racks with back plate(s) for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other similar devices.

C. Surface mounted cabinets and panelboards: Provide a minimum of four anchors. Provide steel channel supports to stand cabinet 1 inch off the wall, or on 3/4-inch painted (all sides) fire-rated plywood backboard.

D. Flush mounted cabinets and panelboards: Provide bridging, top and bottom, between studs in wall.

E. Do not fasten hangers or supports to piping, ductwork, mechanical equipment, or other electrical conduit.

F. Ceiling
   1. Support equipment and luminaires from the top chord of bar joists. Connect at bar joist top chord panel point, junction of vertical or angular member to top chord.
   2. Unless otherwise noted on the plans/drawings, do not support equipment from roof deck.
   3. Raceway and junction box installation installed under roof decking shall be supported so that nearest outside surface of the raceway is not less than 1-1/2 inches from the nearest surface of the roof decking.

G. Concrete Housekeeping Pads: Install free-standing electrical equipment on concrete pad(s) that overlap equipment footprint by 4 inches on equipment sides where not against wall. Pad thickness shall be minimum 4 inches, unless otherwise indicated on drawings.

2.07 INSTALLATION OF CONCRETE BASES

A. Construct concrete bases of dimensions indicated on drawings and/or as required to meet these specifications.

B. Concrete mix design shall meet the following minimum requirements:
   1. Concrete fc' = 4,000 PSI min. after 28 days.
   2. Maximum slump shall be 3 inches plus or minus 1 inch before addition of super-plasticizer, max. 7 inches after.
   3. All concrete, except concrete used for interior slabs, shall be air entrained to 6% plus or minus 1.5%. Interior floor concrete shall not be air entrained.
   4. Cement water ratio shall not exceed 0.45.

C. Concrete reinforcement shall be ASTM A615, Grade fy=60,000 PSI.

D. Anchor equipment to concrete base.
   1. Anchors shall be a minimum of 10 bolt diameters from edge of the base.

2. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
3. Install anchor bolts to elevations required for proper attachment to supported equipment.
4. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

E. See Division 03, where applicable, for additional information on the material and installation requirements for concrete bases. Where the specifications are in conflict, the more stringent requirement will be enforced. Consult the Engineer for clarification and/or resolution of any conflict between Division 03 and this Specification Section.

2.08 PAINTING

A. Touchup. Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use the same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup. Cleaning and touchup painting required for field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces. Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

2.09 GUARANTEE (WARRANTY)

No additional material and/or labor warranty beyond that specified in Section 26 05 00 “Common Work Results for Electrical.”

END OF SECTION

SECTION 26 05 33
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings, the provisions of the Contract including the General and Supplementary Conditions, and the General Requirements apply to the Work of this Section.

B. The following sections have been specifically referenced in this specification.
   1. Section 26 05 00 Common Work Results for Electrical.

1.02 SCOPE

A. This Section covers basic electrical requirements for providing labor, materials, equipment, and services necessary for the selection and installation of raceways, fittings, boxes, and accessories or a complete grounded raceway system as shown on the drawings and specified herein. In general, this consists of:
   1. Metal conduits, tubing, and fittings.
   2. Nonmetal conduits, tubing, and fittings.
   3. Metal wireways and auxiliary gutters.
   4. Nonmetal wireways and auxiliary gutters.
   5. Surface raceways.
   6. Boxes, enclosures, and cabinets.
   7. Sleeves for Raceway.
   8. Innerduct.
   9. Conduit Seals.
   10. Corrosion Protective Coatings for Conduits.

1.03 DEFINITIONS/ABBREVIATIONS

A. No additional definitions/abbreviations provided.

1.04 SUBMITTALS

A. Bid: Provide the following with the bid documents.
   1. No additional submittals required; see Specification Section 26 05 00.

B. Manufacture: Provide the following prior to release for manufacture and/or purchase.
   1. Shop Drawings/Data Sheets shall be submitted for approval for the following equipment (confirm list with Engineer):
      a. Data sheets for Surface Raceway.
      b. Shop drawings for custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.
      c. Floor Boxes.
      d. Data sheets for conduit seal.
      e. Data sheets for corrosion protective coating.
   2. Coordination Drawings. Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved.
      a. Structural members in paths of conduit groups with common supports.
      b. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
   3. No submittals required for conduit and fittings.
   4. No samples required.
   5. Submit Seismic Guides and Certification to verify that the specified equipment and installation meet all requirements to withstand potential seismic forces, where required.
      a. Enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.
   6. See also Specification Section 26 05 00.

C. Construction: Provide the following during construction.
   1. No additional submittals required; see Specification Section 26 05 00.

D. Closeout: Provide the following to complete the project.
   1. No additional submittals required; see Specification Section 26 05 00.

1.05 QUALITY ASSURANCE

A. Manufacturer: The equipment manufacturer shall be regularly engaged in the manufacture of raceways, fittings, boxes, and accessories of the types, capabilities, and capacities required, and whose products have been in satisfactory use in similar service for not less than ten years.

B. Installer Qualifications: No additional qualifications specified.

C. Codes/Standards: The products provided by this section shall comply with the latest editions of the following references:
   1. ANSI C80.1 – Rigid Steel Conduit, Zinc Coated
   2. ANSI C80.3 – Electrical Metallic Tubing, Zinc Coated
   3. ANSI C80.5 – Aluminum Rigid Conduit
   4. ANSI C80.6 – Intermediate Metallic Conduit
   5. ANSI/NEMA FB-1 – Fittings and Supports for Conduit and Cable Assemblies
   6. NEMA 250 Enclosures for Electrical Equipment (1000V Maximum)
   7. NEMA OS 1 – Sheet Steel Outlet Boxes, Device Boxes, Covers and Box Supports
   8. NEMA RN-1 – PVC Externally-Coated Galvanized Rigid Steel Conduit
   9. NEMA TC2 – Electrical Plastic Tubing and Conduit
   10. NEMA TC3 – PVC Fittings for Use with Rigid PVC Conduit and Tubing
   11. UL, Building Materials Directory
   12. UL 5 – Surface Metal Raceways and Fittings
   13. UL 651 – Schedule 40 and 80 Rigid PVC Conduit
   14. UL 886 – Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations

D. Equipment Quality: Raceway, fittings, boxes, and accessories shall be “Listed” or “Labeled” as defined in NFPA 70, Article 100, by a National Recognized Testing Laboratory acceptable to authorities having jurisdiction, and marked for the intended location and use.

PART 2 PRODUCTS

2.01 GENERAL INFORMATION.

A. All raceway, fittings, boxes, accessories, and materials shall be new unless otherwise specified on the plan drawings and associated notes. The type of equipment and/or material shall be approved for its planned use and environment and is so defined by NEMA/NFPA 70 standards and NRTL certifications.

2.02 ACCEPTABLE MANUFACTURERS.

A. None Specified.

2.03 METAL CONDUITS, TUBING, AND FITTINGS

A. Metal conduits, tubing, and fittings shall be listed or labeled, and marked for the intended location and application.

B. RMC (steel). Comply with ANSI C80.1 and UL 6.

C. RMC (aluminum). Comply with ANSI C80.5 and UL 6A.

D. IMC. Comply with ANSI C80.6 and UL 1242.

E. PVC-Coated Steel Conduit. PVC-coated Rigid Conduit.
   1. Comply with NEMA RN 1.
   2. Coating Thickness. 0.040 inch (1 mm), minimum.

F. EMT. Comply with ANSI C80.3 and UL 797.

G. FMC. Comply with UL 1; zinc-coated steel or aluminum.

H. LFMC. Flexible steel conduit with PVC jacket and complying with UL 360.

I. Fittings for Metal Conduit. Comply with NEMA FB 1 and UL 514B.
   1. Conduit Fittings for Hazardous (Classified) Locations. Comply with UL 886 and NFPA 70.
   2. Expansion Fittings. PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

3. Coating for Fittings for PVC-Coated Conduit. Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

J. Joint Compound for IMC, GRC, or ARC. Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.04 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Nonmetallic conduits, tubing, and fittings shall be listed or labeled, and marked for the intended location and application.

B. ENT. Comply with NEMA TC 13 and UL 1653.

C. RNC. Complying with NEMA TC 2 and UL 651 unless otherwise indicated.

D. LFNC. Comply with UL 1660.

E. Continuous HDPE. Comply with UL 651B.

F. Coilable HDPE. Preassembled with conductors or cables, and complying with ASTM D 3485.

G. Fittings for ENT and RNC. Comply with NEMA TC 3; match to conduit or tubing type and material.

H. Fittings for LFNC. Comply with UL 514B.

2.05 FIBERGLASS CONDUIT

A. Reinforced Thermosetting Resin (RTRC) per NEC 355. May be used for underground application. May be used for factory elbows in lieu of RMC.

2.06 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description. Sheet metal, complying with UL 870 and NEMA 250 unless otherwise indicated, and sized according to NFPA 70. See drawings for ‘Type’.
   1. Metal wireways installed outdoors shall be listed or labeled, and marked for intended location and application.

B. Fittings and Accessories. Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

C. Wireways shall be provided without knockouts and shall have hinged covers.

2.07 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

A. Nonmetallic wireways and auxiliary gutters shall be listed or labeled, and marked for the intended location and application.

B. Description. Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.

C. Description. PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.

D. Fittings and Accessories. Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

E. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers.

2.08 SURFACE RACEWAYS

A. Surface raceways shall be listed or labeled, and marked for intended location and application.

B. Surface Metal Raceways – Undivided
   1. Painted 0.040” thickness steel housing. 2 inches wide single wiring compartment.

2. Snap on painted steel cover
3. Receptacles installed every 24 inches.
4. Factory supplied complete line of fittings, including inside corners, outside corners, vertical and horizontal conduit entry fittings,
5. Factory supplied tools specifically designed to cut channel to length without damage and to punch receptacle openings without damage to painted finish.
6. UL 5 listed component raceway system
7. Wiremold/Legrand type V2400 series, suitable for indoor dry locations only.

C. Surface Metal Raceway – Divided
1. Galvanized and Painted 0.050" thickness steel housing (base). 4 inches wide, 1.75 inches deep, with divider for power receptacles and data jacks. Field cut to length
2. Snap on galvanized and painted steel cover with pre-cut outlet openings spaced at 24" on center.
3. Provide receptacles installed every 24 inches
4. Factory supplied complete line of fittings, including inside corners, outside corners, vertical and horizontal conduit entry fittings.
5. Factory supplied tools specifically designed to cut channel to length without damage and to punch receptacle openings without damage to painted finish.
6. UL listed multi-outlet assembly
7. Wiremold/Legrand the V4000 series. Suitable for indoor dry locations only.

D. Surface Nonmetallic Raceways. Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.

2.09 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets. Boxes, enclosures, and cabinets installed in wet locations shall be labeled or listed, and marked for use in wet locations.

B. Sheet Metal Outlet and Device Boxes. Comply with NEMA OS 1 and UL 514A.

C. "Cast-Metal Outlet and Device Boxes" as noted below, shall be suitable for use with steel raceways in the installed environments. Use Type FD device box with extra depth, unless otherwise specified on the drawings or approved by the Engineer.

D. Cast-Metal Outlet and Device Boxes. Comply with NEMA FB 1, non-ferrous alloy, Type FD, with gasketed cover.

E. Nonmetallic Outlet and Device Boxes. Comply with NEMA OS 2 and UL 514C.

F. Metal Floor Boxes:
1. Listing and Labeling. Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Nonmetallic Floor Boxes:
1. Nonmetallic floor boxes shall be listed or labeled, and marked for intended location and application.

H. Luminaire Outlet Boxes. Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed or labeled, and marked for the maximum allowable weight.

I. Paddle Fan Outlet Boxes. Nonadjustable, designed for attachment of paddle fan weighing 70 lb (32 kg).
1. Paddle fan outlet boxes shall be listed or labeled, and marked for intended location and application.

J. Small Sheet Metal Pull and Junction Boxes. NEMA OS 1.

K. Cast-Metal Access, Pull, and Junction Boxes. Comply with NEMA FB 1 and UL 1773, with gasketed cover.

L. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

M. Hinged-Cover Enclosures. Comply with UL 50 and NEMA 250, with continuous-hinge cover with flush latch unless otherwise indicated. Type shall be as required by drawings and / or to match existing adjacent enclosures.
   1. Metal Enclosures. Steel, finished inside and out with manufacturer's standard enamel.
   2. Interior Panels. Steel; all sides finished with manufacturer's standard enamel.

N. Cabinets
   1. NEMA 250, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Type shall be as required by drawings and / or to match existing adjacent enclosures.
   2. Hinged door in front cover with flush latch and concealed hinge.
   3. Key latch to match panelboards.
   4. Metal barriers to separate wiring of different systems and voltage.
   5. Accessory feet where required for freestanding equipment.
   6. Nonmetallic cabinets shall be listed or labeled, and marked for intended location and application. Use permitted where noted on drawings or approved by the Engineer.

2.10 SLEEVES FOR RACEWAYS

A. Provide sleeves for all cables passing through walls. Provide sleeves for conduits passing through floors, footings, and/or exterior walls. Provide metal pipe sleeves for conduits 1-1/4” and larger passing through walls.

B. Provide sealing material at pipe sleeves that must be sealed against hydrostatic pressure, i.e. footing penetrations. Sleeve seals shall be furnished with EPDM sealing elements, plastic pressure plates, and carbon-steel bolts. NBR and silicone sealing elements, carbon- and stainless-steel pressure plates, and stainless-steel bolts are available for special applications.

C. Sleeves for penetrations through fire rated walls for low voltage cables that are UL listed shall be used. Hilti CP Speed Sleeve or equal.

2.11 INNERDUCT

A. Provide a 3-cell non-metallic plastic PET fabric mesh type inner-duct installed in all outdoor underground telecom conduits. All inner-ducts shall include a pull string rated for 1,250 lbs. pulling tension. Use MAXCELL Edge series or similar.

2.12 CONDUIT SEAL AT OUTDOOR CONDUITS

A. Provide sealant inside conduit around conductors to prevent air movement for all conduits that penetrate exterior walls. Sealant shall be specifically identified for use for the conductor insulation per NEC 300.7; PolyWater FST or equal.

2.13 CONDUIT SEAL AT UNDERGROUND CONDUITS

A. At all locations where underground conduits enter the building (i.e., service entrance or ductbanks) provide inflatable water and moisture seal; PolWater ZipSeal, Raychem RDSS, or equal.

2.14 CORROSION PROTECTIVE COATING

A. Provide corrosion protection spray applied coating to all factory of field cut conduit threads for RMC and IMC; PolyWater CG Cold-Galv spray or equal.

B. Provide corrosion protective tape installed along all direct buried rigid metal conduits. Wrap tape using 1/3 lap spiral wrapping. Use 3M #50 or #51 corrosion protective tape.

2.15 FIRESTOPPING

Seal all openings around conduit or other electrical work penetrating fire and smoke rated partitions, floors, and ceilings. Firestop material shall comply with UL 1479, NEC 300-21, and NEC 800-3(c). 3M FireStop putty or caulk.

PART 3 EXECUTION

3.01 GENERAL INFORMATION

A. Provide all labor and raceways, fittings, boxes, associated equipment, and materials required to provide a complete raceway system in accordance with applicable local, state, national codes,

and the manufacturers' recommendations, except where the plan set drawings, associated notes, schedules, and/or specifications are stricter.

B. Raceways and boxes shall be installed in a neat and workmanlike manner.
   1. The NEIS Standard Practices for Good Workmanship in Electrical Contracting NECA 1 (latest edition) is hereby adopted to define the minimum guideline for such workmanship and the installation:
      a. Comply with NECA 101 for steel conduit installation requirements.
      b. Comply with NECA 102 for aluminum conduits installation requirements.
      c. Comply with NECA 111 for non-metallic conduit installation requirements
   2. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors

C. Coordinate layout and installation of raceways, boxes, and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

D. Flattened, dented, deformed, or opened conduit shall not be permitted. If damaged during installation, damaged conduit shall be replaced with new undamaged material. Prevent foreign matter from entering raceways by using temporary closure protection. Test conduits with ball mandrel. Clear any conduit which rejects the ball and mandrel

E. Minimum size conduit run shall be 3/4 inch.

F. Installation shall be in accordance with the NEC and as shown in the Drawings.

G. Install surface raceways as shown in the Drawings.

H. Environment:
   1. Consult the drawings for the required raceway types and locations. Where no selection is provided use the following minimum requirement:

a.	Outdoors Exposed	RMC
b.	Outdoor Buried	RMC
c.	Outdoor Buried Corrosive Soils	PVC-80
d.	Embedded Concrete	PVC-40
e.	Indoor Dry Exposed Office/Warehouse	EMT
f.	Indoor Dry Exposed Factory	IMC
g.	Indoor Wet Exposed	IMC
h.	Indoors Concealed	EMT, Flexible Metal Conduit
i.	Corrosive Area:	Coated RMC, RTRC, PVC-40
j.	Classified Areas:	RMC
k.	Indoor below slabs	PVC-40

   2. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
   3. Do not install nonmetallic conduit where ambient temperature exceeds 120°F.

I. Raceway Fittings
   1. Compatible with raceways and suitable for use and location.
   2. Rigid and Intermediate Steel Conduit. Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
   3. PVC Externally Coated, Rigid Steel Conduits. Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant that is recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.

3.02 RACEWAY AND BOX INSTALLATION

A. Raceways General:
   1. Conceal raceways within finished walls, ceilings, and floors, unless otherwise noted.
   2. Assure that conduit installation does not encroach into the ceiling height headroom, walkways, or doorways. Align and run conduit parallel or perpendicular to the building lines and or adjacent piping. Install horizontal runs close to the ceiling or beams, and

secure with conduit straps. Independently support all conduits. Do not use other supports i.e., (suspended ceilings, suspended ceiling supporting members, lighting fixtures, mechanical piping, or mechanical ducts).

3. Complete raceways installation before starting conductor installation.
4. Support all trapezes and all above ground feeder conduits from the building structure. Parallel runs of six (6) or more conduits shall be supported from the building structure. Do not support conduit with wire, nylon ties, nor perforated pipe straps. Remove wire used for temporary supports. Do not attach conduit to ceiling support wires. Do not support raceways from mechanical ductwork or equipment, except where required to connect to the equipment.
5. Run all conduit in areas with unfinished ceilings above bottom chord of joists.
6. Arrange stub-ups so curved portions of bends are not visible above finished slab.
7. Support conduit within 12 inches (300 mm) of changes in direction.
8. Support conduit within 12 inches (300 mm) of enclosures to which attached.
9. Do not run conduits in columns except to feed column mounted devices.
10. Place conduits at least 24 inches away from all hot piping and surfaces including domestic hot water lines. Do not mount conduit on mechanical equipment except where necessary to connect electrical devices mounted on the equipment. Provide 18 inches of flexible conduit in all runs "bridging" vibration mountings.
11. Do not run conduit on or directly in front of access doors, removable panels, equipment removal spaces, control devices or other spaces necessary for normal maintenance and repair of the equipment.
12. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system. Cap or plug conduit ends during construction. Cap or plug ends of conduits that are to remain empty and make watertight. Clean and swab conduits prior to pulling in conductors.
13. Uncoated metal conduits must be approved by the Engineer for installation underground. If approved the conduit shall be protected by two coats of bituminous paint (Koppers Bitumastic or equal) or by vinyl tape (3M Scotchrap #51 or equal).
14. Seal all conduits penetrations of smoke or fire rated walls or floors with intumescent type fire barriers, 3M or equal. Seal all conduits where they pass through exterior walls and where they enter exterior fixtures. Seal all conduits where temperature differential between adjacent spaces is greater than 30 degrees Fahrenheit.
15. Do not route line side and load side conductors for a VFD in the same raceway. Provide dedicated, separate line side and load side conduits and conductors for each VFD controlled motor.
16. Protect all grounding electrode conductors from physical damage using schedule 80 PVC conduit per NEC 250.64 requirements.
17. All underground transitions to above ground shall be RMC or IMC or Fiberglass. All underground elbows shall be RMC or fiberglass.

B. Raceways Embedded in Slabs:

1. Install in middle third of the slab thickness where practical and leave at least 2-inch (25 mm) concrete cover. Tie raceways to reinforcing rods or otherwise secure them to prevent sagging or shifting during concrete placement. Space raceways laterally to prevent voids in the concrete. Where nonmetallic conduit is used, raceways must be converted to rigid steel conduit or IMC before rising above floor.
2. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m) intervals.
3. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
4. Arrange raceways to keep a minimum of 2 inches (50 mm) of concrete cover in all directions.
5. Do not embed threadless fittings in concrete unless specifically approved by Engineer for each specific location.
6. Use of nonmetallic tubing in fire-rated slabs must be approved by the Engineer and authority having jurisdiction.

C. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

D. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions. Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

E. Coat field-cut threads on all threaded raceways with a corrosion-preventing compound. Use cold galv spray.

F. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35-mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

G. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

H. Surface Raceways General:
1. Install surface raceway with a minimum 2-inch radius control at bend points.
2. The raceway shall be securely supported at intervals in accordance with NEC and manufacturer’s installation sheets. All raceway systems shall be installed complete, including insulating bushings and inserts where required by manufacturer’s installation sheets. Coordinate installation with General Contractor where raceway is installed in or above casework.
    a. Secure surface raceway with screws or other anchor-type devices at maximum intervals not exceeding 36 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods
3. Provide a separate ground conductor in each section of raceway and bond to supply conduit system in an approved manner

I. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.

J. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

K. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m).
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
    a. Outdoor Locations Not Exposed to Direct Sunlight. 125 deg F (70 deg C) temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight. 155 deg F (86 deg C) temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation. 125 deg F (70 deg C) temperature change.
    d. Attics. 135 deg F (75 deg C) temperature change.
3. Install expansion fittings at all locations where conduits cross building or structure expansion joints.

4. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

L. Flexible Conduit Connections. Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

M. Boxes General:
1. Installation shall be in accordance with the NEC Article 314 and as shown on schedules on the drawings.
2. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements.
3. Recessed Boxes in Masonry Walls. Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between the box and cover plate or the supported equipment and box.
4. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
5. Locate boxes so that cover or plate will not span different building finishes.
6. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
7. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
8. Set metal floor boxes level and flush with finished floor surface.
9. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
10. Interior outlet junction boxes shall not be mounted back-to-back in the same wall.
11. Junction boxes shall be securely mounted and arranged so that the boxes are square with the building surfaces.
12. Wall outlet boxes shall be plumb and accurately aligned in rows. Mount ceiling boxes symmetrical with walls, beams and/or tiles.
13. Mount outlet boxes in exposed masonry walls with the top and one side of the box on mortar joints but not less than 15" A.F.F.
14. Provide center mounted fixture studs in boxes for direct fixture mounting. Provide special fixture hangers and/or auxiliary supports where the weight of the fixture requires more support than the fixture stud.
15. Thru-wall boxes shall not be used unless specifically noted.
16. Close openings in all outlet boxes during plaster and concrete work with plain paper or slip on plastic or metal plates. Do not use newspaper.
17. Provide pull boxes fabricated of code gauge, galvanized sheet steel with screw covers held in place by corrosion resistant screws, and located to be accessible when the building is finished. Do not locate pull boxes in finished spaces without the specific approval of the Engineer/Architect. Equip boxes requiring 4 1/2" square or smaller covers with blank covers to match switch plates. Paint 5" square or larger steel pull box covers to match electrical panel fronts.

N. Raceways for Optical Fiber and Communications Cable. Install ferrous raceways, metallic, rigid or flexible, as follows:
1. 3/4-Inch (19-mm) Trade Size and Smaller. Install raceways in maximum lengths of 50 feet (15 m).
2. 1-Inch (25-mm) Trade Size and Larger. Install raceways in maximum lengths of 75 feet (23 m).
3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements. Provide brushed ends.

3.03 INSTALLATION OF WIREWAY

A. Installation shall be in accordance with the NEC Article 376, 378, and 366, respectively, and as shown on the drawings.

B. Manufacturer's suggested insulating bushings and inserts at connections to outlets and corner fittings shall be used, as required

3.04 PENETRATIONS.

A. Where raceways pass through fire partitions, fire walls, or smoke partitions, install a fire stop that provides an effective barrier against the spread of fire, smoke, and gasses with rock wool fiber or silicone foam sealant only. Each such penetration shall be separated from all others by 2-inch clear (not center-to-center) minimum. Completely fill and seal clearances between raceways and openings with the fire-stop material. Penetrations shall meet the requirements of UL 1479.

3.05 FIRESTOPPING.

A. Apply fire stop material to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and proposed installation procedures shall be submitted to Engineer for approval.

3.06 INSTALLATION OF SLEEVES

A. Coordinate sleeve locations.
   1. Where raceways pass through floors, floors shall be core drilled and appropriately sized sleeves shall be installed. Sleeves shall terminate not less than 3 inches above floor slabs and not less than 3 inches below the ceiling of the floor below. Completely seal clearances between the raceway and sleeve, and make watertight. Low-voltage sleeves shall be brushed.
   2. Schedule 40 pipe sleeves shall have at least three (3) concrete anchors.
   3. Set all sleeves true to line, grade and position and plumb or level after concrete is poured. Correct any deviation from proper position.
   4. Provide galvanized steel tube sleeve 1-1/2 inches larger than O.D. of conduit. Sleeve shall have wall thickness of 0.061 inches.
   5. Engineer shall approve below grade conduit seal method. Where conduits pass through exterior concrete walls below grade, provide "Link-Seal" or caulk both sides with oakum and lead wool or otherwise adequately waterproof the openings around the conduit.
   6. Caulk spaces between pipe and floor sleeves inside the building with a waterproof caulking material. Spaces between pipe and exterior partition sleeves shall be caulked with fiber glass insulation.
   7. Seal space outside of sleeves with grout for penetrations of concrete and masonry
   8. Roof-Penetration Sleeves. Seal penetration of individual raceways with flexible boot-type flashing units applied in coordination with roofing work.
   9. Aboveground, Exterior-Wall Penetrations. Seal penetrations using pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
   10. Underground, Exterior-Wall Penetrations. Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.07 PROTECTION/CLEANING

A. Upon completion of installation of raceways, inspect interiors of raceways; clear all blockages and remove burrs, dirt, and construction debris.

B. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion. Remove all construction debris.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.08 GUARANTEE (WARRANTY)

No additional material and/or labor warranty beyond that specified in Section 26 05 00 “Common Work Results for Electrical.”

END OF SECTION

SECTION 26 05 43
UNDERGROUND RACEWAYS

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. Metal conduits and fittings, including RMC.
   2. Rigid nonmetallic duct.
   3. Duct accessories.
   4. Polymer concrete handholes and boxes with polymer concrete cover.
   5. High-density plastic boxes.

1.03 DEFINITIONS

A. Direct Buried: Duct or a duct bank that is buried in the ground, without any additional casing materials such as concrete.

B. Duct: A single duct or multiple ducts. Duct may be either installed singly or as component of a duct bank.

C. Duct Bank:
   1. Two or more ducts installed in parallel, with or without additional casing materials.
   2. Multiple duct banks.

D. RMC: Galvanized rigid (steel) metal conduit.

E. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include duct-bank spacers and miscellaneous components.
   2. Include duct, conduits, and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
   3. Include accessories for manholes, handholes,
   4. Include underground-line warning tape.
   5. Include warning planks.

B. Shop Drawings:
   1. Factory-Fabricated concrete handholes and Boxes Other Than Precast Concrete:
      a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.
      b. Include duct entry provisions, including locations and duct sizes.
      c. Include cover design.
      d. Include grounding details.
      e. Include dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For duct and duct bank. Show duct profiles and coordination with other utilities and underground structures.
   1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
   2. Drawings shall be signed and sealed by a qualified professional engineer.

B. Qualification Data: For professional engineer and testing agency responsible for testing nonconcrete handholes and boxes.

C. Product Certificates: For concrete and steel used in precast concrete handholes, as required by ASTM C 858.

D. Source quality-control reports.

E. Field quality-control reports.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

1.07 FIELD CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions, and then only after arranging to provide temporary electrical service according to requirements indicated:
   1. Notify Owner no fewer than two days in advance of proposed interruption of electrical service.
   2. Do not proceed with interruption of electrical service without owner's written permission.

B. Ground Water: Assume ground-water level is at grade level unless a lower water table is noted on Drawings.

C. Ground Water: Assume ground-water level is 36 inches below ground surface unless a higher water table is noted on Drawings.

PART 2 PRODUCTS

2.01 METAL CONDUIT AND FITTINGS

A. RMC: Comply with ANSI C80.1 and UL 6.

2.02 RIGID NONMETALLIC CONDUIT

A. Underground Plastic Utilities Duct: Type EPC-40-PVC RNC, complying with NEMA TC 2 and UL 651, with matching fittings complying with NEMA TC 3 by same manufacturer as duct.

B. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

C. Solvents and Adhesives: As recommended by conduit manufacturer.

D. HDPE Duct: Type EPEC-40 HDPE, complying with NEMA TC 7 and UL 651A.

2.03 DUCT ACCESSORIES

A. Duct Spacers: Factory-fabricated, rigid, PVC interlocking spacers; sized for type and size of duct with which used, and selected to provide minimum duct spacing indicated while supporting duct during concreting or backfilling.

B. Underground-Line Warning Tape: Comply with requirements for underground-line warning tape specified in Section 260553 "Identification for Electrical Systems."

2.04 PRECAST CONCRETE HANDHOLES

A. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.

B. Comply with ASTM C 858 for design and manufacturing processes.

C. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.

D. Frame and Cover: Weatherproof steel frame, with steel cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.

E. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

F. Cover Legend: Molded lettering, “**ELECTRIC."**

G. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.

H. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

I. Knockout Panels: Precast openings in walls, arranged to match dimensions and elevations of approaching duct, plus an additional 12 inches vertically and horizontally to accommodate alignment variations.
   1. Splayed location.
   2. Knockout panels shall be located no less than 6 inches from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.
   3. Knockout panel opening shall have cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct.
   4. Knockout panels shall be framed with at least two additional No. 3 steel reinforcing bars in concrete around each opening.

J. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
   1. Type and size shall match fittings to duct to be terminated.
   2. Fittings shall align with elevations of approaching duct and be located near interior corners of handholes to facilitate racking of cable.

K. Handholes 48 X 48 INCHES X 48” DEEP as a typical size. Larger may be used. Submittal required. Or two handholes may be used where a single is not large enough to handle the approaching conduits in a duct.

2.05 POLYMER CONCRETE HANDHOLES AND BOXES WITH POLYMER CONCRETE COVER

A. Manufacturer: Hubbell Power Systems – Quazite, Oldcastle, or prior approved equivalent.

B. Description: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.

C. Standard: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.

D. Color: Gray.

E. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.

F. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.

G. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

H. Cover Legend: Molded lettering, "ELECTRIC."

I. Handholes 48 INCHES X 48 INCHES X 48 INCHES DEEP. Larger may be used. Submittal required. Or two handholes may be used where a single is not large enough to handle the approaching conduits in a duct

2.06 HIGH-DENSITY PLASTIC BOXES

A. Manufacturer: Channell, or prior approved equivalent.

B. Description: Injection molded of HDPE or copolymer-polypropylene. Cover shall be made of polymer concrete. USED ONLY FOR LIGHTING CIRCUITS.

C. Standard: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.

D. Lid Color: Gray.

E. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.

F. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.

G. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

H. Cover Legend: Molded lettering, "ELECTRIC."

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate layout and installation of duct, duct bank, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Architect if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.

B. Coordinate elevations of duct and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of duct and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct and duct bank will drain to manholes and handholes, and as approved by Architect.

C. Clear and grub vegetation to be removed, and protect vegetation to remain according to Section 311000 "Site Clearing." Remove and stockpile topsoil for reapplication according to Section 311000 "Site Clearing."

3.02 UNDERGROUND DUCT APPLICATION

A. Duct for Electrical Cables More Than 600 V: Type EPC-40-PVC RNC, concrete-encased unless otherwise indicated.

B. Duct for Electrical Feeders 600 V and Less: Type EPC-40-PVC RNC, concrete-encased unless otherwise indicated.

C. Duct for Electrical Branch Circuits: Type EPC-40-PVC RNC, direct-buried unless otherwise indicated.

D. Underground Ducts Crossing Paved Paths, Walks and Roadways: Type EPC-40 PVC RNC, encased in reinforced concrete.

E. Stub-ups: Concrete-encased GRC.

3.03 UNDERGROUND ENCLOSURE APPLICATION

A. Handholes and Boxes for 600 V and Less:
   1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17,H-20 structural load rating.
   2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-20 Polymer concrete or High Density Plastic, SCTE 77, Tier 22 structural load rating.
   3. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Precast concrete or High Density Plastic, AASHTO HB 17, H-10 structural load rating.
   4. Units Subject to Light-Duty Pedestrian Traffic Only: Precast concrete or High Density Plastic, AASHTO HB 17, H-10 structural load rating.
   5. Cover design load shall not exceed the design load of the handhole or box.

3.04 DUCT AND DUCT-BANK INSTALLATION

A. Where indicated on Drawings, install duct, spacers, and accessories into the duct-bank configuration shown. Duct installation requirements in this Section also apply to duct bank.

B. Install duct according to NEMA TCB 2.

C. Slope: Pitch duct a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope duct from a high point between two manholes, to drain in both directions.

D. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 60 inches, both horizontally and vertically, at other locations unless otherwise indicated.
   1. Duct shall have maximum of two 90 degree bends or the total of all bends shall be no more 180 degrees between pull points.

E. Joints: Use solvent-cemented joints in duct and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent duct do not lie in same plane.

F. Installation Adjacent to High-Temperature Steam Lines: Where duct is installed parallel to underground steam lines, perform calculations showing the duct will not be subject to

environmental temperatures above 40 deg C. Where environmental temperatures are calculated to rise above 40 deg C, and anywhere the duct crosses above an underground steam line, install insulation blankets listed for direct burial to isolate the duct bank from the steam line.

G. End Bell Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch duct, and vary proportionately for other duct sizes.
   1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell, without reducing duct slope and without forming a trap in the line.
   2. Expansion and Deflection Fittings: Install an expansion and deflection fitting in each duct in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight line direct-buried duct with calculated expansion of more than 3/4 inch.
   3. Grout end bells into structure walls from both sides to provide watertight entrances.

H. Entrances to Manholes and Concrete and Polymer Concrete Handholes: Change spacing from duct spacing to allow conduits to enter handhole.
   1. Begin change from regular spacing to handhole spacing 10 feet from the handhole without reducing duct line slope and without forming a trap in the line.

I. Building Wall Penetrations: Make a transition from underground duct to GRC at least 10 feet outside the building wall, without reducing duct line slope away from the building and without forming a trap in the line. Use fittings manufactured for GRC transition. Install GRC penetrations of building walls as specified in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

J. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal all conduits that enter buildings or basements. Use Polywater FST foam sealant.

K. Pulling Cord: Install 200-lbf- test nylon cord in empty ducts.

L. Concrete-Encased Ducts and Duct Bank:
   1. Excavate trench bottom to provide firm and uniform support for duct. Prepare trench bottoms as specified in Section 312000 "Earth Moving".
   2. Width: Excavate trench 12 inches wider than duct on each side.
   3. Depth: Install so top of duct envelope is at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 36 inches below finished grade in deliberate traffic paths for vehicles unless otherwise indicated.
   4. Support duct on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
   5. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 feet of duct. Place spacers within 24 inches of duct ends. Stagger spacers approximately 6 inches between tiers. Secure spacers to earth and to duct to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
   6. Elbows: Use manufactured GRC elbows for stub-ups, at building entrances, and at changes of direction in duct run.
      a. Couple RNC duct to GRC with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
      b. Stub-ups to Outdoor Equipment: Extend concrete-encased GRC horizontally a minimum of 12 inches from edge of base. Install insulated grounding bushings on terminations at equipment.
         1) Stub-ups shall be minimum 4 inches above finished floor and minimum 3 inches from conduit side to edge of slab
      c. Stub-ups to Indoor Equipment: Extend concrete-encased GRC horizontally a minimum of 6 inches from edge of wall. Install insulated grounding bushings on terminations at equipment.
         1) Stub-ups shall be minimum 4 inches above finished floor and no less than 3 inches from conduit side to edge of slab

7. Reinforcement: Reinforce concrete-encased duct using hoop ties and lengthwise rebar as indicated.
8. Forms: Form all duct banks. Possible to use gypsum board (sheetrock) as a form material to avoid stripping the forms after the pour.
9. Concrete Cover: Install a minimum of 3 inches of concrete cover between edge of duct to exterior envelope wall.
10. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
    a. Start at one end and finish at the other, allowing for expansion and contraction of duct as its temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written instructions, or use other specific measures to prevent expansion-contraction damage.
    b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing-rod dowels extending a minimum of 18 inches into concrete on both sides of joint near corners of envelope.
11. Pouring Concrete: Comply with requirements in "Concrete Placement" Article in Section 033000 "Cast-in-Place Concrete." Place concrete carefully during pours to prevent voids under and between duct and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow around duct and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-installation application.

M. Back Fill: Provide coarse sand to backfill duct banks.

N. Underground-Line Warning Tape: Bury conducting underground line specified in Section 260553 "Identification for Electrical Systems" no less than 12 inches above all concrete-encased duct and duct banks.

3.05 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of duct, and seal joint between box and extension as recommended by manufacturer.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch above finished grade or flush with concrete sidewalks.

D. Install handholes and boxes with bottom below frost line, 48” below grade.

E. Field cut openings for duct according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

F. For enclosures installed subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.
    1. Concrete: 3000 psi, 28-day strength, complying with Section 033000 "Cast-in-Place Concrete," with a troweled finish.
    2. Dimensions: 10 inches wide by 12 inches deep.

3.06 GROUNDING

A. Ground underground ducts and utility structures according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

3.07 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
    1. Demonstrate capability and compliance with requirements on completion of installation of underground duct, duct bank, and utility structures.

2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 12-inch-long mandrel equal to duct size minus 1/4 inch. If obstructions are indicated, remove obstructions and retest.
3. Test and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 26 05 26 "Grounding and Bonding for Electrical Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.

C. Prepare test and inspection reports.

3.08 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of duct until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes, including sump.
1. Sweep floor, removing dirt and debris.
2. Remove foreign material.

END OF SECTION

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings, the provisions of the Contract including the General and Supplementary Conditions, and the General Requirements apply to the Work of this Section.

B. The following sections have been specifically referenced in this specification:
   1. Section 26 05 00 Common Work Results for Electrical.

1.02 SCOPE

A. This Section covers basic electrical requirements for providing labor, materials, supplies, and services necessary for the implementation of the identification of electrical equipment as shown on the drawings and specified herein.
   1. Identification for raceways.
   2. Identification of power and control cables.
   3. Identification for conductors.
   4. Underground-line warning tape.
   5. Warning labels and signs.
   6. Instruction signs.
   7. Equipment identification labels.
   8. Miscellaneous identification products.

1.03 DEFINITIONS/ABBREVIATIONS

A. No additional definitions/abbreviations provided.

1.04 SUBMITTALS

A. Bid. Provide the following with the bid documents.
   1. No additional submittals required; see Specification Section 26 05 00.

B. Manufacture. Provide the following prior to release for manufacture and/or purchase.
   1. Shop Drawings/Data Sheets shall be submitted for approval for the following equipment:
      a. Schedule of equipment nameplates
      b. Color graphic mock-up of equipment nameplates.
      c. Data Sheet of buried electrical line warning tape.
   2. Samples of each type of proposed label and/or signs for examination/approval.

C. Construction. Provide the following during construction.
   1. No additional submittals required; see Specification Section 26 05 00.

D. Closeout. Provide the following to complete the project.
   1. Confirmation report that all labelling has been completed.
   2. See also Specification Section 26 05 00.

1.05 QUALITY ASSURANCE

A. Manufacturer: The equipment manufacturer shall be regularly engaged in the production of materials of the types, capabilities, and capacities required, and whose products have been in satisfactory use in similar service for not less than ten years.

B. Installer Qualifications: No additional qualifications specified.

C. Codes/Standards: The products provided by this section shall comply with the latest editions of the following references.
   1. ANSI A13.1 – Pipe Identification Standard.
   2. 29 CFR 1910.145 – Accident Prevention Tags.
   3. ANSI Z535.4 – Safety Signs and Labels.

D. Equipment Quality: Electrical materials and accessories shall be “Listed” or “Labeled” (where applicable) as defined in NFPA 70, Article 100, by a National Recognized Testing Laboratory acceptable to authorities having jurisdiction, and marked for the intended location and use.

PART 2 PRODUCTS

2.01 GENERAL INFORMATION.

A. All materials and accessories shall be new unless otherwise specified on the drawings, schedules, and associated notes. The type of equipment and/or material shall be approved for its planned use and environment and is so defined by NEMA/NFPA 70 standards and NRTL certifications.

2.02 ACCEPTABLE MANUFACTURERS

A. None specified.

2.03 EQUIPMENT IDENTIFICATION LABELS

A. Standard Nameplate (Applied on the Exterior of Equipment)
   1. Engraved, Laminated Acrylic or Melamine Label.
   2. Mounting
      a. Punched or drilled for screw mounting.
      b. Alternate: Backed double sided adhesive tape. Requires Engineering approval.
   3. Minimum letter height shall be 3/8 inch.

B. Interior Nameplate: (Applied on Interior of Equipment)
   1. Adhesive Film Label with Clear Protective Overlay. Overlay shall provide a weatherproof and UV-resistant seal for label.
   2. Machine printed by thermal transfer or equivalent process.
   3. Minimum letter height shall be 3/8 inch.

C. Outdoor Nameplate (Applied on Equipment located Outside)
   1. Stenciled, nonfading, waterproof, ink or paint on white field.
   2. Minimum letter height shall be 2 inches

D. Nameplate Color
   1. Equipment Supplied by Normal Utility Power System.
      a. Above 600V: White letters on a Red field.
      b. Above 480V to 600V: Black letters on an Orange field.
      c. Above 250V or less: White letters on a Blue field.
   2. Generator or standby power system.
      a. Generator Standby (NEC 701 Required, NEC 702 Optional) Black letters on a Yellow field.
      b. Generator Emergency (NEC 700 Life Safety) Red letters on a White field

E. Panelboard and lightning control cabinet relay schedules shall be typed and dated on card stock.

2.04 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Standard Raceway Label (Located Inside)
   1. Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label

C. Standard Raceway Label (Located Outside)
   1. Stenciled, nonfading, waterproof, ink or paint on white field

D. Colors for Raceway Labels
   1. Above 600V: White letters on a Red field.
   2. Above 480V to 600V: Black letters on an Orange field.
   3. Above 250V or less: White letters on a Blue field.

2.05 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.

B. This section includes plastic/rubber jacketed, armor, and metal clad cable.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Marker Tags: Polyester tag, 0.015 inch thick with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
   1. Marker for Tags: Machine-printed, permanent, and waterproof.

E. Colors for Armored and Metal Clad cables only.
   1. Above 600V: White letters on a Red field.
   2. Above 480V to 600V: Black letters on an Orange field.
   3. Above 250V or less: White letters on a Blue field

2.06 CONDUCTOR IDENTIFICATION MATERIALS

A. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

B. Marker Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
   1. Marker for Tags: Machine-printed, permanent, and waterproof.

C. Standard Coloring: Color manufactured into insulated conductor jacket.

D. Alternate Coloring: Colored Phasing Tape
   1. Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide. Use of phasing tape must be approved by the Engineer.

2.07 FLOOR MARKING TAPE

A. A 2-inch wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.08 UNDERGROUND-LINE WARNING TAPE

A. Tape:
   1. Suitable to identify and locate underground electrical and communication utility lines.
   2. Recognized by NRTL and conforming to the Manufacturer's published uses and suitable for direct burial.
   3. Printing on tape shall be permanent and shall not be damaged by burial operations.
   4. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:
   1. Comply with ANSI Z535.1 through ANSI Z535.5.
   2. Pigmented polyolefin, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
      a. Thickness: 4 mils.
      b. Weight: 18.5 lb./1000 sq. ft.
      c. 3-Inch Tensile According to ASTM D 882: 30 lbf, and 2500 psi
   3. HIGH VOLTAGE Lines:
      a. Tape Color: Red
      b. Tape Message: ELECTRIC LINE, HIGH VOLTAGE
   4. SIGNAL Lines:
      a. Tape Color: Orange
      b. Tape Message: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

2.09 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:
   1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
   2. 1/4-inch (6.4-mm) grommets in corners for mounting.
   3. Nominal size, 7 by 10 inches (180 by 250 mm).

D. Metal-Backed, Butyrate Warning Signs:
   1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application.
   2. 1/4-inch (6.4-mm) grommets in corners for mounting.
   3. Nominal size, 10 by 14 inches (250 by 360 mm).

E. Warning label and sign shall include, but are not limited to, the following legends:
   1. Power Source Warning: DANGER XX VOLTS - ELECTRICAL SHOCK, ARC FLASH HAZARD, ARC BLAST HAZARD."
   2. First subparagraph below applies to OSHA requirements for building operations and does not reflect the clear working space required by NFPA 70.
   3. Workspace Clearance Warning: WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES
   4. Explosion Hazard: DANGER CLASS I DIVISION 1 ELECTRICAL HAZARDOUS CLASSIFICATION AREA
   5. See Project documents for other labeling, including arc-flash, multiple services, multiple voltages, and others.

2.10 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.
   1. Engraved legend with black letters on white face.
   2. Punched or drilled for mechanical fasteners.
   3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

2.11 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Select paint system applicable for surface material and location (exterior or interior). Prepare surface to improve application and durability of paint.

B. Mechanical Fasteners for Labels and Signs:
   1. Self-tapping, stainless-steel screws.
   2. Stainless-steel machine screws with nuts and flat and lock washers.

C. Cable Ties:
   1. Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
      a. Minimum Width: 3/16 inch.
      b. Tensile Strength: 50 lb. minimum.
      c. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
      d. Color: Black, except where used for color-coding.

PART 3 EXECUTION

3.01 GENERAL INFORMATION.

A. Provide all labor and materials required for the installation of all markings, warning and informational signs, labels, and nameplates to completely document the electrical system in accordance with applicable local, state, national codes, and the manufacturers' recommendations, except where the plan set drawings, associated notes, schedules, and/or specifications are stricter.

B. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Orient labels so that visible from the floor.

D. Increase sizes of labels and letters to those appropriate for viewing from the floor, when equipment positioned in elevated locations

E. Position the label so that it is not obscured by other piping, equipment, or other visual obstructions.

F. Apply identification devices to surfaces that require finish after that finish work is completed.

G. Clean surfaces before application of self-adhesive identification products using materials and methods recommended by manufacturer of identification device.

H. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

I. Install continuous, underground line, warning tape directly above line at 12 inches below finished grade during backfilling of trenches. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 18 inches overall.

J. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

K. Coordinate installation of identifying devices with location of access panels and doors.

L. Install identifying devices before installing acoustical ceilings and similar concealment

M. Develop text for raceway, cable, and conductor labels using the designations found in the project oneline, schedules, schematics, manufacturer's documents, etc. and using the following label naming format:
   1. Typical label content:
   2. "System Type-Circuit Voltage-Power Source Name-Load Served Name"
      Example: NP 480V HP-3#15 RTU9
   3. Label naming content shall be comprised of any or all of the following components:
      a. System Type
         1) EP Emergency Power (NEC700 Life Safety) — EP
         2) Standby Power (NEC701 Required or NEC 702 Optional Standby) — SP
         3) Critical Power (NEC708) — CP
         4) Normal Power (Utility Power) — NP
         5) Alternate Backup Power System (UPS or other backup power source) — BU
      b. Circuit Voltage — Nominal circuit voltage
         Typical: 120V, 208V, 240V, 277V, 480V, 2400V, 4160V, 12.8KV, 13.2KV, 13.8KV.
      c. Power Source — Distribution Equipment Name and Circuit Number
      d. Load Served (Acronym)
         Example: Distribution Equipment (LP-1), Process Equipment (AHU-2).

N. Use consistent naming designations for nameplates and labels developed throughout the Project.

O. Painted identifications shall comply with standard industry practice for surface preparation and paint application. Painted identification shall be adequate to remain visible for a period of three years. Painting specifications can be provided on request if not included in Division 09 "Finishes" of this Specification.

P. See drawings, schedules, and associated notes for additional information or changes to these specifications and/or match existing identification style, if mandated by the Owner.

3.02 INSTALLATION OF EQUIPMENT NAMEPLATES

A. Degrease and clean surfaces to receive nameplates.

B. Install nameplates parallel to equipment lines. Secure nameplates to equipment fronts using screws.

C. Use of rivets or self-adhesives fasteners as alternate mounting methods when screws are not suitable, shall be pre-approved by the Engineer.

D. Selected nameplate and label mechanical fasteners shall not change the NEMA or NRTL rating of the enclosure.

E. Install Equipment Identification Nameplate on each unit of equipment. Designation on nameplate is to use and/or be consistent with wiring diagrams, schedules, etc.
   1. Apply labels to disconnect switches, distribution equipment, control panels, control stations, terminal cabinets, and racks of each system.
   2. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification
   3. Nameplate Text Content:
      a. Distribution Equipment: Provide two lines of text (Equipment Name/Power Source). Example:
         PB LP2A
         Fed From MSB2#CB3A
      b. Switchboard/Panel Mounted Fuse/Circuit Breaker: Provide two lines of text (Device Type/Number/Name Load). Example:
         CB3A
         PB LP2A
      c. Utilization Equipment: Provide two lines of text (Device Name/Power Source). Example:
         AHU-2
         LP2A#15

3.03 INSTALLATION OF RACEWAYS MARKINGS

A. Raceways and Duct Banks More Than 600V:
   1. Provide 3-inch-wide black stripes on 10-inch centers over 6-inch wide orange background that extends full length of raceway or duct concealed within buildings. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch-high black letters on 48-inch centers. Stop stripes at legends. Apply to the following finished surfaces:
      a. Floor surface directly above conduits running within 12-inch beneath floor that is in contact with earth or is framed above unexcavated space.
      b. Wall surfaces directly external to raceways concealed within wall.
      c. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

B. Accessible Raceways More Than 600V:
   1. Identify with "DANGER-HIGH VOLTAGE" in white letters at least 2 inches high on red field. Repeat legend at maximum 10-foot intervals

C. Provide Labels for Accessible Raceways and Metal-Clad Cables, 600V or Less:
   1. Restricted to Service and Feeders raceways
   2. Label to indicate highest nominal voltage of circuits in the raceway.

D. Accessible Raceways and Cables 600V or Less within Buildings:
   1. Branch Circuit wiring raceways.
   2. Mark the cover of each junction box, pull box, or similar enclosure with self-adhesive vinyl labels. The labels are to contain the System type, Source, and Circuit number for the wiring circuits contained within the box.

3.04 INSTALLATION OF CABLE/CONDUCTOR LABELS

A. Wire Identification
   1. Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection. Identify power Source, Branch Circuit or Feeder number for power and lighting circuits, and with control wire number as indicated on schematic and interconnection diagrams or equipment manufacturer's shop drawings for control wiring.

2. Power-Circuit Feeder Conductor Identification: Identify Source and Circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.
3. Branch-Circuit Conductor Identification: Where there are two or more circuit conductors with the same color wire jacket in the same junction or pull box, identify each ungrounded conductor according to source and circuit number. In addition, label the junction box cover with the System type, Source, and Circuit numbers.
4. Spare Circuit Conductors: Attach label to both ends of conductor with the term “Spare” (with unique sequential number) and equipment location of opposite end of the wire. Do not connect the spare wire to an active source or active destination.
5. Signal Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections with System Name (FA, PA, Data, etc.), Source Equipment Name, and Circuit/Zone number.

B. Power-Circuit Conductor Identification, 600V or Less: For conductors in vaults, pull and junction boxes, manholes, and hand holes, use color-coded conductor jackets (or tape where approved by the Engineer) to identify the phase.
1. Color-Coding for Phase and Voltage Level Identification, 600V or Less: Use colors listed below for ungrounded service, feeders, and branch-circuit conductors, unless otherwise specified by the Owner or drawings, schedules, or associated notes.
a. Color shall be integral to the wire insulation, unless otherwise permitted by the Engineer.
b. Colors for 240/120V and 208Y/120V Circuits:
1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.
c. Colors for 480Y/277-V Circuits:
1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.
2. Field-Applied, Color-Coding Conductor Tape: Where permitted by the Engineer, apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate marking tape bands to avoid obscuring factory cable markings

3.05 INSTALLATION OF MISCELLANEOUS LABELS AND MARKINGS

A. Provide the following default identification requirements, unless otherwise specified by the drawings, schedules, and associated notes or to match existing labeling methods where required by the Owner.

B. Install instructional sign including the color code for grounded and ungrounded conductors using adhesive-film-type labels.

C. Electrical Signal Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by System and Circuit Number.
2. Use system of marker tape designations that are uniform and consistent with system used by the manufacturer for factory-installed connections.
3. Coordinate identification with Project drawings and/or the Manufacturer's wiring diagrams.

D. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
1. Install underground-line warning tape for both direct-buried cables and cables in raceway.

E. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

F. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Special Circuits:

1. Self-adhesive warning labels.
2. Comply with 29 CFR 1910.145.
3. Identify System Type, Voltage, Source, and Circuit Number Designation as appropriate with black letters on an orange background.
4. Apply to exterior of door, cover, or other access.
5. For equipment with electrical power, hazard classification, automatic start or multiple control sources, apply to door or cover of equipment including, but not limited to, the following:
    a. Electrical room doors.
    b. Controls with external control power connections.
    c. Door access to hazard classified areas.

G. Operating Instruction Signs: Install instruction signs to notify Operator of proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

H. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.

3.06 GUARANTEE (WARRANTY)

Painted identifications shall be warranted for repair or reapplication that fails in materials or workmanship within three years from date of Substantial Completion. No additional material and/or labor warranty beyond that specified in Section 26 05 00 “Common Work Results for Electrical” for the remaining labeling systems.

END OF SECTION

SECTION 26 08 00
COMMISSIONING OF ELECTRICAL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this section.

B. The OPR and BOD documentation are included by reference for information only.

C. Division 01 section 'LEED Requirements' for additional LEED requirements.

1.02 SUMMARY

A. This section includes commissioning process requirements for Electrical systems, assemblies, and equipment.

B. Related Sections include Division 01 Section "General Commissioning Requirements" for general commissioning process requirements that apply to this section.

1.03 DEFINITIONS

A. Architect. Includes Architect identified in the Contract for Construction between Owner and Contractor, plus consultant/design professionals responsible for design of HVAC, electrical, communications, controls for HVAC systems, and other related systems.

B. BoD. Basis of Design.

C. BoD-HVAC. HVAC systems basis of design.

D. CxA. Commissioning Authority.

E. OPR. Owner's Project Requirements.

F. Systems, Subsystems, and Equipment. Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, and equipment.

G. TAB. Testing, Adjusting, and Balancing.

1.04 CONTRACTOR'S RESPONSIBILITIES

The following responsibilities are in addition to those specified in Division 01 Section "General Commissioning Requirements."

A. Contractor
   1. Attend procedures meeting for Electrical commissioning work.
   2. Certify that the electrical commissioning tasks are complete.

B. Mechanical Contractor
   1. Attend TAB verification testing.
   2. Provide measuring instruments and logging devices to record test data, and data acquisition equipment to record data for the complete range of testing for the required test period.

C. HVAC Instrumentation and Control Contractor. With the CxA, review control designs for compliance with the OPR and BoD, controllability with respect to actual equipment to be installed, and recommend adjustments to control designs and sequence of operation descriptions. A
   1. Additional Responsibilities. Participate in tests specified in Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls" and

D. Electrical Contractor
   1. Conduct electrical system commissioning.
   2. With the Mechanical Contractor, coordinate installations and connections between and among electrical and HVAC systems, subsystems, and equipment.

1.05 SUBMITTALS

A. Refer to Division 01 Section "General Commissioning Requirements" for CxA's role.

B. Refer to Division 01 Section “Submittals” for specific requirements. In addition, provide the following:

C. In addition, provide the following:
   1. Certificates of readiness
   2. Certificates of completion of installation, prestart, and startup activities.
   3. O&M manuals
   4. Test reports

1.06 QUALITY ASSURANCE

A. Test Equipment Calibration Requirements: Contractors will comply with test manufacturer’s calibration procedures and intervals. Recalibrate test instruments immediately after instruments have been repaired resulting from being dropped or damaged. Affix calibration tags to test instruments. Furnish calibration records to CxA upon request.

1.07 COORDINATION

A. Refer to Division 01 Section “General Commissioning Requirements” for requirements pertaining to coordination during the commissioning process.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. All standard testing equipment required to perform startup, initial checkout and functional performance testing shall be provided by the Contractor for the equipment being tested. For example, the electrical contractor of Division 26 shall ultimately be responsible for all standard testing equipment for the electrical systems and controls systems in Division 26. A sufficient quantity of two-way radios shall be provided by each con- tractor.

B. Special equipment, tools and instruments (specific to a piece of equipment and only available from vendor) required for testing shall be included in the base bid price to the Owner and left on site, except for stand-alone data logging equipment that may be used by the CxA.

C. Proprietary test equipment and software required by any equipment manufacturer for programming and/or start-up, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist in the commissioning process as needed. Proprietary test equipment (and software) shall become the property of the Owner upon completion of the commissioning process.

D. Data logging equipment and software required to test equipment will be provided by the CxA, but shall not become the property of the Owner.

E. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not other- wise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5°F and a resolution of ±0.1°F. Pressure sensors shall have an accuracy of ±2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year.

PART 3 EXECUTION

3.01 GENERAL DOCUMENTATION REQUIREMENTS

A. With assistance from the installing contractors, the CxA will prepare Pre-Functional Checklists for all commissioned components, equipment, and systems

B. Red-lined Drawings:
   1. The contractor will verify all equipment, systems, instrumentation, wiring and components are shown correctly on red-lined drawings.
   2. Preliminary red-lined drawings must be made available to the Commissioning Team for use prior to the start of Functional Performance Testing.
   3. Changes, as a result of Functional Testing, must be incorporated into the final as-built drawings, which will be created from the red-lined drawings.
   4. The contracted party, as defined in the Contract Documents will create the as- built drawings.

C. Operation and Maintenance Data:
   1. Contractor will provide a copy of O&M literature within 45 days of each submittal acceptance for use during the commissioning process for all commissioned equipment and systems.
   2. The CxA will review the O&M literature once for conformance to project requirements.
   3. The CxA will receive a copy of the final approved O&M literature once corrections have been made by the Contractor.

D. Demonstration and Training:
   1. Contractor will provide demonstration and training as required by the specifications.
   2. A complete training plan and schedule must be submitted by the Contractor to the CxA four weeks (4) prior to any training.
   3. A training agenda for each training session must be submitted to the CxA one (1) week prior the training session.
   4. The CA shall be notified at least 72 hours in advance of scheduled tests so that testing may be observed by the CA and Owner's representative. A copy of the test record shall be provided to the CA, Owner, and Architect.
   5. Engage a Factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specific equipment.
   6. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, trouble shooting, servicing, and maintaining equipment.
   7. Review data in O&M Manuals.

E. Systems manual requirements: Remove if Systems manual is not required.
   1. The Systems Manual is intended to be a usable information resource containing all of the information related to the systems, assemblies, and Commissioning Process in one place with indexes and cross references.
   2. The GC shall include final approved versions of the following information for the Systems Manual:
      a. As-Built System Schematics
      b. Verified Record Drawings
      c. Test Results (not otherwise included in Cx Record)
      d. Periodic Maintenance Information for computer maintenance management system
      e. Recommendations for recalibration frequency of sensors and actuators
      f. A list of contractors, subcontractors, suppliers, architects, and engineers involved in the project along with their contact information
      g. Training Records, Information on training provided, attendees list, and any on-going training
   3. This information shall be organized and arranged by building system, such as fire alarm, chilled water, heating hot water, etc.
   4. Information should be provided in an electronic version to the extent possible. Legible, scanned images are acceptable for non-electronic documentation to facilitate this deliverable.

3.02 CONTRACTOR'S RESPONSIBILITIES

A. Perform commissioning tests at the direction of the CxA.

B. Attend construction phase controls coordination meetings.

C. Participate in Electrical systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.

D. Provide information requested by the CxA for final commissioning documentation.

E. Include requirements for submittal data, operation and maintenance data, and training in each purchase order or sub-contract written.

F. Prepare preliminary schedule for Electrical system orientations and inspections, operation and maintenance manual submissions, training sessions, equipment start-up and task completion for owner. Distribute preliminary schedule to commissioning team members.

G. Update schedule as required throughout the construction period.

H. During the startup and initial checkout process, execute the related portions of the prefunctional checklists for all commissioned equipment.

I. Assist the CxA in all verification and functional performance tests.

J. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

K. Gather operation and maintenance literature on all equipment, and assemble in binders as required by the specifications. Submit to CxA 45 days after submittal acceptance.

L. Coordinate with the CxA to provide 48-hour advance notice so that the witnessing of equipment and system start-up and testing can begin.

M. Notify the CxA a minimum of two weeks in advance of the time for start of the testing and balancing work. Attend the initial testing and balancing meeting for review of the official testing and balancing procedures.

N. Participate in, and schedule vendors and contractors to participate in the training sessions.

O. Provide written notification to the CM/GC and CxA that the following work has been completed in accordance with the contract documents, and that the equipment, systems, and sub-system are operating as required.
   1. Electrical equipment including switchgear, panel boards, motor control centers, lighting, receptacles, dimmers and all other equipment furnished under this Division.
   2. Emergency generators, ATS switches and emergency power systems.
   3. Fire alarm system
   4. Lightning protection
   5. UPS systems
   6. List other systems

P. The equipment supplier shall document the performance of his equipment.

Q. Provide a complete set of red-lined drawings to the CxA prior to the start of Functional Performance Testing.

R. Provide training of the Owner's operating staff using expert qualified personnel, as specified.

S. Equipment Suppliers
   1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner, to keep warranties in force.
   2. Assist in equipment testing per agreements with contractors.
   3. Provide information requested by CxA regarding equipment sequence of operation and testing procedures.

T. Refer to Division 01 Section "General Commissioning Requirements" for additional Contractor responsibilities.

3.03 OWNER'S RESPONSIBILITIES

A. Refer to Division 01 Section "General Commissioning Requirements" for Owner's Responsibilities.

3.04 DESIGN PROFESSIONAL'S RESPONSIBILITIES

A. Refer to Division 01 Section "General Commissioning Requirements" for Design Professional's Responsibilities.

3.05 CXA'S RESPONSIBILITIES

A. Refer to Division 01 Section "General Commissioning Requirements" for CxA's Responsibilities.

3.06 TESTING PREPARATION

A. Certify in writing to the CxA that Electrical systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify in writing to the CxA that Electrical instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Certify in writing that testing procedures have been completed and that testing reports have been submitted, discrepancies corrected, and corrective work approved.

D. Place systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

E. Inspect and verify the position of each device and interlock identified on checklists.

F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.07 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.

B. Scope of Electrical testing shall include the entire Electrical installation, from the incoming power equipment throughout the distribution system. Testing shall include measuring, but not limited to resistance, voltage, and amperage of system(s) and devices.

C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. The CxA along with the Electrical contractor and other contracted subcontractors, including the fire alarm Subcontractor shall prepare detailed testing plans, procedures, and checklists for Electrical systems, subsystems, and equipment.

E. Tests will be performed using design conditions whenever possible.

F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

G. The CxA may direct that set points be altered when simulating conditions is not practical.

H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

I. If tests cannot be completed because of a deficiency outside the scope of the Electrical system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.08 ELECTRICAL SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

A. Equipment Testing and Acceptance Procedures: Testing requirements are specified in individual Division 26 sections. Provide submittals, test data, inspector record, infrared camera and certifications to the CA.

B. Electrical Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Division 26 Sections "Instrumentation and Control" and "Sequence of Operations" Assist the CxA with preparation of testing plans.

C. Emergency Generator Testing and Acceptance Procedures: Provide technicians, load banks, infrared cameras, instrumentation, tools and equipment to test performance of designated systems and devices at the direction of the CxA. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.

D. Fire Detection and Alarm System Testing: Provide technicians, instrumentation, tools and equipment to test performance of designated systems and devices at the direction of the CxA. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.

E. Electrical Distribution System Testing: Provide technicians, load banks, infrared cameras, instrumentation, tools and equipment to test performance of designated systems and devices at the direction of the CxA. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested

F. Vibration and Sound Tests: Provide technicians, instrumentation, tools, and equipment to test performance of vibration isolation and seismic controls.

G. The work included in the commissioning process involves a complete and thorough evaluation of the operation and performance of all components, systems and sub-systems. The following equipment and systems shall be evaluated:
   1. Automatic temperature controls (BAS) integrated with the electrical systems
   2. Automatic Transfer Switch
   3. Emergency Generator
   4. Emergency Power System
   5. Fire Alarm System
   6. Lighting Controls
   7. Low Voltage Switchgear
   8. Motor Control Center
   9. Power Monitoring/Metering System
   10. Switchboard
   11. Transformer

3.09 DEFICIENCIES/NON-CONFORMANCE, COST OF RETESTING, FAILURE DUE TO MANUFACTURER DEFECT

A. Refer to Division 01 Section “General Commissioning Requirements” for requirements pertaining to deficiencies/non-conformance, cost of retesting, or failure due to manufacturer defect.

3.10 APPROVAL

A. Refer to Division 01 Section “General Commissioning Requirements” for approval procedures.

3.11 DEFERRED TESTING

A. Refer to Division 01 Section “General Commissioning Requirements” for requirements pertaining to deferred testing.

3.12 OPERATION AND MAINTENANCE MANUALS

A. The Operation and Maintenance Manuals shall conform to Contract Documents requirements as stated in Division 01.

B. Refer to Division 01 Section “General Commissioning Requirements” for the AE and CxA roles in the Operation and Maintenance Manual contribution, review and approval process.

3.13 TRAINING OF OWNER PERSONNEL

A. Refer to Division 01 Section “General Commissioning Requirements” for requirements pertaining to training.

B. Electrical Contractor. The electrical contractor shall have the following training responsibilities:
   1. Provide the CA with a training plan two weeks before the planned training.
   2. Provide designated Owner personnel with comprehensive training in the understanding of the systems and the operation and maintenance of each major piece of commissioned electrical equipment or system.
   3. Training shall start with classroom sessions, if necessary, followed by hands on training on each piece of equipment, which shall illustrate the various modes of operation, including startup, shutdown, fire/smoke alarm, power failure, etc.

4. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.
5. The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. This person may be the start-up technician for the piece of equipment, the installing contractor or manufacturer's representative. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training.
6. The training sessions shall follow the outline in the Table of Contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.
7. Training shall include:
    a. Use the printed installation, operation and maintenance instruction material included in the O&M manuals.
    b. Include a review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include start-up, operation in all modes possible, shut-down, seasonal changeover and any emergency procedures.
    c. Discuss relevant health and safety issues and concerns.
    d. Discuss warranties and guarantees.
    e. Cover common troubleshooting problems and solutions.
    f. Explain information included in the O&M manuals and the location of all plans and manuals in the facility.
    g. Discuss any peculiarities of equipment installation or operation.
8. Hands-on training shall include start-up, operation in all modes possible, including manual, shut-down and any emergency procedures and preventative maintenance of all pieces of equipment.
9. The electrical contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls, not controlled by the central control system.
10. Training shall occur after functional testing is complete, unless approved otherwise by the Owner's.

END OF SECTION

SECTION 26 09 23
LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings, the provisions of the Contract including the General and Supplementary Conditions, and the General Requirements apply to the Work of this Section.

B. The following sections have been specifically referenced in this specification:
   1. Section 26 05 19 Low-Voltage Electrical Power Conductors and Cables.
   2. Section 26 09 23 Lighting Control Devices.
   3. Section 26 05 53 Identification for Electrical Systems.

1.02 SCOPE

A. This Section includes the furnishing and installing of all labor, materials, tools, appliances, control hardware, sensor, wire, junction boxes, and equipment necessary for and incidental to the delivery, installation, and furnishing of lighting control devices as described herein. Unidentified devices shall be the same types as those provided in similar areas.

1.03 SUBMITTALS

A. Shop Drawings shall be submitted for approval for all lighting control devices as follows:
   1. Time Clock
   2. Time switches.
   3. Outdoor and indoor photoelectric switches.
   4. Indoor occupancy sensors.
   5. Outdoor motion sensors.
   6. Lighting contactors.
   7. Emergency shunt relays.

B. While “typical” connections and circuits are of interest, complete system Shop Drawings shall be prepared for this particular project that include device layout, orientation, point-to-point wiring diagram(s), and conductor sizes and types.
   1. Submit any interconnection diagrams to the lighting control panel showing proper wiring.
   2. Submit lighting plan showing location, orientation, and coverage area of each sensor.

C. Samples of any or all proposed equipment or system components shall be submitted for examination/approval as requested.

D. Record Drawings. The Contractor shall keep layout plans on the job site, marking all changes made during installation. A set of As-Built / Record drawings shall be submitted.

E. Final Documentation. Submit all operation, maintenance and warranty data manuals showing test results.

1.04 QUALITY ASSURANCE.

A. The equipment manufacturer shall be regularly engaged in manufacture of lighting control devices, of the types and capacities required, and whose products have been in satisfactory use in similar service for not less than ten years.

B. Electrical lighting components, devices, and accessories shall be listed or labeled as defined in NFPA 70, Article 100, by a National Recognized Testing Laboratory acceptable to authorities having jurisdiction, and marked for intended location and use.

PART 2 PRODUCTS

2.01 GENERAL INFORMATION

A. All electrical equipment and material shall be new and bear a recognized testing laboratory’s label, where applicable. The type of equipment and/or material shall be designated by the location where it will be installed and so defined by NEMA / NFPA 70 standards.

B. Lighting control devices shall communicate with the Lighting Control Panelboard, unless otherwise specified.

C. All occupancy sensors shall be hardwired type; battery type shall not be permitted.

2.02 TIME CLOCKS

A. Unit shall be a multi-purpose, 7 day, 365 day advance single and skip a day, combination 2 channel electronic time clock with a SPDT switching configuration and astronomic dial.

B. The contacts shall be rated 10 amp resistive at 120/250 VAC, 7.5 amps inductive at 120/250 VAC, 5 amps inductive at 30 VDC and up to 1/2 hp at 250 VAC. The unit shall be rate for 30 VDC, 120 VAC, 250 VAC and 277 VAC.

C. The controller shall be capable of programming in the AM/PM or 24 hour format by jumper selection, in one minute resolution, using 2 buttons only for all basic settings.

D. Display shall be LED type.

E. The unit shall have 365 day and or holiday selection capabilities, with 16 single date and 5 holiday selection options and user selectable daylight savings/standard time functions.

F. The unit shall have 72 hour memory backup with rechargeable battery and charger.

G. The unit shall be capable of manual override, On and OFF to the next scheduled event, using 1 button for each channel.

H. The enclosure shall be rated for indoor or outdoor installation

2.03 TIME-SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Area Lighting Research, Inc.; Tyco Electronics.
   2. Grasslin Controls Corporation; a GE Industrial Systems Company.
   3. Intermatic, Inc.
   4. Leviton Mfg. Company Inc.
   5. Lightolier Controls; a Genlyte Company.
   6. Lithonia Lighting; Acuity Lighting Group, Inc.
   7. Paragon Electric Co.; Invensys Climate Controls.
   8. Square D; Schneider Electric.
   9. TORK.
   10. Touch-Plate, Inc.
   11. Watt Stopper (The).

B. Electronic Time-Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.
   1. Contact Configuration: DPST
   2. Contact Rating: 30-A inductive or resistive and rated 120/277VAC.
   3. Programs: 4, 8, or 12 channels as noted on drawing. Where not specified on drawings, provide minimum 4 channels; each channel shall be individually programmable with on-off set points on a 24-hour schedule.
   4. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program.
   5. Astronomic Time: All channels.
   6. Battery Backup: For schedules and time-switch.

C. The switch shall be programmed to automatically turn lights off after a preset time. The delay timer shall be adjustable with a range of 5 minutes to 12 hours.

D. Switch shall be rated for 120/277V, 1200W load.

E. The switch shall beep warning every 5 seconds during the last minute of countdown. Also, the switch shall flash lights (for warning) at one minute before timer expires.

F. Time scrolling shall be provided to override preset time by pressing the ON/OFF switch for four seconds.

G. LCD provided to show count down time.

H. The switch shall have zero crossing circuitry.

2.04 OUTDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Area Lighting Research, Inc.; Tyco Electronics.
   2. Grasslin Controls Corporation; a GE Industrial Systems Company.
   3. Intermatic, Inc.
   4. Lithonia Lighting; Acuity Lighting Group, Inc.
   5. Novitas, Inc.
   6. Paragon Electric Co.; Invensys Climate Controls.
   7. Square D; Schneider Electric.
   8. TORK.
   9. Touch-Plate, Inc.
   10. Watt Stopper (The).
   11. Shall be compatible with Lighting Control System and/or provide interface equipment.

B. Description: Solid-state, with DPST dry contacts rated for 2000-VA tungsten, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.
   1. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lx), with an adjustment for turn-on and turn-off levels within that range and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
   2. Time Delay: 15-second minimum, to prevent false operation.
   3. Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.

C. Mounting: Twist-lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

D. The controller shall be rated at 120, 240 or 277 volts. The cell shall be cadmium sulfide, 1" diameter.

E. The enclosure shall be die cast zinc, gasketed for maximum weather proofing.

F. The enclosure shall include the positioning lug on the top of the enclosure.

G. The unit shall have a delay of up to two minutes to prevent false switching. ON/Off adjustment shall be done by moving a light selector with a range from 2 to 50 foot-candles.

H. Mounting shall be for a 1/2" conduit nipple.

I. The contacts shall be SPST normally closed.

J. The operational temperature range shall be -40 to 140 degrees F

2.05 INDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Allen-Bradley/Rockwell Automation.
   2. Area Lighting Research, Inc.; Tyco Electronics.
   3. Eaton Electrical Inc; Cutler-Hammer Products.
   4. Grasslin Controls Corporation; a GE Industrial Systems Company.
   5. Hubbell Lighting.
   6. Intermatic, Inc.
   7. Lithonia Lighting; Acuity Lighting Group, Inc.
   8. MicroLite Lighting Control Systems.
   9. Novitas, Inc.
   10. Paragon Electric Co.; Invensys Climate Controls.
   11. Square D; Schneider Electric.
   12. TORK.
   13. Touch-Plate, Inc.
   14. Watt Stopper (The).
   15. Shall be compatible with Lighting Control System and/or provide interface equipment.

B. Ceiling-Mounted Photoelectric Switch: Solid-state, light-level sensor unit, with separate relay unit, to detect changes in lighting levels that are perceived by the eye. Cadmium sulfide photoresistors are not acceptable.
   1. Sensor Output: Contacts rated to operate the associated relay, complying with UL 773A. Sensor shall be powered from the relay unit.
   2. Relay Unit: Dry contacts rated for 20A ballast load at 120- and 277-V ac, for 13A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
   3. Light-Level Monitoring Range: 10 to 200 fc (108 to 2152 lx), with an adjustment for turn-on and turn-off levels within that range.
   4. Time-Delay: Adjustable from 5 to 300 seconds to prevent cycling, with deadband adjustment.
   5. Indicator: Two LEDs to indicate the beginning of on-off cycles.

C. Skylight Photoelectric Sensors: Solid-state, light-level sensor; housed in a threaded plastic fitting for mounting under skylight, facing up at skylight; with separate relay unit (mounted on luminaire), to detect changes in lighting levels that are perceived by the eye. Cadmium sulfide photoresistors are not acceptable.
   1. Sensor Output: Contacts rated to operate the associated relay, complying with UL 773A. Sensor shall be powered from the relay unit.
   2. Relay Unit: Dry contacts rated for 20A ballast load at 120- and 277-V ac, for 13A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
   3. Light-Level Monitoring Range: 1000 to 10,000 fc (10 800 to 108 000 lx), with an adjustment for turn-on and turn-off levels within that range.
   4. Time-Delay: Adjustable from 5 to 300 seconds to prevent cycling, with deadband adjustment.
   5. Indicator: Two LEDs to indicate the beginning of on-off cycles.

2.06 INDOOR OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Hubbell Lighting.
   2. Nexlight.
   3. Shall be compatible with existing Nexlight Lighting Control System and/or provide interface equipment.

B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit:
   1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time-delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
   2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
   3. Relay Unit / Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70. Unit shall have low-voltage Teflon coated leads rated for plenum locations.
   4. Mounting:
      a. Sensor: Suitable for mounting in any position on a standard outlet box.
      b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
      c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
   5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
   6. Bypass Switch: Override the on function in case of sensor failure.
   7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lx); keep lighting off when selected lighting level is present.
   8. High immunity to false triggering by RFI and EMI

9. Separate 24 VAC dry contacts for EMCS connections.
10. Have no leakage current to load, in manual or in Auto/Off mode, and have voltage drop protection.

C. Wall Mounted (Wall Switch Type):
1. The sensor shall use either passive infrared or, if dual technology, passive infrared and passive acoustic sensing, or passive infrared and ultrasonic, for detecting room occupancy. The unit shall fit in/on a standard single gang switch box.
2. Rated capacity: 600 watts minimum at 120 volts, 60 Hz; 1000 watts minimum at 277 volts, 60 Hz.
3. Sensitivity shall be user adjustable or self adjusting type.
4. The delay timer shall be adjusted within a range of 6 to 30 minutes by the contractor in the field. The sensor shall have a test mode for performance testing.
5. The off switch shall have manual override for positive off and automatic on.
6. The test LED shall indicate motion.
7. The area of coverage shall be approximately 180 degrees by 35-40 feet.

D. Ceiling Mounted:
1. The sensor shall use either passive infrared or, if dual technology, passive infrared and passive acoustic sensing, or passive infrared and ultrasonic, for detecting room occupancy. The unit shall fit in/on a standard octagon box. All ceiling mounted sensors shall be installed to a box with ring and box support.
2. Rated capacity shall be 20 amps at 120 or 277 volts, for fluorescent lamps. Provide power pack as required for low voltage sensors.
3. Sensitivity shall be user adjustable or self adjusting type.
4. The delay timer shall be adjusted within a range of 6 to 30 minutes by the contractor in the field. The sensor shall have a test mode for performance testing.
5. The coverage area shall be 360 degrees by approximately 15 feet radius when mounted at 9 foot height. The sensor shall have provisions, such as masking, to block out problem areas.
6. Test LED to indicate motion.
7. See drawings for actual type of sensor.

E. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage:
1. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm).
2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
3. Detection Coverage (Corridor): Detect occupancy within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling.

F. Ultrasonic Type / Microphonic: Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage:
1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. (56 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. (186 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling in a corridor not wider than 14 feet (4.3 m).

G. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit:

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.

2.07 OUTDOOR MOTION SENSORS (PIR)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Bryant Electric; a Hubbell Company.
2. Hubbell Lighting.
3. Lithonia Lighting; Acuity Lighting Group, Inc.
4. Paragon Electric Co.; Invensys Climate Controls.
5. RAB Lighting, Inc.
6. TORK.
7. Watt Stopper (The).

B. Performance Requirements: Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 deg F (minus 40 to plus 54 deg C), rated as raintight according to UL 773A:
1. Operation: Turn lights on when sensing infrared energy changes between background and moving body in area of coverage; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
2. Mounting:
a. Sensor: Suitable for mounting in any position on a standard outdoor junction box.
b. Relay: Internally mounted in a standard weatherproof electrical enclosure.
c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
3. Bypass Switch: Override the on function in case of sensor failure.
4. Automatic Light-Level Sensor: Adjustable from 1 to 20 fc (11 to 215 lx); keep lighting off during daylight hours.

C. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm).

D. Detection Coverage: Up to 35 feet (11 m), with a field of view of 180 degrees.

E. Lighting Fixture Mounted Sensor: Suitable for switching 300 W of tungsten load at 120- or 277-V ac.

F. Individually Mounted Sensor: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
1. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
2. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.

2.08 LIGHTING CONTACTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Allen-Bradley/Rockwell Automation.
2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
3. Eaton Electrical Inc.; Cutler-Hammer Products.
4. GE Industrial Systems; Total Lighting Control.
5. Grasslin Controls Corporation; a GE Industrial Systems Company.
6. Hubbell Lighting.
7. Lithonia Lighting; Acuity Lighting Group, Inc.

8. MicroLite Lighting Control Systems.
9. Square D; Schneider Electric.
10. TORK.
11. Touch-Plate, Inc.
12. Watt Stopper (The).

B. Description: Electrically operated and mechanically held, combination type with fusible switch, complying with NEMA ICS 2 and UL 508.
1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA 250.
4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

2.09 EMERGENCY SHUNT RELAY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Lighting Control and Design, Inc.
2. Bodine GTD20A.
3. Lutron Equal.
4. Prior Approval Equal.

B. Description: Normally closed, electrically held relay, to automatically transfer from normal power circuit supply to the emergency power circuit supply and arranged for wiring in parallel with manual or automatic switching contacts; complying with UL 924. Verify all wiring contacts and connection requirements with manufacturer.
1. Coil Rating: 120VAC or 277VAC as noted on drawing or coordinate with lighting control system supplier..
2. Contacts Rating: 20A at 120/277VAC.

2.10 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 EXECUTION

3.01 GENERAL INFORMATION

A. Lighting control devices shall be installed in a neat and workmanlike manner. The NEIS Standard Practices for Good Workmanship in Electrical Contracting NECA 1-2006 is hereby adopted to define such workmanship and the installation of conductors and cables.

B. System installation shall be accomplished in a professional manner by qualified personnel regularly engaged in and experienced in this type of work. All wiring and devices shall be installed in accordance with manufacturer’s and UL recommendations. Class II low-voltage occupancy sensor wiring in exposed areas shall be installed in metallic raceway. Class II low-voltage occupancy sensor wiring in concealed accessible areas that is not installed in conduit shall be plenum rated. All system junction boxes must be clearly marked for easy identification.

C. Wiring splices shall be avoided and, if needed, must be made only in junction boxes. All conductors shall be labeled on each end with “E-Z markers,” or equivalent. Conductors in cabinets shall be carefully formed and harnessed so that each drops off directly opposite its

terminal. Cabinet terminals shall be numbered and coded. All controls, function switches, etc., shall be clearly labeled on the equipment panel.

D. All sensors shall blend in aesthetically; coordinate with Architect for final finish color.

3.02 PLANNING / COORDINATION

A. The Contractor shall arrange a pre-installation meeting with the lighting control device vendor(s), and an Owner's representative at the Owner's facility to verify placement of devices, installation criteria, and functionality.

3.03 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

B. Coordinate layout and installation of wall-mounted devices with other construction, including door frames, HVAC equipment, receptacles, voice/data outlets, etc.

C. Coordinate layout and installation of power supplies and/or contactors and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

3.04 TIME-SWITCH INSTALLATION

A. Mount time switches with elastomeric isolator pads, to eliminate structure-borne vibration, unless time-switches are installed in an enclosure with factory-installed vibration isolators.

3.05 LIGHT LEVEL SENSOR INSTALLATION

A. Install and aim sensors north if possible, never south. Install pointing away from artificial sources of light.

3.06 OCCUPANCY SENSOR INSTALLATION

A. The Contractor shall locate and aim sensors for complete and proper volumetric coverage per manufacturer's recommendations. Rooms shall have 90% to 100% coverage of the designated controlled area to accommodate all occupancy habits of single or multiple occupants at any location with the room or area. The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms or areas which are to be provided with sensor protection. Proper judgment must be exercised in executing the installation so as to ensure the best possible installation (placement and quantity) in the available space and to overcome local difficulties due to space limitations or interference of structural components. Provide additional occupancy sensors in a room or space beyond that indicated if necessary to provide coverage required.

B. Install ceiling mounted occupancy sensors at least 3 feet away from any HVAC diffuser.

3.07 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.08 WIRING INSTALLATION

A. Wiring Method: Comply with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch (13 mm).
   1. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
   2. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
   3. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.09 IDENTIFICATION

A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."
   1. Identify controlled circuits in lighting contactors.
   2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
   3. Label time-switches and contactors with a unique designation.

3.10 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including luminaires, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

3.11 FIELD QUALITY CONTROL

A. Field Wiring shall be checked and tested to ensure that there are no grounds, opens, or shorts. The minimum allowable resistance between any two conductors or between conductors and ground is 10 megohms after all conduit and conductors have been installed, but before the sensors are connected. Perform walk tests and set-up procedures for each sensor as specified by the manufacturer to ensure that all boundaries of coverage are sufficient.

B. The Manufacturer’s Representative shall submit a written test report that the system has been 100% tested, approved, and commissioned. The final test shall be witnessed by the Owner’s representative, Electrical Engineer, Electrical Contractor, and performed by the manufacturer’s representative. The final test report must be received and acknowledged by the Engineer prior to request for final payment. Perform all electrical and mechanical tests required by the equipment manufacturer. The installer shall prepare a checkout report and submit in triplicate, one copy of which will be registered with the equipment manufacturer. The report shall include, but not be limited to:
   1. Indication that lighting control devices are properly located, adjusted, (time-delay confirmed, aimed and sensitivity level determined) and communicating with desired load equipment.
   2. Indication that lighting control devices are functioning as determined by the specifications and as decided at the pre-installation meeting.
   3. Identification and replacement of lighting control devices that failed tests.
   4. Tests of individual areas as applicable.
   5. Installer’s name and date.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit occupied conditions. Provide up to two visits to Project site during other-than-normal occupancy hours for this purpose.

3.12 DEMONSTRATION

A. Coordinate demonstration of products specified in this Section with demonstration requirements for any lighting control systems specified elsewhere in Division 26 Sections.

B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices. The training shall familiarize the Owner’s personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems. Provide forms and schedules for organization and documentation of all system operating parameters.

3.13 RECORD DRAWING DOCUMENTATION

A. After successful completion of all the tests and adjustments listed above, the Contractor shall submit the following information to the Engineer in the Operation, Maintenance and Warranty Data Manuals:
   1. Complete As-Built Wiring Diagrams.
   2. System Operating Manuals.
   3. Copy of the Test Report, as detailed above

3.14 GUARANTEE (WARRANTY)

A. The Contractor shall provide parts and labor warranty for the completed occupancy sensor system wiring, equipment, and software to be free from inherent mechanical and electrical defects for a period of one year from the date of completion and acceptance as issued by the Architect's certificate of completion. The individual sensors shall have a five year warranty."

END OF SECTION

SECTION 26 09 26
LIGHTING CONTROL PANELBOARDS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings, the provisions of the Contract including the General and Supplementary Conditions, and the General Requirements apply to the Work of this Section.

B. The following sections have been specifically referenced in this specification:
   1. Section 26 05 00 Common Work Results for Electrical.
   2. Section 26 05 19 Low-Voltage Electrical Power Conductors and Cables.
   3. Section 26 09 23 Lighting Control Devices.
   4. Section 26 05 53 Identification for Electrical Systems.

1.02 SCOPE

A. This Section includes the furnishing and installation of all labor, materials, tools, appliances, hardware, lighting control panels, relays, sensors, wiring, junction boxes, switches, and ancillary equipment for and incidental to the delivery, installation, and furnishing of a completely operational lighting control system as described herein. The system shall be addressable and able to communicate with BACnet.

B. The Lighting Control System shall communicate with miscellaneous lighting control devices. See Division 26 Section 26 09 23 “Lighting Control Devices”.

C. The Lighting Control System shall communicate with a modular dimming system.

1.03 SUBMITTALS

A. While “typical” connections and circuits are of interest, complete system Shop Drawings shall be prepared for this particular project that include device layout, orientation, point-to-point wiring diagram(s), and conductor sizes and types:
   1. Submit wiring diagrams for typical connections of switches, occupancy sensors, photocells, and other connected systems or devices.

B. Samples of any or all proposed equipment or system components shall be submitted for examination/approval as requested.

C. Record Drawings. The Contractor shall keep layout plans on the job site, marking all changes made during installation. A set of As-Built / Record drawings shall be submitted.

D. Final Documentation. Submit all operation, maintenance and warranty data manuals showing test results.

1.04 QUALITY ASSURANCE.

A. The equipment manufacturer shall be regularly engaged in manufacture of lighting control devices, of the types and capacities required, and whose products have been in satisfactory use in similar service for not less than ten years.

B. Electrical lighting control panelboards, components, and accessories shall be listed or labeled as defined in NFPA 70, by National Recognized Testing Laboratory acceptable to authorities having jurisdiction, and marked for intended location and use.

1.05 REFERENCES

A. The products provided by this section shall comply with the following applicable references (latest edition):
   1. UL 508– Standard for Industrial Control Equipment.

1.06 MAINTENANCE

A. Lighting Control Panel manufacturer / vendor shall:
   1. Make ordering of new equipment for expansions, replacements, and spare parts available to end user.
   2. Make new replacement parts available for minimum of ten years from date of manufacture.
   3. Provide factory direct technical support hotline 24 hours per day, 7 days per week.

4. Provide on-site service support within 24 hours anywhere in continental United States.
5. Offer renewable service contract on yearly basis, to include parts, factory labor, and annual training visits. Make service contracts available up to ten years after date of system commissioning.

1.07 SYSTEM DESCRIPTION

A. The objective of this section is to ensure the proper installation of a lighting control system so that Owner desired 'scene' light levels are implemented and versatile. The system shall be capable of accepting multiple addressable low-voltage occupancy sensor signals, light level sensor signals, and multiple low-voltage switch inputs. The lighting control system shall be installed so that lighting may be operated manually by the occupant, automatically by time schedule, and/or by commands from other connected systems, computer software, or controlling devices. This system shall accommodate all conditions of the space utilization and all irregular work hours and habits.

B. The general automatic control of lighting loads shall be by zones or 'scenes' using the following control sequence:
   1. Office Areas: Automatic shut-off, via occupancy sensor input and field mounted relay pack, manual switch override.
   2. Locker Rooms, Mechanical Rooms, Storage Areas: Automatic shut-off, via occupancy sensor input to lighting control panel housing relays and programmable controllers and manual switch override. Light level determined by interior photo sensor. For example, the system may be programmed as follows:
      a. Photo Sensor reads 3000fc, which during startup evaluation relates to 20fc in between grids 4.3 & 4.8, 30fc in between 3.8 & 4.3, etc.
      b. Occupancy sensor, in region 4.3-4.8, senses motion and triggers 5/8 level lighting for grid 4.3 – 4.8 and 3/8 level lighting for grid 3.8-4.3.
   3. Exterior lighting: Two zones photo sensor or Astro on/time-off, time-on/photo sensor or Astro off and as described on the drawings.

C. Interior lighting shall have the ability to provide a warning blink prior to automatically shutting off. Operation of the local switches in each individual space or room shall allow override of the interior lighting shut-off event for a period of 60 minutes, adjustable.

D. Provide BACnet Communications for all lighting control panels, as indicated on the Drawings.

E. Tie modular dimming system control panel to lighting control panel.

PART 2 PRODUCTS

2.01 GENERAL INFORMATION.

A. All electrical equipment and material shall be new and bear a recognized testing laboratory's label, where applicable. The type of equipment and/or material shall be designated by the location where it will be installed and so defined by NEMA / NFPA 70 standards.

2.02 LIGHTING CONTROL PANELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Nexlight.
   2. Wattstopper
   3. Lutron

2.03 GENERAL

A. Provide hardware that is designed, tested, manufactured, and warranted by a single manufacturer.

B. Lighting Controls: Ten-year operational life while operating continually at any temperature in an ambient temperature range of 0° C (32° F) to 40° C (104° F) and 90 percent non-condensing relative humidity.

C. Designed and tested to withstand electrostatic discharges up to 15,000 V without impairment per IEC 801-2.

D. Nomenclature used on the Drawings and in the Specification is that of Lutron (Softswitch 128) and is intended to indicate type and quality of equipment required.

2.04 PANEL/RELAY PERFORMANCE REQUIREMENTS

A. Electrolytic capacitors to operate at least 20° C below the component manufacturer's maximum temperature rating when device is under fully-loaded conditions in 40° C (104° F) ambient temperature.

B. Capable of withstanding repetitive inrush current of 50 times operating current without impacting lifetime of dimmer/relay.

C. Design and test relays to withstand line-side surges without impairment to performance:
   1. Panels: Withstand surges without impairment of performance when subjected to surges of 6,000 volts, 3,000 amps per ANSI/IEEE C62.41B.

D. Utilize air gap off, activated when user selects "off" at any control to disconnect the load from line supply.

E. Possess power failure memory such that if power is interrupted and subsequently returned, lights will automatically return to same levels (on or off) prior to power interruption within three seconds.

F. Non-dim circuits to meet the following requirements:
   1. Rated life of relay: Minimum 1,000,000 cycles.
   2. Load switched in manner that prevents arcing at mechanical contacts when power is applied to load circuits.
   3. Fully rated output continuous duty for inductive, capacitive, and resistive loads.

2.05 POWER PANELS

A. Product: Lutron Softswitch 128:

B. Mechanical:
   1. Listed to UL 508 as industrial control equipment.
   2. Delivered and installed as a UL listed factory assembled panel.
   3. Field wiring accessible from front of panel without need to remove dimmer assemblies or other components.
   4. Panels passively cooled via free-convection, unaided by fans or other means.
   5. Ship panels with each relay in mechanical bypass position by means of jumper bar inserted between input and load terminals. Jumpers to carry full rated load current and be reusable at any time. Mechanical bypass device to allow for switching operation of connected load with relay removed by means of circuit breaker.
   6. Surface mounted.

C. Electrical:
   1. Panels contain branch circuit protection for each circuit unless the panel is a dedicated feed-through type panel or otherwise indicated on the drawings.
   2. Branch circuit breakers, meet following requirements:
      a. Listed to UL 489 as molded case circuit breaker for use on lighting circuits.
      b. Contain visual trip indicator, rated at 10,000 AIC.
      c. Thermal-magnetic construction for overload, short-circuit, and over-temperature protection. Use of breakers without thermal protection requires dimmers/relays to have integral thermal protection to prevent failures when overloaded or ambient temperature is above rating of panel.
      d. Accept tag-out/lock-out devices to secure circuit breakers in off position when servicing loads.
      e. Replaceable without moving or replacing dimmer/relay assemblies or other components in panel. UL listed as switch duty (SWD) so that loads can be switched on and off by breakers.
   3. Minimum UL listed Short Circuit Current Rating, SCCR 65,000A.
   4. Rated life of relay: Minimum 1,000,000 cycles.
   5. Load switched in manner that prevents arcing at mechanical contacts when power is applied to load circuits.

6. Fully rated output continuous duty for inductive, capacitive, and resistive loads.

D. LCD Panel Processor:
   1. System to be password protected.
   2. Language selection: English.
   3. Integral contact closure inputs.
   4. Programming and system operation:
      a. Control stations, control interfaces, and contact closure inputs:
         1) Assign functionality of each control station button or infrared interface.
            (a) Select patterns.
            (b) Select customized pattern.
            (c) Enable/Disable time-clock.
            (d) Initiate delay to off.
            (e) Toggle one, some, or all zones.
      b. Time-Clock:
         1) Integral astronomical time clock
            (a) Geographic location (city or latitude/longitude).
            (b) Adjustable date and time format.
            (c) Adjustable starting and ending of daylight savings time.
            (d) Review and modify time clock schedule to add, copy, modify, and delete events.
      c. Overrides:
         1) Set circuit status.
         2) Select pattern.
         3) Time-clock override.
         4) Control station overrides.
         5) After-hours override.

E. Diagnostics and Service:
   1. Replacing relay does not require re-programming of system or processor.
   2. Relays: Include diagnostic LED's to verify proper operation and assist in system troubleshooting.
   3. Relay panels: Include tiered control scheme for dealing with component failure that minimizes loss of control for occupant:
      a. If lighting control system fails, lights to remain at current level. Panel processor provides local control of lights until system is repaired.
      b. If panel processor fails, lights to remain at current level. Circuit breakers can be used to turn lights off or to full light output, allowing non-dim control of lights until panel processor is repaired.
      c. If relay fails, factory-installed mechanical bypass jumpers to allow each relay to be mechanically bypassed. Mechanical bypass device to allow for switching operation of connected load with relay removed by means of circuit breaker.

2.06 LOW-VOLTAGE WALL STATIONS

A. Product: See Touch:
   1. Use RS485 wiring for low-voltage communication.

B. Functionality:
   1. Upon button press, LEDs to immediately illuminate.
   2. LEDs to reflect the true system status. LEDs to remain illuminated if the button press was properly processed or the LEDs turn off if the button press was not processed.
   3. Allow for easy reprogramming without replacing unit.
   4. Replacement of units does not require reprogramming.

C. Color: Custom color to be selected by the Architect.

D. Provide faceplates with concealed mounting hardware.

E. Engrave wall stations with appropriate button, zone, and scene engraving descriptions furnished prior to fabrication.

F. Silk-screened borders, logos, and graduations to use graphic process that chemically bonds graphics to faceplate, resistant to removal by scratching and cleaning.

2.07 LOW-VOLTAGE CONTROL INTERFACES

A. Contact Closure Interfaces: Lutron Model OMX-AV.
   1. Where contact closures are used to integrate between lighting controls and other systems:
      a. Input open circuit voltage not to exceed 36V.
      b. Input short circuit current not to exceed 0.5 mA.
      c. Mechanical contact closures to be dry contact rated.
      d. Solid-state contact closures:
         1) Output off-state leakage current not to exceed 50 mA.
         2) Output on-state saturation voltage not to be less than 2V.
      e. The contact closure input device will accept both momentary and maintained contact closures.

2.08 SOURCE QUALITY CONTROL

A. Perform full-function testing on completed assemblies at end of line. Statistical sampling is not acceptable.

2.09 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply

PART 3 EXECUTION

3.01 GENERAL INFORMATION.

A. Lighting control panels shall be installed in a neat and workmanlike manner. The NEIS Standard Practices for Good Workmanship in Electrical Contracting NECA 1-2006 is hereby adopted to define such workmanship and the installation of conductors and cables.

B. System installation shall be accomplished in a professional manner by qualified personnel regularly engaged in and experienced in this type of work. All wiring, devices and control panel(s) shall be installed in accordance with manufacturer's and UL recommendations. Class II low-voltage occupancy sensor wiring in exposed areas shall be installed in metallic raceway. Class II low-voltage occupancy sensor wiring in concealed accessible areas that is not installed in conduit shall be plenum rated. All system junction boxes must be clearly marked for easy identification.

C. Wiring splices shall be avoided and, if needed, must be made only in junction boxes. All conductors shall be labeled on each end with "E-Z markers," or equivalent. Conductors in cabinets shall be carefully formed and harnessed so that each drops off directly opposite its terminal. Cabinet terminals shall be numbered and coded. All controls, function switches, etc., shall be clearly labeled on the equipment panel.

D. All lighting control panel devices (switches) shall blend in aesthetically; coordinate with Architect for final finish color.

3.02 PLANNING / COORDINATION

A. The Contractor shall arrange a pre-installation meeting with the lighting control panel vendor(s), and an Owner's representative at the Owner's facility to verify placement of devices, installation criteria, and functionality.

3.03 LIGHTING CONTROL PANEL INSTALLATION

A. Mount lighting control panel with elastomeric isolator pads, to eliminate structure-borne vibration, unless lighting control panels are installed in an enclosure with factory-installed vibration isolators.

B. Provide equipment at locations and in quantities indicated on drawings. Provide any additional equipment required to provide control intent.

C. Mount daylight sensors to point due north with constant view of daylight.

3.04 WIRING INSTALLATION

A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors." Minimum conduit size shall be 1/2 inch (13 mm):
   1. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
   2. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
   3. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.05 IDENTIFICATION

A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."
   1. Identify controlled circuits in lighting contactors.
   2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.
   3. Label lighting control panel(s) with a unique designation(s).

3.06 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

B. Coordinate layout and installation of wall-mounted devices with other construction, including door frames, HVAC equipment, receptacles, voice/data outlets, etc.

3.07 FIELD QUALITY CONTROL

A. Field Wiring shall be checked and tested to ensure that there are no grounds, opens, or shorts. The minimum allowable resistance between any two conductors or between conductors and ground is 10 megohms after all conduit and conductors have been installed, but before the sensors are connected. Perform walk tests and set-up procedures for each sensor as specified by the manufacturer to ensure that all boundaries of coverage are sufficient.

B. The Manufacturer’s Representative shall submit a written test report that the system has been 100% tested, approved, and commissioned. The final test shall be witnessed by the Owner’s representative, Electrical Engineer, Electrical Contractor, and performed by the manufacturer’s representative. The final test report must be received and acknowledged by the Engineer prior to request for final payment. Perform all electrical and mechanical tests required by the equipment manufacturer. The installer shall prepare a checkout report and submit in triplicate, one copy of which will be registered with the equipment manufacturer. The report shall include, but not be limited to:
   1. Sensors are properly placed and adjusted properly.
   2. Indication that the lighting control panel is receiving switch and sensor signals accurately.
   3. The lighting control panel functions and conforms to these and the Owner’s Specifications.
   4. Identification and replacement of lighting control devices that failed tests
   5. Tests of individual areas as applicable.
   6. Installer’s name and date.
   7. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting lighting control panel programming to suit occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.08 WARRANTY

A. The Contractor shall provide parts and labor warranty for the completed lighting control panel, equipment, and software to be free from inherent mechanical and electrical defects for a period of one year from the date of completion and acceptance as issued by the Architect's certificate of completion. The individual sensors shall have a five year warranty.

3.09 DEMONSTRATION

A. Coordinate demonstration of products specified in this Section with demonstration requirements for any lighting control systems specified elsewhere in Division 26 Sections.

B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices. The training shall familiarize the Owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems. Provide forms and schedules for organization and documentation of all system operating parameters.

C. Factory support shall be available free of charge during the warranty period to answer programming and application questions. The manufacturer, or their representative, shall have a remote terminal capable of programming the controller to support the Owner's personnel during this period. The system shall include a modem (EMODEM-2 or equal), necessary cabling, and telephone extension to support this telecommunications operation.

3.10 RECORD DRAWING DOCUMENTATION

A. After successful completion of all the tests and adjustments listed above, the Contractor shall submit the following information to the Engineer:
   1. Complete as-built wiring diagrams to aid the Owner in any future changes to the programming. The diagrams shall indicate the load controlled by each relay and the identification number for that relay. They shall also identify the physical location of each switch or occupancy sensor and which input it is connected with and the identification number of that input. The Contractor shall furnish sets of space plans or reflected ceiling plans that indicate which fixtures are controlled by each relay.
   2. Control Panel Directory. The Contractor shall furnish accurate up-to-date circuit/relay directory for all panels.
   3. System operating manuals.
   4. Copy of the test report, as detailed above.

B. Submit in Operation, Maintenance and Warranty Data Manuals

3.11 GUARANTEE (WARRANTY)

A. No additional material and/or labor warranty beyond that specified in Section 26 05 00 "Common Work Results for Electrical.

END OF SECTION

SECTION 26 12 19
PAD-MOUNTED MEDIUM-VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings, the provisions of the Contract including the General and Supplementary Conditions, and the General Requirements apply to the Work of this Section.

B. The following sections have been specifically referenced in this specification:
   1. Section 26 05 00 Common Work Results for Electrical.
   2. Section 26 05 13 Medium-Voltage Cables".
   3. Section 26 0519 Low-Voltage Electrical Power Conductors and Cables.
   4. Section 26 05 26 Grounding and Bonding for Electrical Systems.
   5. Section 26 05 29 Hangers and Supports for Electrical Systems.
   6. Section 26 05 53 Identification for Electrical Systems.

1.02 SUMMARY

A. This Section covers basic electrical requirements for providing labor, materials, equipment, and services necessary for the selection and installation of pad-mounted, liquid filled, medium voltage distribution transformers as shown on the drawings and specified herein. In general, this consists of:
   1. Pad-mounted Transformer.
   2. Surge Arrestors
   3. Service Connection Cabinet (Not Applicable this Project)
   4. Precast Concrete Pad and Trays (Not Applicable this Project)
   5. Cast in Place Concrete Pads (Not Applicable this Project)
   6. Accessories.

1.03 DEFINITIONS/ABBREVIATIONS

A.	ASEA Brown Boveri Company	ABB Company
B.	Eaton Electrical Inc.; Cutler-Hammer Products	Eaton Electrical Inc.
C.	Square D; Schneider Electric	Square D Company
D.	HV	High Voltage
E.	LV	Low Voltage

F. Seismic Withstand: The term "withstand" means that the transformer will remain in place without separation of any parts when subjected to the seismic forces specified and the transformer will be fully operational after the seismic event.

1.04 SUBMITTALS

A. Bid. Provide the following with the bid documents.
   1. No additional submittals required; see Specification Section 26 05 00.

B. Manufacture. Provide the following prior to release for manufacture and/or purchase.
   1. Transformer: Shop Drawings/Data Sheets shall be submitted for approval for each transformer and related accessory.
      a. Dimensioned plans, elevations, sections, and details.
      b. Transformer Ratings including configuration, current, voltage, taps, impedance, etc.
      c. Show tabulations of installed equipment devices, features, and accessories.
   2. Protective Device: Data Sheets for each fuse with characteristics, ratings, for each type and rating included in the transformers(s).
      a. Protective Device Performance Data.
         1) Complete verified SKM format electronic library models for each type and size of fuse.
         2) Time Current Curve in electronic pdf format. Website links will not be accepted.
      b. Complete detailed catalog number reflecting the type, rating, and characteristics of the fuse(s) to be furnished with the transformer.
   3. Transformer damage curve with inrush and thru fault current indicated.

4. Lightning Arrestor Data Sheets.
5. Seismic Qualification Certificates. Submit certification that the transformer assembly, accessories, and components will withstand potential seismic forces, where required.
6. Nameplate Content
    a. See plan set drawings for required nameplate size, format, content and colors.
    b. Provide nameplate schedule with text content, sizes, and colors shown and images of proposed nameplates as each would appear once engraved.
7. Precast Concrete dimensioned plans, elevations, sections, and details. (Not required for this Section for this Project)
8. Cast in Place concrete materials, dimensioned plans, reinforcement, placement requirements, and details where concrete work is required on drawings, schedules, and associated notes.
9. No samples requested.
10. See also Specification Section 26 05 00.

C. Construction. Provide the following during construction.
1. Factory Tests: Provide Factory Testing report certifying that the transformer complies with IEEE C57.12.90. Perform the following IEEE C57.12.00 factory-certified routine tests on each transformer for this Project:
    a. Resistance.
    b. Turns ratio, polarity, and phase relation.
    c. Transformer no-load losses and excitation current at 100 percent of ratings.
    d. Transformer impedance voltage and load loss.
    e. Operation of all devices.
    f. Lightning impulse.
    g. Low frequency.
    h. Leak
2. Field Tests: Provide planned Field Test procedure(s) to Engineer prior to energizing and testing transformer(s) and associated equipment.
3. Field Report: Provide results of field testing of the transformer and all associated equipment in the final Field Test Report, including baseline transformer oil and electrical tests.

D. Closeout. Provide the following to complete the project.
1. No additional submittals required; see Specification Section 26 05 00.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: The equipment manufacturer shall be regularly engaged in the manufacture of pad mount transformer(s), components, and accessories of the types, capabilities, and capacities required, and whose products have been in satisfactory use in similar service for not less than ten years.

B. Installer Qualifications: The National Electrical Contractors Association installation and maintenance guide NECA 410 Standard for Installing and Maintaining Liquid Filled Transformers is hereby identified to define workmanship related to the installation of equipment and/or materials specified by this Specification section.

C. Codes/Standards: The products provided by this section shall comply with the latest editions of the following references:
1. DOE2016 - Department of Energy 10 CFR Part 431 “Energy Conservation Program: Energy Conservation Standards for Distribution Transformers”, Standard in 2016.
2. IEEE C2 – National Electrical Safety Code.
3. IEEE C37.47-2011 – Standard Specifications for High Voltage Distribution Current Limiting Type Fuses and Accessories.
4. IEEE C57.12.00-2010 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.
5. IEEE C57.12.28-2005 – Standard for Pad Mounted Equipment, Enclosure Integrity.
6. IEEE C57.12.34-2009 – Standard Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers (2500 kVA and Smaller, 34.5KV or less, and 480 or less).

7. IEEE C57.12.70-2011 – Standard for Terminal Markings for Distribution and Power Transformers.
8. IEEE C57.12.90-2010 – Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers and IEEE Guide for Short-Circuit Testing of Distribution and Power Transformers.
9. IEEE C62.11 – Standard for Metal Oxide Surge Arrestors for AC Power Circuits.
10. IEEE 386-2006 – Standard for Separable Insulated Connector System for Power Distribution Systems above 600V.

D. Equipment Quality: Pad mounted transformers, components, and accessories shall be "Listed" or "Labeled" as defined in NFPA 70, Article 100, by a National Recognized Testing Laboratory acceptable to authorities having jurisdiction, and marked for the intended location and use.

PART 2 PRODUCTS

2.01 GENERAL INFORMATION

A. All transformers, supports, accessories, and materials shall be new unless otherwise specified on the plan drawings and associated notes. The type of equipment and/or material shall be approved for its planned use and environment and is so defined by NEMA/NFPA 70 standards and NRTL certifications.

B. See drawings, schedules, and associated notes for specific transformer type features required.

2.02 ACCEPTABLE MANUFACTURERS

A. Manufacturers subject to compliance with requirements, provide transformer by one of the following:
1. ABB Company
2. Eaton Electrical Inc (Cooper).
3. Square D Company

2.03 GENERAL TRANSFORMER REQUIREMENTS

A. See drawings, schedules, and associated notes for transformer features. Where none specified provide the following minimum requirements and features.

B. Factory-assembled and factory-tested, air-cooled units for 60-Hz service.

C.	Primary Voltage	See Drawings/Schedules
D.	Secondary Voltage	See Drawings/Schedules
E.	KVA Rating	See Drawings/Schedules
F.	Primary BIL	95KV
G.	Secondary BIL	30KV
H.	Surge Arrestor	Intermediate Class
I.	Switching	No transformer internal primary switching required.

J. Tank/Coil/Core:

1.	Tank Rating	No deformation at 7 PSIG; No rupture at 15 PSIG; 15 PSIG pressure relief valve with minimum 35 SCFM or as recommend by the Manufacturer.
2.	Insulating Fluid:	Biodegradable Less Flammable Seed Oil. Typical "Envirotemp" FR3 or "Biotemp" vacuum processed for maximum penetration into coil insulation system.
3.	Winding	Aluminum
4.	Coil Insulation	220C; B-stage, Epoxy Coated paper
5.	Impedance	5% Minimum
6.	Temperature Rise	55C/65C above 40C Ambient
7.	Core	Burr free, grain oriented, silicon steel, precisely stacked to eliminate gaps.
8.	Taps	(2) 2.5% Above
9.		(3) 2.5% Below
10.	Efficiency	Comply with level stipulated in current DOE standard

K. Enclosure

1.	Outdoor	Weatherproof, Sun Resistant

2. Finish Color: Manufacturers Std Munsell Green
3. Secure: Recessed, penta-head, captive bolt, and padlock.
4. I/R Window: Three dual IR/Visible light windows. Two in the primary section and one in the secondary section positioned for connections.
5. Lifting: Four removable lifting eye bolts in corners.
6. Special: Steel bottom for HV/LV compartments due to roof curb.

L. Seismic: Zone 4, for better support to span roof curb.

M. Sound: NEMA Levels

2.04 PAD MOUNT THREE PHASE TRANSFORMER

A. Surge Arresters: Comply with IEEE C62.11, Intermediate Class; metal-oxide-varistor type, fully shielded, separable-elbow type, suitable for plugging into the inserts provided in the high-voltage section of the transformer. Connected in each phase of incoming circuit and ahead of any disconnecting device.

B. Winding Connections: The connection of windings and terminal markings shall comply with IEEE C57.12.70.

C. Insulation: Transformer kVA rating shall be as follows: The average winding temperature rise above a 30 deg C ambient temperature shall not exceed 65 deg C and 80 deg C hottest-spot temperature rise at rated kVA when tested according to IEEE C57.12.90, using combination of connections and taps that give the highest average winding temperature rise.

D. Tap Changer: External handle, for de-energized operation.

E. Enclosure Integrity: Comply with IEEE C57.12.28 for pad-mounted enclosures that contain energized electrical equipment in excess of 600 V that may be exposed to the public.

F. Mounting: An integral skid mounting frame, suitable to allow skidding or rolling of transformer in any direction, and with provision for anchoring frame to pad.

G. Corrosion Protection:
1. Transformer coating system shall be factory applied, complying with requirements of IEEE C57.12.28.

H. Compartment Construction:
1. Double-Compartment Construction: Individual compartments for high- and low-voltage sections, formed by steel isolating barriers that extend full height and depth of compartments, with hinged, lift-off doors and three-point latching, with a stop in the open position and provision for padlocking. Low Voltage compartment to be to the right side of the high voltage compartment.

I. Primary Fusing: Designed and rated to provide thermal protection of transformer by sensing overcurrent and high liquid temperature.
1. Externally removable load break expulsion Bayonet fuse assembly. The bayonet fuses shall be in series with ELSP under-oil partial-range current-limiting back-up fuses.
2. 150-kV BIL current-limiting fuses, conforming to requirements of IEEE C37.47.
3. Interrupting Rating: 50,000 A RMS symmetrical at system voltage.
4. Provide bayonet fuse assembly with an oil retention valve and an external drip shield inside the housing to eliminate or minimize oil spills. Valve shall close when fuse holder is removed and an external drip shield is installed.
5. Provide a conspicuously displayed warning adjacent to bayonet fuse(s), cautioning against removing or inserting fuses unless transformer has been de-energized and tank pressure has been released.

J. High-Voltage Section: Dead-front design.
1. To connect primary cable, use separable, load break, insulated, rubber, elbow connectors. Bushings shall be one-piece units, with ampere and BIL ratings the same as connectors.
2. Bushing inserts:
a. Conform to the requirements of IEEE 386.
b. Rated at 200 A, with voltage class matching connectors. Provide a parking stand near each bushing well. Provide grounded parking stands.

c. Provide insulated protective caps for insulating and sealing out moisture from unused bushing inserts.
3. Bushing wells configured for radial feed application and dead front surge arresters.
4. Access to liquid-immersed fuses.
5. Tap-changer operator.
6. Ground pad.

K. Low-Voltage Section:
1. Bushings with spade terminals drilled for terminating the number of conductors indicated on the Drawings, and the lugs that comply with requirements of Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

L. Transformer Accessories:
1. Drain and filter connection; inside cable compartment.
2. Accessible liquid test port valve. External drain valve with sampler – A 1.0” drain valve with sampling device shall be located outside of the cable compartment on the low voltage side of the tank. The valve shall be protected by a hinged cover with padlock provisions.
3. Filling and top filter press connections; located inside cable compartment.
4. Pressure-vacuum gauge with status/alarm contact; located inside cable compartment.
5. Dial-type analog thermometer with alarm contacts; located inside cable compartment.
6. Magnetic liquid level indicator with high/low alarm contacts; located inside cable compartment.
7. Automatically resetting pressure-relief device. Device flow shall be as recommended by manufacturer when not otherwise specified herein; located inside cable compartment.
8. Ground connection pads.
9. When specified in this section or on plan set drawings and schedules, included gauges and instrumentation devices shall be located outside of the cable compartments such that access to them does not require exposure to any live circuits. They shall be located inside a separate NEMA® 4 rated enclosure on the low voltage side of the tank.

2.05 LABELS AND SIGNS

A. Comply with requirements for labels and signs specified in Section 26 05 53 "Identification for Electrical Systems" or plan set drawings, schedules, and associated notes.
1. High-Voltage Warning Label: Provide OSHA compliant warning signs on outside of high-voltage compartment door(s). The sign legend shall state "DANGER HIGH VOLTAGE". The sign shall be constructed with material that will resist fading from UV light exposure and from the effects of weather. The sign shall be mounted on the high voltage compartment door.

B. Additional transformer rating nameplate: In addition to the standard nameplate located on the transformer tank, a second nameplate shall be included. The nameplate shall be mounted external to the termination compartments on the low voltage compartment door.

C. Arc Flash Warning Label: Install Owner furnished self-adhesive arc flash hazard labels. One for the HV compartment and one for the LV compartment.

PART 3 EXECUTION

3.01 GENERAL INFORMATION

A. Provide all labor and transformers, supports, pads and associated materials required for the installation of a complete and operating system in accordance with applicable local, state, national codes, and the manufacturers' recommendations, except where the plan set drawings, associated notes, schedules, and/or specifications are stricter.

3.02 RECEIVE, INSPECT, STORE

A. Receive, inspect, handle, and store transformers ready for installation.

B. Examine areas and space conditions for compliance with requirements for pad-mounted, liquid-filled, medium-voltage transformers and other conditions affecting performance of the Work.

C. Examine roughing-in of conduits and grounding systems to verify the following:
1. Wiring entries comply with layout requirements.

2. Entries are within conduit-entry tolerances specified by manufacturer, and no feeders will cross section barriers to reach load or line lugs.

D. Where applicable, examine area for suitability of transformer clearances, connection cabinet, precast concrete or fiber glass pads, concrete or fiberglass bases, and/or for cast-in-place concrete pads/structures.

E. Verify that ground connections are in place and that requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at transformer location.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 INSTALLATION

A. Where cast-in-place concrete pad or bases are planned, verify compliance with requirements for equipment bases and foundations specified in Section 260529 "Hangers and Supports for Electrical Systems" and plan drawings and associated notes. Unless otherwise specified, provide five feet of compacted, Class 5 fill.
   1. Class 5 Aggregate to consist of durable particles of crushed stone free from silt, clay, or other unsuitable materials and have a percentage of wear of not more than 40% when tested in accordance with ASTM C131 or C535. The source of material shall meet the gradation requirements in accordance with ASTM D448, size number 357.

B. Comply with requirements for vibration isolation and seismic control devices, where applicable.

C. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions, IEEE C2, and plan set drawings.

D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems", unless otherwise noted on plan set drawings and associated notes.
   1. For counterpoise, use tinned bare copper cable not smaller than # 4/0 AWG, buried not less than 30 inches below grade interconnecting the grounding electrodes. Bond surge arrester, cable shields, and grounding electrode conductor directly to transformer enclosure ground bar. Bond neutral with manufacturer supplied ground strap or other provided method when neutral bond is indicated on plan set drawings. Use insulated ground conductor above grade and bare conductors below grade when wire is in contact with earth and/or embedded in concrete. Keep lead lengths as short as practical and with minimum kinks and sharp bends.
   2. Where applicable, fence and equipment connections shall not be smaller than #2 AWG. Ground fence at each gate post and corner post and at intervals not exceeding 10 ft. Bond each gate section to fence post using 1/8 by 1 inch tinned flexible braided copper strap and associated clamps.
   3. Make joints in underground grounding conductors and loops by exothermic weld.
   4. Make joints in above ground grounding conductors and loops by compression connector.
   5. Terminate all grounding and bonding conductors on a common equipment grounding bar, which is bonded to the transformer enclosure.
   6. Complete transformer tank grounding and lightning arrester connections prior to making any other electrical connections.

E. Terminate medium-voltage cables in incoming section of transformers according to Section 26 05 13 "Medium-Voltage Cables."

F. Comply with installation requirements for labels and signs specified in Section 26 05 53 "Identification for Electrical Systems", unless otherwise specified in plan set drawings and schedules.

G. Install warning signs, nameplates, and labels where required.

3.04 ADJUSTING AND CLEANING

A. Upon completion of installation of transformer(s), inspect interiors and equipment finishes; remove burrs, paint splatters, stains, dirt, and other construction debris. Touch up stains, scratches, and mars on the equipment finish with paint to match original finish.

3.05 ACCEPTANCE TESTING

A. After installing transformer but before primary is energized, verify that grounding system at the transformer is tested at specified value or less with reference to the building service ground.

B. Testing Agency: Engage a factory qualified technician to assist with inspections and to perform required technical testing and startup.

C. Perform each visual inspection, mechanical inspection, and electrical test stated in NETA Acceptance Testing Specification and provisions of NFPA 70B Ch. "Testing and Test Methods". Certify compliance with test parameters. Testing to include:
   1. Visual Inspection.
   2. Verify torque values of bolted connections.
   3. Electrical Testing
      a. Resistance
      b. Turns ratio, polarity, and phase relation
      c. Operation of all devices
   4. Liquid Oil Analytical Testing
      a. Testing to verify integrity of transformer handling and installation.
      b. Testing to provide baseline for future testing.
      c. Perform test after transformer energized and loaded for one week.
      d. Test sample for acetylene, hydrogen, methane, ethane, ethylene, carbon monoxide, carbon dioxide, nitrogen, oxygen, total gas, total combustible gas, moisture, interfacial tension, pH, color, visual fluid clarity, dielectric strength, and specific gravity.
      e. Test report to include specific acceptable teat value threshold/ranges and technician evaluation of results.

D. Perform Infrared Scan after Substantial Completion, but not more than 30 days after Final Acceptance.
   1. The infrared scan of the transformer shall include the bushings, elbows, and wire connections.
   2. Use calibrated Fluke Ti32 Thermal Imager or equivalent for infrared scanning

E. Adjust power transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

F. Replace and re-test any transformer until in compliance with performance requirements.

G. Report: Prepare a certified report identifying transformer checked and describing results of inspection, testing, and scanning. Include notation of deficiencies detected, remedial action taken, and observations after remedial action completed. Report shall include:
   1. Inspection observations and comments
   2. Testing measurements with acceptable levels and summary comment/analysis.
   3. I/R images with summary comment/analysis.

H. Output voltage measurements and tap settings.

3.06 TRAINING

A. No additional training required.

3.07 SPARE PARTS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Provide three of each type and rating of Power Fuses.

3.08 GUARANTEE (WARRANTY)

No additional material and/or labor warranty beyond that specified in Section 26 05 00 “Common Work Results for Electrical”.

END OF SECTION

SECTION 26 22 00
LOW-VOLTAGE DRY TYPE TRANSFORMERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings, the provisions of the Contract including the General and Supplementary Conditions, and the General Requirements apply to the Work of this Section.

B. The following sections have been specifically referenced in this specification:
   1. Section 26 05 00 Common Work Results for Electrical.
   2. Section 26 05 29 Hangers and Supports for Electrical Systems.
   3. Section 26 05 53 Identification for Electrical Systems.

1.02 SUMMARY

A. This Section covers basic electrical requirements for providing labor, materials, equipment, and services necessary for the selection and installation of low voltage dry type transformers and associated hardware as shown on the drawings and specified herein. In general, this consists of
   1. Distribution transformers below 600V and up to 1000KVA.
   2. Buck-boost transformers.

1.03 DEFINITIONS/ABBREVIATIONS

A. Eaton Electrical Inc.; Cutler-Hammer Products	Eaton Electrical Inc.
B. Siemens Energy & Automation, Inc.	Siemens Company
C. Square D; Schneider Electric	Square D Company

D. Non-Linear Loads refers to loads that have component frequencies above the fundamental (60 HZ) frequency usually caused by VFD, computer, and similar electronic power loads. See UL 1561 and IEEE 519 for additional definition and information.

1.04 SUBMITTALS

A. Bid: Provide the following with the bid documents.
   1. No additional submittals required; see Specification Section 26 05 00.

B. Manufacture: Provide the following prior to release for manufacture and/or purchase.
   1. Shop Drawings/Data Sheets shall be submitted for approval for the following equipment (confirm list with Engineer):
      a. Data sheet with transformer rating, taps, impedance, temperature rise, efficiency at various load levels, clearance requirements, and physical information.
      b. Drawing with transformer dimensions and weight.
      c. Power connection, tap, and winding wiring diagram.
      d. Shop drawings for equipment supports.
   2. Welding Certificates where welding required for the Project.
   3. Concrete materials, reinforcement, and placement requirements where concrete work is required on drawings.
   4. No samples requested.
   5. Provide Manufacturer Seismic Qualification Certification where applicable. Submit certification that transformers, accessories, and components will withstand potential seismic forces as required by applicable codes.
   6. See also Specification Section 26 05 00

C. Construction: Provide the following during construction.
   1. Test reports as specified herein.
   2. See also Specification Section 26 05 00.

D. Closeout: Provide the following to complete the project.
   1. No additional submittals required; see Specification Section 26 05 00

1.05 QUALITY ASSURANCE

A. Manufacturer: The equipment manufacturer shall be regularly engaged in the manufacture of dry type transformers and accessories of the types, capabilities, and capacities required, and whose products have been in satisfactory use in similar service for not less than ten years.

B. Installer Qualifications: In addition to qualifications stated in Specification Section 26 05 00:
   1. Welder Qualifications: Certified procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code – Steel."

C. Codes/Standards: The products provided by this section shall comply with the latest editions of the following references:
   1. IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers".
   2. IEEE C57.110 "Recommended Practice for Establishing Transformer Capability When Feeding Non-Sinusoidal Load Currents".
   3. IEEE 519 "Recommended Practice and Requirements for Harmonic Control in Electric Power Systems".
   4. Department of Energy "Energy Conservation Program: Energy Conservation Standards for Distribution Transformers", current edition.
   5. NEMA ST-20 "Dry Type Transformers for General Applications."
   6. NEMA TP-1 "Guide for Determining Energy Efficiency for Distribution Transformers." To be rescinded, replaced in 2016.
   7. NEMA TP2 "Standard Test Method for Measuring the Energy Consumption of Distribution Transformers." To be rescinded, replaced in 2016.
   8. NEMA TP3 "Standard for the Labeling of Distribution Transformers." To be rescinded, replaced 2016.
   9. NEMA "Premium Efficiency Transformer Program", Pending DOE acceptance.
   10. SSPC-PA 1 "Shop, Field, and Maintenance Painting of Steel."
   11. UL 506 "Standard for Specialty Transformers."
   12. UL 1561 "Standard for Dry Type General Purpose and Power Transformers."

D. Equipment Quality: Electrical dry type transformers, supports, and accessories shall be "Listed" or "Labeled" as defined in NFPA 70, Article 100, by a National Recognized Testing Laboratory acceptable to authorities having jurisdiction, and marked for the intended location and use.

PART 2 PRODUCTS

2.01 GENERAL INFORMATION.

A. All transformers, supports, accessories, and materials shall be new unless otherwise specified on the plan drawings and associated notes. The type of equipment and/or material shall be approved for its planned use and environment and is so defined by NEMA/NFPA 70 standards and NRTL certifications.

B. See drawings, schedules, and associated notes for specific transformer type features required.

2.02 ACCEPTABLE MANUFACTURERS

A. Manufacturers subject to compliance with requirements, provide transformer by one of the following:
   1. Eaton Electrical Inc.
   2. Siemens Company.
   3. Square D Company.
   4. Power Smiths Harmonic Canceling Transformer T1000-2016.

2.03 GENERAL TRANSFORMER REQUIREMENTS

A. See drawings, schedules, and associated notes for transformer features. Where none specified provide the following minimum requirements and features.

B. Factory-assembled and factory-tested, air-cooled units for 60-Hz service.

C. Comply with NEMA ST-20

D. Primary Voltage See Drawings/Schedules

E. Secondary Voltage See Drawings/Schedules

F. KVA Rating — See Drawings/Schedules

G. Coil/Core:

1.	Core:	Grain-oriented, non-aging silicon steel
2.	Windings	Continuous without splices except for taps
3.	Windings Sealing	Vacuum Pressure Impregnated Resin Compound
4.	Internal Coil Connections	Brazed or pressure type
5.	Coil Material	Aluminum
6.	Coil Insulation	220C
7.	Temperature Rise	150C above 40C Ambient
8.	Core Leg	One leg per phase
9.	Taps	(3) 2.5% Above, (2) 2.5% Below
10.	Efficiency	Comply with level stipulated in current DOE standard

H. Enclosure

1.	Indoor	NEMA 1 Ventilated
2.	Outdoor	NEMA 3R
3.	Finish Color:	ANSI 61 gray
4.	Wall Brackets	Manufacturer's Standard brackets

I. Sound — NEMA ST-20 Levels

J. Constructed to withstand seismic forces.

2.04 GENERAL DISTRIBUTION TRANSFORMER

A. Energy Efficiency for Transformers:
1. Comply with all current Federal, State, and Local energy efficiency requirements.
2. Complying with DOE-2016 efficiency levels.
3. Tested according to NEMA TP-2.
4. Labeled according to NEMA TP-3

2.05 K-RATED TRANFORMER

A. Where specified the transformer shall be K-factor rated complying with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor.
1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
2. Indicate value of K-factor on transformer nameplate.

2.06 ISOLATION TRANSFORMER

A. Where specified, the transformer shall be constructed with electrostatic shielding. Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize inter-winding capacitance.

B. RF Filtering front end.

C. Constant voltage output.

2.07 HARMONIC CANCELING TRANSFORMERS

A. Where specified, the transformer shall be constructed to mitigate the 5th and 7th harmonics and associated multiples to levels specified when carrying up to full load current without exceeding stated temperature rise or requiring external cooling.

B. Mitigation shall comply with IEEE 519 harmonic levels identified for the Point of Common Coupling at the primary lugs of the transformer.

C. Neutral rated 200% of full load capacity of transformer.

D. Electrostatic shielding.

2.08 BUCK-BOOST TRANSFORMERS

A. Where specified, the transformer shall be self-cooled, two-winding dry type, rated for continuous duty and with wiring terminals suitable for connection as autotransformer.

B. Transformers shall comply with NEMA ST 1 and shall be listed and labeled as complying with UL 506 and UL 1561.

2.09 IDENTIFICATION

A. Provide engraved, metal nameplate indicating key transformer ratings, characteristics, winding configuration, and voltage taps.

B. Provide engraved, laminated-plastic nameplate indicating equipment name and power source. See drawings, schedules and associated notes for additional requirements or Section 260553 "Identification for Electrical Systems" for minimum requirements.

PART 3 EXECUTION

3.01 GENERAL INFORMATION

A. Provide all labor and transformers, supports, pads and associated materials required for the installation of a complete and operating system in accordance with applicable local, state, national codes, and the manufacturers' recommendations, except where the plan set drawings, associated notes, schedules, and/or specifications are stricter.

3.02 INSTALLATION

A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.
   1. Brace wall-mounting transformers for load requirement and existing building structural conditions.

B. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions for sound attenuation and structural support.

C. Apply applicable seismic codes.

D. Consult Section 26 05 29 "Hangers and Supports for Electrical Systems" for additional installation requirements.

3.03 ACCEPTANCE TESTING

A. Perform each visual inspection, mechanical inspection, and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

B. Perform Infrared Scan after Substantial Completion, but not more than 30 days after Final Acceptance.
   1. The infrared scan of the transformer shall include the winding, bus, bus connections, and wire connections.
   2. Use calibrated Fluke Ti32 Thermal Imager or equivalent for infrared scanning

C. Adjust power transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

D. Connect buck-boost transformers to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.

E. Replace and re-test any transformer until in compliance with performance requirements.

F. Report: Prepare a certified report identifying transformer checked and describing results of inspection, testing, and scanning. Include notation of deficiencies detected, remedial action taken, and observations after remedial action completed. Report shall include:
   1. Inspection observations and comments
   2. Testing measurements with acceptable levels and summary comment/analysis.
   3. I/R images with summary comment/analysis.
   4. Output voltage measurements and tap settings.

3.04 GUARANTEE (WARRANTY)

No additional material and/or labor warranty beyond that specified in Section 26 05 00 “Common Work Results for Electrical”.

END OF SECTION

SECTION 26 24 13
SWITCHBOARDS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings, the provisions of the Contract including the General and Supplementary Conditions, and the General Requirements apply to the Work of this Section.

B. The following sections have been specifically referenced in this specification:
   1. Section 26 05 00 Common Work Results for Electrical.
   2. Section 26 05 29 Hangers and Supports for Electrical Systems.
   3. Section 26 05 53 Identification for Electrical Systems.

1.02 SUMMARY

A. This Section covers basic electrical requirements for providing labor, materials, equipment, and services necessary for the selection and installation of the switchboard(s) as shown on the drawings and specified herein. In general, this consists of the following:
   1. Service Switchboards rated 600V and less.
   2. Distribution Switchboards rated 600V and less.
   3. Disconnecting and Overcurrent Protective Devices.
   4. Surge Protective Devices.
   5. Instrumentation and Power Metering.
   6. Equipment and Breaker Control Power and Communication.
   7. Accessory Components and Features.
   8. Identification.
   9. Completely installed, tested, and operative.

1.03 DEFINITIONS/ABBREVIATIONS

A.	CPT	Control Power Transformer.
B.	CT	Current Transformer.
C.	MCCB	Molded Case Circuit Breaker.
D.	MCP	Motor Circuit Protector.
E.	MCS	Motor Circuit Breaker
F.	OCPD	Overcurrent Protective Device.
G.	PT	Potential Transformer.
H.	SPD	Surge Protective Device.
I.	ASEA Brown Boveri Company	ABB Company
J.	Eaton Electrical Inc.; Cutler-Hammer Products	Eaton Electrical Inc.
K.	General Electric Company	GE Company
L.	Hammond Co.; Matra Electric, Inc.	Hammond Company
M.	Siemens Energy & Automation, Inc.	Siemens Company
N.	Square D; Schneider Electric	Square D Company

O. Front Access Only: “Front, Access Only” is defined in this specification to mean that all activities necessary to install, operate, or maintain the switchboard can be performed by removing only the front cover(s) to complete the task(s) without the removal of any additional covers, components, structural members or without the necessity for extended reach by a worker. In addition, the equipment can be placed against a wall without any detrimental impact or issues.

P. Provision for Circuit Breaker: The term “Provision” when applied to switchboard construction means that the manufacturer shall provide all of the bus structure, extension busing, hardware, blank plates, etc., necessary so that in the future the assigned space would require the removal of the blank plate and the installation of a breaker only to complete the assembly to be ready for operation.

Q. See also Specification Section 26 05 00 for additional definitions/abbreviations.

1.04 SUBMITTALS

A. Bid. Provide the following with the bid documents.
   1. No additional submittals required; see Specification Section 26 05 00.

B. Manufacture. Provide the following information prior to release for manufacture and/or purchase.
   1. Switchboard Structure: Shop Drawings/Data Sheets shall be submitted for approval for each switchboard and related equipment.
      a. Dimensioned plans, elevations, sections, and details.
      b. Show tabulations of installed devices, equipment features, and ratings.
      c. Detail enclosure types and details for types other than NEMA 250, Type 1.
      d. Detail bus configuration, current, and voltage ratings.
      e. Short-circuit current rating of switchboard(s) and overcurrent protective devices.
      f. Include evidence of NRTL (UL) listing for series rating of installed devices, where series rating is specified on the drawings.
      g. Control power, internal and external control/interlock/interface schematics, and/or network diagram(s) with clear indication of necessary field wiring and connection points.
      h. Include time-current coordination curves for each type and rating of overcurrent protective device included in the switchboard(s).
      i. Include required clearances and service space needed around equipment for installation, conduit entries, operation, and maintenance.
   2. Protective Device: Data Sheets for each protective device with characteristics, ratings, for each type and rating included in the switchboard(s).
      a. Protective Device Performance Data
         1) Complete verified SKM format electronic library models for each type and size protective device.
         2) Time Current Curve in electronic pdf format. Website links will not be accepted.
      b. Complete detailed catalog number including numbers reflecting the type, rating, configuration, characteristics, features, and auxiliary components to be furnished with the protective device.
         1) Include a guide to identify (decode) the protective device characteristics conveyed by the detailed catalog number. This guide will be used to interpret and verify the proposed protective device ratings and features. Where this guide does not exist, the information shall be included in the tabulated detailed list of the ratings and features for the protective device description in the submittal.
      c. Circuit Breaker control power, status, and network wiring diagram where applicable.
   3. Seismic Qualification Certificates: Submit certification that switchboard(s), overcurrent protective devices, accessories, and components will withstand potential seismic forces, where required.
   4. Surge Protective Device (SPD)
      a. Verification that the SPD device complies with the latest edition UL 1449 and CSA/cUL approvals. Submit UL-1449 reports showing Suppressed Voltage Rating (SVR) for each specified unit.
      b. Provide Data Demonstrating that the SPD is capable of surviving the minimum repetitive surge current rating specified below without failure or performance degradation of more than 10%.
      c. Provide a complete documentation package per the requirements of NEMA LS1.
   5. Nameplate Content
      a. New Equipment: Provide nameplate schedule with text, sizes, and colors shown and images of proposed nameplates as each would appear once engraved.
      b. Existing Equipment: Provide nameplate schedule with text, sizes, and colors matching existing nameplates and images of proposed nameplates as each would appear once engraved.

6. Concrete materials, reinforcement, and placement requirements where concrete work is required on drawings.
7. No samples requested.
8. See also Specification Section 26 05 00.

C. Construction. Provide the following during construction.
1. Planned field Test procedure(s) to Engineer prior to energizing and testing switchboard(s) and associated equipment.
2. Provide results of field testing of the switchboard, protective devices, and all associated equipment in the final Field Test Report.
3. Provide laminated Oneline diagram of switchboard and upstream feeder and protective device. Engineer will provide content for oneline drawing. Contractor will prepare and install the oneline.
4. See also Specification Section 26 05 00.

D. Closeout. Provide the following to complete the project.
1. Operation and Maintenance Manual(s) shall be submitted with the Project Closeout documents. The Operation and Maintenance Manual(s) shall include:
a. Routine maintenance requirements for switchboard(s) and all installed components.
b. Manufacturer's written instructions for testing and adjusting overcurrent protective devices, assemblies, and components.
2. No additional submittals required; see also Specification Section 26 05 00.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications. The equipment manufacturer shall be regularly engaged in manufacture of switchboard(s), components, and accessories of the types, capabilities, and capacities required, and whose products have been in satisfactory use in similar service for not less than ten years.

B. Installer Qualifications. The National Electrical Contractors Association installation and maintenance guide NECA 400 Standard for Installing and Maintaining Switchboard(s) is hereby identified to define workmanship related to the installation of equipment and/or materials specified by this Specification Section. NEMA PB 2.1 shall also be used as a guide to the proper installation and maintenance of the switchboard and associated equipment.

C. Codes/Standards. The products provided by this section shall comply with the latest editions of following references:
1. ANSI/IEEE C62.41 - Category C, B, and A, Recommended Practice for Surge Voltages in Low Voltage AAAAC Power Circuits
2. NECA 400 – Standard for Installing and Maintaining Switchboards.
3. NEMA AB-1 – Molded Case Circuit Breakers.
4. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches.
5. NEMA LS1 – Low Voltage Surge Protection Devices.
6. NEMA PB 2 – Dead Front Distribution Switchboards.
7. NEMA PB 2.1 – Instructions for Safe Handling, Installation, Operation and Maintenance of Dead Front Distribution Switchboards Rated 600V or less.
8. NEMA 250 Enclosures for Electrical Equipment (1000V Maximum).
9. UL 198E – Class R Fuses.
10. UL 489 - Molded Case Circuit Breakers Marking and Application Guide.
11. UL 508 – Standard for Industrial Control Panels.
12. UL 869 – Reference Standard for Service Equipment.
13. UL 891 – Standard for Dead Front Switchboards.
14. UL 1066 – Standard for Low Voltage AC and DC Power Circuit Breakers.
15. UL 1244 – Standard for Electrical and Electronic Measuring and Testing.
16. UL 1449 - Surge Protective Devices.

D. Equipment Quality. The electrical switchboards, components, and accessories shall be “Listed” or “Labeled” as defined in NFPA 70, Article 100, by a National Recognized Testing Laboratory acceptable to authorities having jurisdiction, and marked for the intended location and use.

PART 2 PRODUCTS

2.01 GENERAL INFORMATION

A. All electrical equipment and material shall be new unless otherwise specified in the plan drawings, associated notes, and/or riser/oneline diagram. The type of equipment and/or material shall be approved for its planned use and environment and is so defined by NEMA/NFPA 70 standards and NRTL certifications.

B. Switchboards shall be constructed with the following default features, unless otherwise noted on the drawings, schedules, and/or associated notes.

C. Enclosure
   1. Rated for environmental conditions at installed location typical.
      a. Rate equipment capable of continuous operation under the following ambient temperature conditions (unless otherwise indicated): 32°F to 104°F
      b. Indoor Dry and Clean Locations: NEMA 250, Type 1
      c. Indoor Dusty or Dirty Locations: NEMA 250, Type 12.
      d. Outdoor Locations (Falling Water): NEMA 250, Type 3R.
      e. Wet or Damp Locations (Directed Water): NEMA 250, Type 4.
      f. Wet Corrosive Locations: NEMA 250, Type 4X stainless steel.
   2. Structure
      a. Ambient: Inside Building Conditioned Space.
      b. Enclosure: Minimum NEMA 1.
      c. Dimensions:
         1) Width Section Minimum 36”.
         2) Depth Maximum 48”.
         3) Height Maximum 92”.
         4) Oversized Enclosure: See Drawings/Schedules.
      d. Mounting: Freestanding, Floor Mounted.
      e. Alignment: Front/Rear
      f. Work Access: Front Access Only.
      g. Bolted Cover(s)
      h. Incoming Conduit Access: Top.
      i. Feeder Conduit Access: Top.
      j. Branch Circuit Conduit Access: Top.
      k. Pull Section: See Drawings/Schedules.
      l. Top Hat: As Required.
      m. Utility Metering Section: None.
      n. Power Meter Required.
      o. Infrared Windows: Required.
      p. Color: Mfg. Standard ANSI Gray.
      q. Shipping Splits Determined by Contractor.

D. Ratings
   1. Switchboards shall be provided with the following default voltage, current, phase, and frequency rating unless otherwise noted on the drawings, schedules, and/or associated notes.
      a. Voltage: See Drawings/Schedules.
      b. Phase: See Drawings/Schedules.
      c. Frequency: 60 HZ
      d. Current: See Drawings/Schedules.
      e. Service Rated: MSB-2 and MSB-5.
      f. Provide NRTL (UL) Service Entrance label and necessary applicable service entrance features

E. Phase, Neutral, and Ground Buses
   1. Material: Silver Plated Copper.
   2. Fault Rating: See Drawings/Schedules for required AIC RMS Symmetric ratings.
   3. Phase Bus: See Drawings/Schedules
   4. Insulated Phase Bus: Not Required

5. Neutral Bus: Same Size as Phase Bus.
6. Ground Bus: Continuous Entire Length of Switchboard.
7. Isolated Ground Bus: Not Required.

F. Conductor Connections: Furnished with the switchboard and suitable for use with conductor material and sizes.
1. Material: Silver Plated Copper.
2. Main and Neutral Lugs: Mechanical or compression type, minimum 75◦C rating.
3. Ground Lugs: Mechanical or compression type, minimum 75◦C rating.
4. Bus Configured Terminators: Mechanical or compression type, minimum 75◦C rating

G. Service Equipment Rated: Provide switchboard with features and appropriate NRTL (UL) label for use as service entrance equipment. Switchboards shall be constructed for service entrance use per UL 869 where required by the drawings, associated notes, schedules, and/or Project use.

H. Provision for Future Devices: Equip sections with mounting brackets, supports, bus connections, appurtenances at full rating of planned circuit-breaker, and blank/filler plates/covers/doors as specified herein or on drawings, associated notes and/or schedules.

I. Switchboards shall be constructed and installed to withstand the effects of potential earthquake motions. The term “withstand” means the unit will remain in place without separation of any parts from the device when subjected to potential seismic forces and the unit will be fully operational after the seismic event, so that the equipment can operate immediately after an earthquake. Switchboards shall withstand the effects of earthquake potential seismic forces as determined according to IEEE 344, SEI/ASCE 7, and as applicable to the Project location and codes.

2.02 ACCEPTABLE MANUFACTURERS

A. The switchboard(s), overcurrent protective devices, components, and accessories shall be from a single source from single manufacturer Manufacturers subject to compliance with requirements, provide switchboard(s), components, and accessories by one of the following:
1. Eaton Electrical Inc.
2. Square D Company.
3. American Power Company

2.03 ENCLOSURE AND BUS STRUCTURE

A. See drawings for physical arrangement of switchboard sections.
1. Switchboard dimensions, where shown on drawings, must be maintained to permit working access to switchboard and NEC clearance requirements.
2. Protective device layout(s) shown on drawings may be modified as required to accommodate manufacturer’s construction requirements, unless otherwise specified on drawings.

B. Phase Buses and Neutral Bus shall be as follows unless otherwise specified above or on drawings.
1. Continuous and fully rated between all sections and provision made for expansion of switchboard to future distribution section through bus splice and removable cover, unless otherwise specified above or on drawings.
2. Phase and neutral buses and connections shall be silver plated, hard-drawn copper of 98 percent conductivity.
3. Where Phase Bus Bars are to be insulated, they shall be individually covered with full sleeves type insulator material and with provision to access bolted connections through removable cover boots without removing bus bar insulation. Insulation material shall be factory-applied, electrically rated for the bus voltage (minimum 600V), flame-retardant, and minimum insulation temperature rating of 105 C.

C. Ground Bus shall be as follows unless otherwise specified above or on drawings.
1. Continuous throughout switchboard.
2. Minimum 1/4-by-2-inch size, silver plated, hard-drawn copper of 98 percent conductivity, equipped with pressure connectors for feeder and branch-circuit ground conductors.

3. Provide for future expansion of ground bus corresponding to expansion of Phase Bus Bars.

D. Enclosure: Welded steel frame with bolted/hinged covers with minimum 12 gauge steel for the enclosure and minimum 14 gauge steel for panels and doors. All welded joints shall be ground flat with no burrs or sharp edges. The switchboard steel frame shall be constructed so that the switchboard can be lifted, slid, or laid back flat during installation without damage, shall be of sufficient strength to support the weight of conduits and wire, and shall be capable of spanning open floor beneath switchgear (to 80% of the switchboard depth) for cable trench without structural failure or excessive deflection of the switchboard frame.
   1. Finish: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface, unless otherwise specified above.
   2. Top: Flat
   3. Side/Rear Access Covers: Bolted covers shall be provided with danger labels on each cover. Hinged covers shall be provided when specified above, noted on drawings, or when a phase bus is routed within 4 inches of the cover and the cover is 48 inches or larger. Make provision for padlocking and supply danger label.
   4. Front Panels: Hinged to allow access to circuit breaker, metering, accessory, and blank compartments.
   5. Lifting Hooks: Removable and set of hooks provided for each shipping split.
   6. Door-mounted infrared testing windows, where required above or on drawings, shall be provided in quantities and locations in each section to permit inspection of fuses, switches, circuit breakers, conductor lugs, and bus connections, where these features would be viewable if the covers were removed. Windows shall be NRTL (UL) listed/labeled, suitable for transmission of visible and IR light, and installed at the factory or in the field by qualified field service technicians or as required to maintain the switchboard NRTL (UL) ratings.
   7. Fabricate and factory test switchboard according to IEEE 344 to withstand potential seismic forces as applicable to the Project location and codes.

E. Utility Revenue Metering Compartment: Where required above or in drawings, provide a fabricated barrier compartment section complying with the utility company's requirements. If a separate vertical section is required for utility metering, match and align with the switchboard front and rear.

F. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard unless otherwise specified.

G. Pull Box on Top of Switchboard: Where required, will match dimensions of switchboard section, unless otherwise specified on drawings.
   1. Adequate ventilation to maintain temperature in pull box within same limits as switchboard.
   2. Removable covers shall form top, front, and sides. Top covers at rear shall be easily removable for drilling and cutting (unless switchboard is front access only).
   3. Bottom shall have adequate opening for cable drops into switchboard. Opening edges shall be smoothed and guarded with insulating, fire-resistive material to protect wire from metal edges. Conductors shall be grouped in feeder sets and routed with minimal crossing to the respective switchboard lugs.
   4. Conductor supports shall be arranged to facilitate cabling and adequate to support cables indicated, including those for future installation.

H. Provision for Future Devices: Equip sections and compartments with mounting brackets, supports, bus extensions, appurtenances at full rating of planned circuit-breaker, and blank plates/covers/doors as specified herein or on drawings, associated notes and/or schedules.

2.04 OVERCURRENT PROTECTIVE DEVICES

A. Comply with UL 489 or UL 1066 as appropriate.

B. Mounting:
   1. Power CB: Drawout or Fixed mounting as noted on schedule.
   2. Molded Case CB: Fixed mounting or as noted on schedule.

C. Compression or mechanical style lugs, suitable for number, size, trip ratings, and conductor materials.

D. Protective device rating minimum default shall be as follows, unless otherwise specified on the drawings, associated notes, and/or schedules.
   1. Main Circuit Breaker or Fuse 100% Rated
   2. Feeder Circuit Breaker 600A and above 100% Rated
   3. Feeder Circuit Breaker Below 600A 80% Rated
   4. Feeder Fuse 1000A and above 100% Rated
   5. Feeder Fuse Below 1000A 80% Rated
   6. Branch Circuit Breaker or Fuse 80% Rated

E. Short Circuit Rating
   1. Full Rating: Switchboard protective devices shall be Fully Rated to interrupt symmetrical short-circuit current available at terminals, unless otherwise noted on drawings, associated notes, and/or schedules.
   2. Series Rating: Where the switchboard protective devices are permitted to be Series Rated, include the size and type of allowable upstream and branch devices labeled on the switchboard and with labeling indicating NRTL approvals for the series-connected short-circuit rating as approved by NRTL listing or label. Provide a sheet summarizing this information with the Submittal.

F. Power Circuit Breakers (PCB): PCB type and rating shall be as indicated on the drawings, associated notes, and in the switchboard drawings and/or schedules.
   1. PCB Electronic Trip with LCD Display: **Applicable to All PCB**
      a. Electronic RMS type sensing equipped with field-replaceable rating plug or electronic trip unit. The circuit trip unit shall be equipped with the following adjustable settings that shall be separate independently adjustable values through a LCD display. Any external hardware or software required to view and/or change settings shall be included with the switchboard. These circuit breakers shall be provided with (a) network communication capability (Modbus, Ethernet) and (b) concentrators/gateway equipment, wiring and connections ready for a potential future connection to an Ethernet IP based computer or SCADA system. A DC power supply shall be provided to power the circuit breaker LCD displays, any required associated power meter, and the network equipment/wiring. The following trip features shall be provided as noted in the schedule, drawings, and/or associated notes:
         1) Long Time Pickup (LTPU).
         2) Long Time Delay (LTD).
         3) Short Time Pickup (STPU).
         4) Short Time Delay with I^2t In/Out response.
         5) Instantaneous (INST).
         6) Ground-fault Pickup (GFPU).
         7) Ground Fault Delay (GFD) with I^2t In/Out response.
      b. Ground Fault protection only for 480V service equipment/conductors and 480V feeders, unless otherwise noted.
      c. The trip units and/or plugs shall be field changeable.
      d. Provide clear, transparent, tamper cover to prevent unauthorized access or inadvertent changes to the circuit breaker settings. The cover shall be removable and equipped with a loop to fit a wire seal in order to lock the cover in place confirming the integrity of the circuit breaker settings per NEC.
      e. Provide hardware for locking the breaker in the racked out position and the breaker contacts open for lock out tag out safety procedures.
      f. See schedule, drawings, and/or associated notes for required locations where these circuit breakers and the selected features are to be provided

G. Molded Case Circuit Breakers (MCCB): See Drawings and Schedules.
   1. MCCB type and rating shall be as indicated on the drawings, associated notes, and in the switchboard schedules.
   2. Motor Circuit Protection (MCP): Any (Non VFD) Size Motor Starter

a. Use MCP for motor protection when motor circuit provided with motor controller and overload protection.
b. Provide MCP with adjustable magnetic trip using easily accessible dial(s). Minimum 3X to 10X range of MCP nominal rating.
c. The trip units and/or plugs shall be field changeable.
d. Do not use MCP with Variable Frequency Drives (VFD); use MCCB with Thermal-Magnetic Trip for VFD.

3. MCCB Thermal-Magnetic Trip**:** **15A to 225A**
   a. Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
   b. Additional MCCB Application Listing:
      1) Type SWD for switching fluorescent lighting loads.
      2) Type HID for fluorescent and high-intensity discharge lighting loads.
   c. Exception: Where the circuit breaker is within the current range from 45A to 225A and is used as the primary protection for a transformer, and that transformer secondary and/or the connected transformer panelboard main is protected by a MCCB with electronic trip unit, then the primary breaker shall be equipped as MCCB Electronic Trip with LCD display as noted below.
4. MCCB Thermal-Magnetic w/Adjustable Instantaneous Trip**:** **250A to 350A**
   a. Inverse time-current element for low-level overloads and adjustable instantaneous magnetic trip element for short circuits. The magnetic trip element shall be front-mounted, field-adjustable trip setting for short circuits.
   b. Exception: Where the circuit breaker is used as the primary protection for a transformer and that transformer secondary and/or the connected transformer panelboard main is protected by a MCCB with electronic trip unit, then the primary breaker shall be equipped as MCCB Electronic Trip with LCD display as noted below.
   c. The trip units and/or plugs shall be field changeable.
5. MCCB Electronic Trip with LCD Display**:** **400A and Above**
   a. Electronic RMS type sensing equipped with field-replaceable rating plug or electronic trip unit. The circuit trip unit shall be equipped with the following adjustable settings that shall be separate independently adjustable values through the LCD display. Any external hardware or software required to view and/or change settings shall be included with the switchboard. These circuit breakers are to be provided with (a) network communication capability (Modbus, Ethernet) and (b) concentrators/gateway equipment, wiring and connections ready for a potential future connection to an Ethernet IP based SCADA system. A DC power supply is to be provided to power the circuit breaker LCD displays, any required associated power meter, and the network equipment/wiring. The following trip features are to be provided as noted in the schedule, drawings, and/or associated notes:
      1) Long Time Pickup (LTPU).
      2) Long Time Delay (LTD).
      3) Short Time Pickup (STPU).
      4) Short Time Delay with I^2t In/Out.
      5) Instantaneous (INST).
      6) Ground Fault Pickup (GFPU).
      7) Ground Fault Delay (GFD) with I^2t In/Out.
   b. Ground Fault protection only for 480V service equipment/conductors and 480V feeders, unless otherwise noted on drawings/schedules.
   c. The trip units and/or plugs shall be field changeable.
   d. Provide clear, transparent, tamper cover to prevent unauthorized access or inadvertent changes to the circuit breaker settings. The cover shall be removable and equipped with a loop to fit a wire seal in order to lock the cover in place confirming the integrity of the circuit breaker settings per NEC.
   e. Provide hardware for locking the breaker contacts open for lock out tag out safety procedures.
   f. See schedule, drawings, and/or associated notes for required locations where these circuit breakers and the selected features are to be provided.

6. Current-Limiting Circuit Breakers: None specified.
7. GFCI Circuit Breakers See Schedules.
    a. Personnel Protection: Single and two pole configurations with Class A ground-fault protection (6-mA trip).
    b. Equipment Protection (GFEP): Single and two pole configuration with Class B ground-fault protection (30-mA trip).
8. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: See Schedules.
    a. Comply with UL 1699; 120/240-V, single-pole configuration.
9. MCCB Features/Accessories:
    a. Where required in the drawings and/or schedules the following features shall be provided as noted:
    b. Instantaneous Override: Provide for all new power circuit and molded case electronic circuit breakers, where available for circuit breakers (a) 1200A and more and (b) on new selected “downstream” breakers as indicated in schedule, drawings, and/or associated notes
    c. Zone Selective Interlocking: Provide for all new circuit breakers (a) 1200A and more and (b) on new selected “downstream” breakers as indicated in schedule, drawings, and/or associated notes.
    d. Maintenance Override Switch: Provide for all new circuit breakers 1200A and larger as indicated on schedule, drawings, and/or associated notes. The maintenance override switch shall eliminate any programmed intentional tripping delay. (Note: The maintenance override cannot be provided with ZSI due to space limitations in the circuit breakers).
    e. Ground-Fault Protection for bolted pressure switches. The relay shall be mounted in the door of the cabinet and be provided with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    f. Shunt Trip with trip coil energized from separate circuit and set to trip at 75 percent of rated voltage. Provide circuit breaker or switch with coil to trip circuit breaker or switch mechanism when coil is energized or de-energized, depending on planned shunt trip function (i.e., trip on event or trip on loss of signal) as indicated in specification, drawings, associated notes, or schedules.
    g. Handle Padlocking Device: Fixed attachment for locking circuit-breaker handle in on or off position.
    h. Handle Clamp: Loose attachment for holding circuit-breaker handle in on position.

H. Fuses See Drawings and Schedules.
1. Comply with the requirements of NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
2. Branch circuit protective devices, where identified in these specifications, drawings, associated, notes, or schedules shall be class J fuses, unless otherwise specified
3. Provide Spare Fuse Cabinet with capacity to hold double the quantity of Project spare fuses as noted in specifications, drawings, or associated notes. Provide cabinet for each major electrical room (i.e., a room being supplied with either a Main switchboard and/or distribution switchboard under this Project and requiring storage of either spare medium voltage fuses or six or more spare fuse sets).

2.05 POWER METERING

A. POWER METER Acceptable Manufacturers: Subject to compliance with Project requirements, provide UL listed Power Meter by one of the following:
1. Electro Industries Nexus 1450 Power Meter (See Drawings, Schedules, and Notes).
2. Power meter by the switchboard manufacturer.

B. Owner Digital Power Meter: Where required above or in drawings, provide a metering compartment with front hinged door. Meter shall be a multifunction, microprocessor-based electronic power meter unit suitable for three- or four-wire systems as described below. The electronic meter shall be removable. The voltage signal potential transformer (PT) or direct wired and current transformers (CT) shall be provided with switches for safe removal and/or maintenance of the unit by isolating the voltage or shunting the current sensor signals. The meter shall be semi-flush mounted and a programmable electronic device with a keypad and

communication port for user programming and display selection. Provide the power meter with the following features.

1. Digital display of the following values with maximum accuracy tolerances as indicated:
    a. Phase Currents, Each Phase: Plus or minus 1 percent.
    b. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
    c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
    d. Kilowatts: Plus or minus 2 percent.
    e. Kilovars: Plus or minus 2 percent.
    f. Power Factor: Plus or minus 2 percent.
    g. Frequency: Plus or minus 0.5 percent.
    h. Accumulated Energy, Kilowatt Hours: Plus or minus 2 percent; accumulated values unaffected by power outages up to 72 hours.
    i. Kilowatt Demand: Plus or minus 2 percent; demand interval programmable from five to 60 minutes (set to 15 minutes).
    j. Total Harmonic Distortion Percentage (THD%) voltage and current.
    k. Total Demand Distortion (TDD%) current.
    l. Individual voltage and current harmonic levels to 19th multiple.
2. Metered valves to include real time, historic maximum and minimum values.
3. The meter shall be capable of communicating as a web server or an Ethernet network and shall be able to communicate all recorded/calculated values to the host computer. Provide a windows based software program for display of all measured parameters.
4. The meter shall also be capable of Modbus connection for communication to power meter memory to upload power metering data to PLC/SCADA systems.
5. The meter shall meet applicable ANSI standards and be listed to UL 508 and UL 1244.
6. The meter shall be powered through a control power transformer with Class CC current-limiting primary fuses for protection of the transformer and secondary fuses for protection of any control circuits.
7. Provide current transformers (CT) sized according to the rating of the equipment bus. No fuses permitted on the CT wiring. Potential transformers, where required, shall be supplied with fusing (Class CC fuses, finger safe) on voltage signal leads and on transformer secondary. All internal, interconnecting, device, CT, PT, instrument, signal, communication, and external (leaving the meter compartment) wiring shall be terminated on terminal blocks.
    a. Current Transformers: IEEE C57.13, 5Amp, 60 Hz, secondary. Burden and accuracy shall be consistent with connected metering.
    b. Current Transformers for each phase conductor and neutral where wye connected service in order to directly measure the neutral current.
    c. Shunt switches (not terminals) for CT wiring.
    d. Instrument grade PT for each phase where reduction/isolation in voltage signal is required or as noted on the drawings.
    e. Isolation switches for direct or PT voltage signals.
    f. Control wiring shall be factory installed, with bundling, lacing, and protection included. Provide flexible conductors for # 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

2.06 ACCESSORY COMPONENTS AND FEATURES

A. DC Power Supply: Provide a control power transformer with DC power supply, protective devices, and terminal blocks to power all switchboard circuit breaker electronic trip units. The DC power circuit will be sized to power network equipment, power meters, and LCD displays to permit verifying and modifying electronic circuit breaker trip unit settings.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from switchboard. Include relay, communication interface cable, software, and meter test plugs and/or software suitable for testing switchboard meters.

2.07 SURGE PROTECTIVE DEVICE (SPD)

A. SPD Acceptable Manufacturers: Subject to compliance with Project requirements, provide UL listed SPD by one of the following:

1. Switchboard Manufacturers listed above.
2. Current Technology

B. SPD shall be provided as noted herein, unless otherwise noted on drawings and schedules:
   1. Service Rated Switchboard
      Always provide SPD.
   2. Distribution Switchboard No SPD required, unless otherwise noted on drawings.
   3. Emergency Life Safety Switchboard Provide SPD per NEC.

C. SPD shall be supplied from one manufacturer and shall match the equipment manufacturer where available as specified.

D. SPD shall be mounted within switchboard and connected to dedicated protective device.

E. SPD Electrical Requirements
   1. Unit Operating Voltage: Refer to drawings, associated notes, and schedules for switchboard operating voltage and for any unit configuration information.
   2. Maximum Continuous Operating Voltage (MCOV): The MCOV shall not be less than 125% of the nominal system operating voltage.
   3. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.
   4. Nominal Discharge Current (In): All SPDs applied to the distribution system shall have a RMS symmetric fault current rating equivalent or greater than the available fault current of the associated switchboard, regardless of their SPD Type (Type 1 and Type 2; see definition below) or operating voltage. SPDs shall otherwise have a minimum of 42kA RMS symmetrical fault rating, unless otherwise pre-approved in writing (separate from the submittal review document process) by the Engineer.
   5. Protection modes and UL 1449 Voltage Protection Rating, VPR, for grounded wye circuits with 480Y/277V or 208Y/120V, three-phase, four-wire circuits shall be as follows:
      a. Line to Line: 2000V for 480Y/277 and 1200V for 208Y/120.
      b. Line to Neutral: 1200V for 480Y/277 and 700V for 208Y/120.
      c. Line to Ground: 1200V for 480Y/277 and 700V for 208Y/120.
      d. Neutral to Ground: 1200V for 480Y/277 and 700V for 208Y/120.

F. SPD Design
   1. Maintenance Free Design: The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
   2. Balanced Suppression Platform: The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.
   3. Electrical Noise Filter: Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Products unable to meet this specification shall not be accepted.
   4. Internal Connections: No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.
   5. Monitoring Diagnostics: Each SPD shall provide the following integral monitoring options.
      a. Protection Status Indicators: Each unit shall have light emitting diode (LED) solid-state indicator light that reports the status of the protection on each phase.
      b. Test Control: Simulates ground fault to test relay and switch (or relay only if "no-trip" mode is selected).

1) For wye configured units, the indicator lights must report the status of all protection elements and circuitry in the L-N and L-G modes. Wye configured units shall also contain an additional LED solid-state indicator light that reports the status of the protection elements and circuitry in the N-G mode.
2) For delta configured units, the indicator lights must report the status of all protection elements and circuitry in the L-G and L-L modes.
3) The absence of a normal status LED light and the presence of problem status LED light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.

c. Surge Counter: The SPD shall be equipped with an LCD display that indicates to the user how many surges have occurred at the location. The surge counter shall trigger each time a surge event with a peak current magnitude of a minimum of 50 ± 20A occurs. A reset pushbutton shall also be standard, allowing the surge counter to be zeroed. The reset button shall contain a mechanism to prevent accidental resetting of the counter via a single, short-duration button press. In order to prevent accidental resetting, the surge counter reset button shall be depressed for a minimum of 2 seconds in order to clear the surge count total.
1) The ongoing surge count shall be stored in non-volatile memory. If power to the SPD is completely interrupted, the ongoing count indicated on the surge counter's display prior to the interruption shall be stored in non-volatile memory and displayed after power is restored. The surge counter's memory shall not require a backup battery in order to achieve this functionality.

6. Overcurrent Protection
a. The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.
b. The unit shall be protected by circuit breaker of fuse as appropriate to the equipment being protected.
c. SPD Type definition and use:
1) SPD Type I: Installed on the line side of the service entrance disconnect. Not permitted unless specifically shown on drawings or approved by the Engineer. Provide protection noted above.
2) SPD Type 2: Installed on the load side of the service entrance disconnect. Typical configuration with protection noted above.

7. Fully Integrated Component Design: All of the SPD's components and diagnostics shall be contained within one discrete assembly. SPDs or individual SPD modules that must be ganged together in order to achieve higher surge current ratings or other functionality shall not be accepted.

G. SPD System Application
1. All SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.
2. Switchboard Peak Single-Impulse Surge Current Rating: The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:
a. Service Entrance: 125kA per mode/250kA per phase (L-N, L-G).
b. Distribution 1200A and above: 125kA per mode/250kA per phase (L-N, L-G).
c. Distribution below 1200A: 80kA per mode/160kA per phase (L-N, L-G).

2.08 MISCELLANEOUS

A. Nameplates: Generally consult the plan set Nameplate Schedule detail drawing(s) for nameplate specifications; otherwise, use the following default minimum requirements:
1. Switchboard: Label each switchboard section with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical

Systems." Provide minimum 4”x2” nameplate with white background. Nameplate shall contain two-lines of text indicating the switchboard Project name (1/2-inch text) and the switchboard power source (3/8-inch text) in black lettering, minimum unless otherwise specified on the drawings and associated notes.

2. Device: Label each protective device in the switchboard main and distribution section(s) with a device nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems." Provide minimum 3”x1-1/2” nameplate on each circuit breaker/fused switch. The white background nameplate shall contain two-lines of text indicating the protective device number (3/8-inch text) within the switchboard and the feeder name (3/8-inch text) protected by the device in black lettering, minimum unless otherwise specified on the drawings and associated notes.

B. Safety Labels: Provide all the code required Warning/Danger safety labels. Provide nameplate for any service rated switchboard identifying the available fault current at the equipment from information provided by the Engineer.

C. Service Rated Switchboard Placard: Provide oneline placard, if required by the NEC, from information and in a format approved by the Engineer.

D. Arc Flash Labels: If an Arc Flash study is included with the Project and the Arc Flash labels are furnished by the Owner or Engineer, then the Contractor shall install the furnished labels. Otherwise, this work shall be provided as stipulated in the Project or other applicable Contract documents.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION

A. Provide all labor, material, lugs, protective devices, equipment, and components necessary for the installation of a complete and functional switchboard in accordance with applicable federal, state, local building electrical codes, and the manufacturers' recommendations, except where the plan set drawings, associated notes, schedules, and/or specifications are stricter. This work will include any required power, control, or signal wiring for equipment, such as breaker control power, cabinet heaters, power meter control power, control interlocks, etc. Install according to NECA 400 and NEMA PB2.1.

B. Provide all labor, material, and components necessary for the installation of a complete communication sub-system(s). This work will include any required control power and communication wiring for equipment, such as circuit breakers, meter control power, and communication components; control interlocks; communication wiring between circuit breaker trip units located in the same or separate distribution equipment (e.g., communication for Zone Selective Interlocking); power meter or circuit breaker gateway/concentrator communication wiring to a local site BAS/BMS/SCADA network switch, etc.

C. Provide a Factory Trained and Authorized representative of the switchboard manufacturer to advise the Contractor in the proper installation of the switchboard and to participate in the inspection and testing of the switchboard.

D. Coordinate layout and installation of switchboard(s) and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

E. Provide a properly trained field service technician to perform the required switchboard circuit breaker, control, communication, and infrared testing.

3.02 RECEIVE, INSPECT, STORE

A. Receive, inspect, handle, and store switchboards ready for installation.

B. Environmental Limitations

1. Do not deliver or install switchboard(s) until Project work area spaces are enclosed and weather tight, wet work in spaces is complete and dry, work above switchboard(s) is complete, and temporary or permanent HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

C. Examine switchboard(s) before installation. Reject switchboards that are moisture or physically damaged.

D. Examine elements and surfaces to receive switchboard(s) for compliance with installation tolerances and other conditions affecting performance of the Work.

E. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboard(s) into place.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

A. Do not interrupt electric service to occupied facilities without notifying and receiving the approval of the Owner. The preparations shall include:

1. Notify Construction Manager, Engineer, Owner, four weeks in advance of proposed interruption of electric service.
2. Allow sufficient time to develop the outage plan, to review and modify outage plan with the Owner, to notify the affected employees/workers, to arrange temporary power if necessary, and to implement outage plan.
3. Do not proceed with any electrical outage without the explicit permission from the Owner or the Owner's Representative.
4. Arrange to provide temporary electric service according to requirements indicated by the Owner. Indicate method of providing temporary electric service.

3.03 INSTALLATION OF SWITCHBOARDS

A. Verify layout and clearances as indicated on drawings or provide proposed layout and clearances for the switchboard(s) to the Engineer for final approval.

B. Equipment Mounting: Install switchboard(s) on concrete base, 4-inch nominal thickness. Comply with requirements for concrete base specified in Section 26 05 29 "Hangers and Supports for Electrical Systems."

1. Coordinate size of equipment bases with actual unit sizes provided. Fabricate base 4 inches larger in both directions than the overall dimensions of the supported unit. Chamfer top edge and corners of pad.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment of the switchboard(s).

C. Provide mounting and anchoring hardware to meet switchboard loading and potential seismic event requirements to comply with any vibration or seismic control requirements.

D. Temporary Lifting Provisions: Remove any temporary lifting eyes, channels, brackets, blocking, and similar moving part components from switchboard(s).

E. Install overcurrent protective devices, surge protective devices, and instrumentation not already factory installed.

F. Install filler and blank plates in unused spaces of switchboard sections.

G. Torque all wire mechanical lug and bolted bus connections. Apply colored hardening liquid seal marker on the bolt/nut lug connection after completing final torque to confirm completion of each task and to disclose any tampering or degradation of the connection by movement breaking the seal.

H. Arrange/route conductors grouped in feeder sets through the switchboard, associated pull sections, top hats, gutters, and wire way(s) in uniform, trained bundles that are supported to the structure with approved wire wraps to prevent uncontrolled movement during a fault.

3.04 INSTALLATION OF SPD (EXTERNALLY MOUNTED OR EXISTING DISTRIBUTION EQUIPMENT)

A. Install field mounted SPD products where SPD is specified for external mounting or the SPD is to be installed in an existing switchboard and in accordance with the following.

1. The SPD shall be parallel connected to the switchboard bus through a switchboard feeder protective device.
    a. The protective device (fuse or circuit breaker) shall have an interrupting rating to match AIC of the switchboard.
    b. The SPD protective device shall be mounted so that the SPD lead lengths are as short as possible. Where the planned wiring will exceed 18 inches, provide a manufactured cable that will compensate for the extra cable length.
2. The SPD shall not be installed on the line side of the electrical service main protective device bus.
3. The SPD may be mounted within the switchboard enclosure as long as:
    a. The switchboard NRTL Listing is maintained.
    b. The SPD is visible from the front and is dead front.
    c. The SPD is capable of being serviced and removed from the front of the switchboard by opening hinged door or removal of screw-panel cover.
4. An externally mounted SPD shall be installed as follows.
    a. Provide uni-strut and/or arrange conduits so that SPD may be mounted on top or side of the switchboard.
    b. Phase conductors shall be twisted around the neutral conductor to reduce inductance.
    c. SPD is mounted in the same vertical section with switchboard main circuit breaker or immediately adjacent in contiguous section.
5. Functionally test each SPD device in the system for proper operation and submit test results.

3.05 IDENTIFICATION

A. Consult plans and drawings for nameplate format, colors, and schedules. Where no instructions are provided, the following specifications and tasks are considered minimum requirements.
    1. Identify field-installed conductors, interconnecting wiring, and components complying with Section 26 05 53 "Identification for Electrical Systems."
    2. Provide proper danger, warning signs, and arc flash labels in accordance with NEC, NFPA, OSHA, and the Owner’s safety standards.
    3. Clean switchboard and device surfaces before applying nameplates.
    4. Install switchboard nameplates.
    5. Install switchboard protective device nameplates.
    6. Provide printed basic operating instructions for switchboard(s), including control and key interlocking sequences and emergency procedures. Mount on the front of switchboard(s).
    7. Provide oneline placard.
    8. Install NEC code compliant labelling to indicate available fault current at switchboard.

3.06 ADJUSTING AND CLEANING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges. The Engineer shall furnish the circuit breaker settings to the Contractor, and the Contractor shall be responsible for setting and testing the circuit breakers settings.

C. Upon completion of installation of switchboard(s), inspect interiors of switchboard(s); clear all blockages and remove burrs, paint splatters and other spots, dirt, and construction debris. Touch up scratches and mars of finish to match original finish.

3.07 ACCEPTANCE TESTING

A. Initial Testing
    1. Coordinate switchboard testing with the conductor testing.
    2. Perform non-destructive insulation resistance test for each switchboard bus, component, connecting supply, feeder, and control circuit.
    3. Test continuity of each circuit.

B. Tests and Inspections

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning circuit breakers, components, controls, and equipment.
4. Perform primary current injection tests on all Long Time, Short Time, Instantaneous, and Ground Fault adjustable trip circuit breaker settings.
    a. Test the ground fault operation in accordance with NEC 230.95(C). The Electrical Inspector or Authority Having Jurisdiction (AHJ) may require that he witness the ground fault test or may require a written record of the testing results. The Contractor shall contact and coordinate any ground test with the Electrical Inspector.
    b. Provide proposed testing procedure to verify functionality of circuit breakers supplied with Zone Selective Interlocking.
5. Perform the following infrared scan tests and inspections and prepare a report.
    a. Perform Infrared Scan after Substantial Completion, but not more than 30 days after Final Acceptance. The infrared scan of the switchboard shall include the circuit breakers, bus, bus connections, and wire connections.
    b. Use calibrated Fluke Ti32 Thermal Imager or equivalent for infrared scanning.

C. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Switchboard will be considered defective and not acceptable if it does not pass tests, inspections, or corrective measures.

E. Prepare final Field Test and Inspection report(s) that identifies the location, switchboard identification number, tests performed, and test results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

3.08 TRAINING

A. Train Owner's maintenance personnel to adjust, operate, and maintain switchboard, overcurrent protective devices, instrumentation, and accessories, and to use and reprogram microprocessor-based trip, power meter, and communication units. Include an approximately 4-hour session.

3.09 SPARE PARTS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
    1. Keys: Two spares for each type of switchboard cabinet lock (if present).
    2. Spare or provisions for circuit breakers shall be as shown on drawings or schedules.
    3. Can of manufacturer touch-up paint.

B. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
    1. Potential Transformer Fuses: One set (typically two primary fuses and one secondary fuse) for each type, and size installed.
    2. Control Power Fuses: Two for each type, and size installed.
    3. Power Fuses, including any Fused Circuit Breakers: Three for each type, and size installed.
    4. Indicating Lights: 10 lamps for each type and size installed, where lamp is replaceable.

3.10 GUARANTEE (WARRANTY)

Provide Manufacturer's warranty to repair or replace any switchboard, component, or accessory that fails in materials or workmanship within two years from date of Substantial Completion.

END OF SECTION

SECTION 26 24 16
PANELBOARDS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings, the provisions of the Contract including the General and Supplementary Conditions, and the General Requirements apply to the Work of this Section.

B. The following sections have been specifically referenced in this specification:
   1. Section 26 05 00 Common Work Results for Electrical.
   2. Section 26 05 29 Hangers and Supports for Electrical Systems.
   3. Section 26 05 53 Identification for Electrical Systems.

1.02 SUMMARY

A. This Section covers basic electrical requirements for providing labor, materials, equipment, and services necessary for the selection and installation of power panelboards as shown on the drawings and specified herein. In general, this consists of:
   1. Distribution Panelboard(s).
   2. Load Center(s)
   3. Branch Circuit (lighting, and appliance) Panelboard(s).
   4. Overcurrent Protective Devices.
   5. Surge Protective Devices.
   6. Identification.
   7. Completely installed, tested, and operative.

1.03 DEFINITIONS/ABBREVIATIONS

A. CPT Control Power Transformer.

B. CT Current Transformer.

C. MCCB Molded Case Circuit Breaker.

D. MCP Motor Circuit Protector.

E. MCS Molded Case Switch

F. OCPD Overcurrent Protective Device.

G. PT Potential Transformer.

H. SPD Surge Protective Device.

I. Provision for Circuit Breaker: The term “Space” (or “Provision”) when applied to panelboard construction means that the Manufacturer shall provide all of the bus structure, extension busing, hardware, blank plates, etc., necessary so that the assigned space would require the removal of the blank filler plate and the installation of a breaker only in the future to complete the assembly to be ready for operation.

J. See also Specification Section 26 05 00 for additional definitions/abbreviations.

1.04 SUBMITTALS

A. Bid. Provide the following with the bid documents.
   1. No additional submittals required; see Specification Section 26 05 00.

B. Manufacture. Provide the following prior to release for manufacture and/or purchase.
   1. Panelboard: Shop Drawings/Data Sheets shall be submitted for approval for each panelboard and related equipment.
      a. Show tabulations of installed devices, equipment features, and ratings.
      b. Detail bus configuration, current, and voltage ratings.
      c. Short-circuit current rating of panelboard(s) and overcurrent protective devices.
   2. Surge Protective Device (SPD)
      a. Verification that the SPD device complies with the latest edition UL 1449 and CSA/cUL approvals. Submit UL-1449 reports showing Suppressed Voltage Rating (SVR) for each specified unit.
   3. No samples requested.

C. Closeout. Provide the following to complete the project.
   1. No additional submittals required; see Specification Section 26 05 00.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: The equipment manufacturer shall be regularly engaged in the manufacture of panelboard(s), components, and accessories of the types, capabilities, and capacities required, and whose products have been in satisfactory use in similar service for not less than ten years.

B. Installer Qualifications: The National Electrical Contractors Association installation and maintenance guide NECA 407 Standard for Installing and Maintaining Panelboard(s) is hereby identified to define workmanship related to the installation of equipment and/or materials specified by this Specification section.

C. Codes/Standards: The products provided by this section shall comply with the latest editions of the following references:
   1. ANSI/IEEE C62.41 - Category C, B, and A, Recommended Practice for Surge Voltages in Low Voltage AAAAC Power Circuits
   2. NECA 407 - Standard for Installing and Maintaining Panelboards
   3. NEMA AB-1 – Molded Case Circuit Breakers
   4. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches
   5. NEMA LS1 – Low Voltage Surge Protection Devices
   6. NEMA PB 1 - Panelboards
   7. NEMA 250 - Enclosures for Electrical Equipment (1000V Maximum)
   8. UL 489 - Molded Case Circuit Breakers Marking and Application Guide
   9. UL 869 – Reference Standard for Service Equipment
   10. UL 1244 – Standard for Electrical and Electronic Measuring and Testing
   11. UL 1449 - Surge Protective Devices
   12. UL 1699 - Arc Fault Circuit Interrupters

D. Equipment Quality: Electrical panelboards, components, and accessories shall be “Listed” or “Labeled” as defined in NFPA 70, Article 100, by a National Recognized Testing Laboratory acceptable to authorities having jurisdiction, and marked for the intended location and use.

PART 2 PRODUCTS

2.01 GENERAL INFORMATION

A. All electrical equipment shall be new unless otherwise specified in the plan drawings and associated notes. The type of equipment and/or material shall be approved for its planned use and environment and is so defined by NEMA/NFPA 70 standards and NRTL certifications.

B. Panelboard shall be constructed with the following default features, unless otherwise noted on the drawings, schedules, and/or associated notes.

C. Enclosures
   1. Rated for environmental conditions at installed location typical.
      a. Rate equipment capable of continuous operation under the following ambient temperature conditions (unless otherwise indicated): 32°F to 104°F
      b. Indoor Dry and Clean Locations: NEMA 250, Type 1.
      c. Indoor Dusty or Dirty Locations: NEMA 250, Type 12.
      d. Outdoor Locations (Falling Water): NEMA 250, Type 3R.
      e. Wet or Damp Locations (Directed Water): NEMA 250, Type 4.
      f. Wet Corrosive Locations: NEMA 250, Type 4X stainless steel.
   2. Structure:
      a. Ambient: Inside Building Conditioned Space.
      b. Enclosure: NEMA 1.
      c. Dimensions:
         1) Width: Cabinet/Section Manufacturer Std.
         2) Depth: Cabinet/Section Manufacturer Std.
         3) Height: Cabinet/Section Manufacturer Std.
         4) Oversized Cabinet: Not required.

d. Mounting: Wall Mounted.
   1) Surface/Flush: See Panelboard Schedule.
   2) Front Outer Cover: Secured to box with concealed trim clamps for surface-mounted front.
   3) Front Inner Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
e. Feeder Conduit Access: Top/Bottom.
f. Branch Circuit Conduit Access: Top/Bottom.
g. Utility Meter Section: None Required.
h. Power Meter: None Required.
i. Power On Status Lights: None Required.
j. Infrared Windows: None Required.
k. Color: Mfg. Standard ANSI Gray.

D. Ratings:
1. Panelboards are to be provided with the following default voltage, current, phase, and frequency rating unless otherwise noted on the drawings, schedules, and/or associated notes.
   a. Voltage: See Drawings/Schedules.
   b. Phase: See Drawings/Schedules.
   c. Frequency: 60 HZ
   d. Current: See Drawings/Schedules.
   e. Service Rated: Not Required.

E. Phase, Neutral, and Ground Buses:
1. Material: Silver Plated Copper.
2. Fault Rating: Circuit Breaker AIC ratings per drawings, schedules, and associated notes. Minimum 10KAIC Symmetrical RMS.
3. Phase Bus: See Drawings/Schedules.
4. Neutral Bus: Same Size as Phase Bus.
   If panelboard loads are more than 25% computer, server, network, or similar nonlinear loads, then neutral bus is to be sized 200% of phase bus.
5. Ground Bus: Separate from neutral terminals, Sized to accommodate all available circuits.

F. Conductor Connections: Furnished with the panelboard and suitable for use with conductor material and sizes.
1. Material: Silver Plated Copper.
2. Main and Neutral Lugs: Mechanical or compression type, minimum 75°C rating.
3. Ground Lugs: Mechanical or compression type, minimum 75°C rating.
4. Bus Configured Terminators: Mechanical or compression type, minimum 75°C rating.
5. Feed-through Lugs: Mechanical or compression type, suitable for use with conductor material. Locate at the opposite end of the bus from incoming main lugs or main device. Minimum 75°C rating.
6. Sub-feed Lugs: Mechanical or compression type suitable for use with conductor material. Locate at same end of bus as incoming main lugs or main device. Minimum 75°C rating.

G. Provision for Future Devices: Equip sections with mounting brackets, supports, bus connections, appurtenances at full rating of planned circuit-breaker, and blank/filler plates/covers/doors as specified herein or on drawings, associated notes and/or schedules.

2.02 ACCEPTABLE MANUFACTURERS

A. The panelboard(s), overcurrent protective devices, components, and accessories to be from a single source from single manufacturer. Manufacturers subject to compliance with requirements, provide panelboard(s), components, and accessories by one of the following:
1. Eaton Electrical Inc.

2. Siemens Company
3. Square D Company

2.03 DISTRIBUTION PANELBOARDS

A. Panelboards: NEMA PB 1, power and feeder distribution type.

B. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

C. Circuit breakers shall be bolt-on circuit breakers where individual positive-locking device requires mechanical release for removal unless otherwise specified. Circuit breaker shall be replaceable without disturbing adjacent units.

2.04 BRANCH-CIRCUIT PANELBOARDS

A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

B. Maximum number of circuits per panelboard is 84.

C. Doors: Door in Door trim. Concealed hinges; secured with flush latch with tumbler lock; keyed alike. Provide latch, lock and key set on the door covering the circuit breakers.

D. Branch circuit breaker shall be bolt-on unless, otherwise specified. Circuit breaker shall be replaceable without disturbing adjacent units.

E. Tandem breakers are prohibited.

2.05 COORDINATION PANELBOARDS

A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type. Panelboards shall be capable of providing full selective coordination between branch circuit overcurrent protection, panel main overcurrent protection, and upstream overcurrent protective devices.

B. Doors: Door in Door trim. Concealed hinges; secured with flush latch with tumbler lock; keyed alike. Provide latch, lock and key set on the door covering the circuit breakers.

C. Branch circuits 100A and less shall incorporate bolt-on fusible overcurrent protection and branch-circuit rated disconnecting means into a single integrated component.
   1. Device shall have visible circuit on/off indication with colored and international symbol markings.
   2. Device shall provide open fuse indication via permanently installed indicating light.
   3. Fuse and disconnect assembly shall be a finger-safe component with trim installed. Fuse and disconnect shall be mechanically interlocked so as not to allow fuse removal while fuse terminals are energized.
   4. Permanently installed lockout means shall be provided on the device.

D. Main disconnect, where provided, shall be quick-make, quick-break type and include permanently installed lockout means.

E. Panelboard shall be equipped with a spare fuse compartment for storing a minimum of six spare branch circuit fuses specific to the panel.

2.06 OVERCURRENT PROTECTIVE DEVICES (OCPD)

A. Comply with UL 489

B. Compression or mechanical style lugs, suitable for number, size, trip ratings, and conductor materials.

C. Protective device rating minimum default shall be as follows, unless otherwise specified on the drawings, associated notes, and/or schedules.

1.	Main Circuit Breaker	100% Rated
2.	Feeder Circuit Breaker 600A and above	100% Rated
3.	Feeder Circuit Breaker Below 600A	80% Rated
4.	Feeder Fuse 1000A and above	100% Rated
5.	Feeder Fuse Below 1000A	80% Rated
6.	Branch Circuit Breaker or Fuse	80% Rated

D. Short Circuit Rating
   1. Full Rating: Panelboard protective devices shall be Fully Rated to interrupt symmetrical short-circuit current listed on the drawings.

2. Series Rating: Series ratings are not allowed on this project.

E. Molded Case Circuit Breakers (MCCB): See Drawings and Schedules.
   1. MCCB type and rating shall be as indicated on the drawings, associated notes, and in the panelboard schedules.
   2. MCCB Thermal-Magnetic Trip: **15A to 225A**
      a. Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
      b. Exception: Where the circuit breaker is within the current range from 45A to 225A and is used as the primary protection for a transformer and that transformer secondary and/or the connected transformer panelboard main is protected by a MCCB with electronic trip unit, then the primary breaker shall be equipped as MCCB Electronic Trip with LCD display as noted below.
   3. MCCB Thermal-Magnetic w/Adjustable Instantaneous Trip: **250A to 350A**
      a. Inverse time-current element for low-level overloads and adjustable instantaneous magnetic trip element for short circuits. The magnetic trip element shall be front-mounted, field-adjustable trip setting for short circuits.
      b. The trip units and/or plugs shall be field changeable.
   4. GFCI Circuit Breakers See Schedules.
      a. Personnel Protection: Single and two pole configurations with Class A ground-fault protection (6-mA trip).
      b. Equipment Protection (GFEP): Single and two pole configuration with Class B ground-fault protection (30-mA trip).
      c. Ground fault sensor and protection shall be integral to the circuit breaker and shall include a push to test feature.
   5. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: See Schedules.
      a. Comply with UL 1699; 120V, single-pole configuration.
   6. MCCB Features/Accessories: See Above and Schedules.
      a. Where required in the drawings, schedules, associated notes, or above, the following features shall be provided as noted:
         1) Shunt Trip with trip coil energized from separate circuit and set to trip at 75 percent of rated voltage. Provide circuit breaker or switch with coil to trip circuit breaker or switch mechanism when coil is energized or de-energized, depending on planned shunt trip function (i.e., trip on event or trip on loss of signal) as indicated in specification, drawings, associated notes, or schedules.
         2) Handle Padlocking Device: Fixed attachment for locking circuit-breaker handle in on or off position.
         3) Handle Clamp: Loose attachment for holding circuit-breaker handle in on position.

F. Fuses See Drawings and Schedules.
   1. Comply with the requirements of NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
   2. Branch circuit protective devices, where identified in these specifications, drawings, associated, notes, or schedules shall be either class J or class CC fuses, unless otherwise specified.
   3. Provide Spare Fuse Cabinet with capacity to hold double the quantity of Project spare fuses as noted in specifications, drawings, or associated notes. Provide cabinet for each major electrical room (i.e., a room being supplied with panelboards under this Project requiring storage of six or more spare fuse sets).

2.07 SURGE PROTECTIVE DEVICE (SPD)

A. SPD shall be provided as noted herein, at a minimum unless otherwise noted on drawings.
   1. Emergency Panelboard: always provide SPD.
   2. Distribution Panelboard: As specified on the drawings.
   3. Branch Circuit Panelboard: As specified on the drawings.

B. SPD shall be supplied from one manufacturer.

C. SPD shall be mounted adjacent to panelboard within 18 inches of panelboard protective device.

D. SPD Acceptable Manufacturers: Subject to compliance with Project requirements, provide UL listed SPD by one of the following:
   1. Manufacturers listed above.
   2. Current Technology.
   3. Environmental Potentials type EP-2500 series.

E. SPD Electrical Requirements
   1. Unit Operating Voltage: Refer to drawings, associated notes, and schedules for panelboard operating voltage and for any unit configuration information.
   2. Maximum Continuous Operating Voltage (MCOV): The MCOV shall not be less than 125% of the nominal system operating voltage.
   3. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.
   4. Nominal Discharge Current (In): All SPDs applied to the distribution system shall have a RMS symmetric fault current rating equivalent or greater than the available fault current of the associated panelboard, regardless of their SPD Type (Type 1 and Type 2; see definition below) or operating voltage. SPDs shall otherwise have a minimum of 42kA RMS symmetrical fault rating, unless otherwise pre-approved in writing (separate from the submittal review document process) by the Engineer.
   5. Protection modes and UL 1449 Voltage Protection Rating, VPR, for grounded wye circuits with 480Y/277V or 208Y/120V, three-phase, four-wire circuits shall be as follows:
      a. Line to Line: 2000 V for 480Y/277 and 1200 V for 208Y/120.
      b. Line to Neutral: 1200 V for 480Y/277 and 700 V for 208Y/120.
      c. Line to Ground: 1200 V for 480Y/277 and 700 V for 208Y/120.
      d. Neutral to Ground: 1200 V for 480Y/277 and 700 V for 208Y/120.

F. SPD Design
   1. Maintenance Free Design: The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPD shall be sine wave tracking. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
   2. Balanced Suppression Platform: The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.
   3. Electrical Noise Filter: Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Products unable to meet this specification shall not be accepted.
   4. Internal Connections: No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.
   5. Monitoring Diagnostics: Each SPD shall provide the following integral monitoring options.
      a. Protection Status Indicators: Each unit shall have light emitting diode (LED) solid-state indicator light that reports the status of the protection on each phase.
      b. Surge Counter: The SPD shall be equipped with an LCD display that indicates to the user how many surges have occurred at the location. The surge counter shall trigger each time a surge event with a peak current magnitude of a minimum of 50 ±20A occurs. A reset pushbutton shall also be standard, allowing the surge counter to be zeroed. The reset button shall contain a mechanism to prevent accidental resetting of the counter via a single, short-duration button press. In order to prevent accidental resetting, the surge counter reset button shall be depressed for a minimum of 2 seconds in order to clear the surge count total.

1) The ongoing surge count shall be stored in non-volatile memory. If power to the SPD is completely interrupted, the ongoing count indicated on the surge counter's display prior to the interruption shall be stored in non-volatile memory and displayed after power is restored. The surge counter's memory shall not require a backup battery in order to achieve this functionality.

6. Overcurrent Protection
   a. The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.
   b. The unit shall be protected by circuit breaker of fuse as appropriate to the equipment being protected.
7. Fully Integrated Component Design: All of the SPD's components and diagnostics shall be contained within one discrete assembly. SPDs or individual SPD modules that must be ganged together in order to achieve higher surge current ratings or other functionality shall not be accepted.

G. SPD System Application
   1. All SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.
   2. Panelboard Peak Single-Impulse Surge Current Rating: The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:
      a. Distribution: 80 kA per mode/160 kA per phase (L-N, L-G).
      b. Branch Circuit: 50 kA per mode/100 kA per phase (L-N, L-G).

2.08 MISCELLANEOUS

A. Nameplates: Generally consult the drawings for equipment naming.
   1. Panelboard: Provide panelboard nameplate complying with the requirements of section 26 05 54 "Identification of Electrical Systems."
   2. Circuit Legend: Furnish each panel with a clear, plastic covered, typed circuit schedule. The schedule shall identify circuits by final room numbers.

B. Safety Labels: Provide all the code required Warning/Danger safety labels. Provide label for all panelboards identifying the available fault current at the equipment from information provided by the Engineer.

C. SPEC WRITER NOTES: [Arc Flash Labels: An Arc Flash study will be furnished by TBD. The contractor shall provide the labels].

PART 3 EXECUTION

3.01 GENERAL INSTALLATION

A. Receive, inspect, handle, store, and install panelboard(s) according to NECA 407 and NEMA PB 1.1.

B. Provide all labor, material, lugs, protective devices, equipment, and components necessary for the installation of a complete and functional panelboard in accordance with applicable federal, state, local building and electrical codes, and the manufacturers' recommendations, except where the plan set drawings, associated notes, schedules, and/or specifications are stricter. This work will include any required power, control, or signal wiring for equipment such as breaker control power, cabinet heaters, power meter control power, control interlocks, etc.

C. Coordinate layout and installation of panelboard(s) and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements.

3.02 RECEIVE, INSPECT, STORE

A. Environmental Limitations
   1. Do not deliver or install panelboard(s) until Project work area spaces are enclosed and weather tight, wet work in spaces is complete and dry, work above panelboard(s) is complete, and temporary or permanent HVAC system is operating and maintaining

ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Examine panelboard(s) before installation. Reject panelboard(s) that are moisture or physically damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 INSTALLATION OF PANELBOARDS

A. Shared Neutrals: Where shared neutral conductors are found within a panelboard, contractor shall identify those circuits and submit a report to the engineer. Following review of the shared neutrals, the contractor shall separate the circuits that have shared neutrals. If the engineer determines the shared neutral circuits cannot be segregated, then provide a handle tie circuit breaker from the panel manufacturer. Replace branch breakers as required for handle ties.

B. Where GFCI breakers are being replaced, contractor shall provide GFCI circuit breakers to match existing types and ratings.

3.04 WHERE EXISTING PANELBOARDS RECESSED WITHIN A MASONRY WALL, CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS RELATED TO THE PHYSICAL PANEL SIZE, THE PHYSICAL SIZE OF THE PANEL INTERIOR COMPONENTS, AND THE WIRE BENDING SPACE. EXISTING BACK BOX MAY BE RE-USED IF THE BOX IS IN GOOD CONDITION WITH NO SIGNS OF RUST OR CORROSION.

3.05 INSTALLATION OF SPD (EXTERNALLY MOUNTED)

A. Install field mounted SPD products where SPD is specified for external mounting or the SPD will be installed in an existing panelboard and in accordance with the following.
   1. The SPD shall be parallel connected to the panelboard bus through a panelboard feeder protective device.
      a. The protective device (fuse or circuit breaker) shall have an interrupting rating to match AIC of the panelboard.
      b. The SPD protective device shall be mounted so that the SPD lead lengths are as short as possible. Where the planned wiring will exceed 18 inches, provide a manufactured cable that will compensate for the extra cable length
   2. The SPD shall not be installed on the line side of the electrical service main protective device bus.
   3. The SPD may be mounted within the panelboard enclosure as long as:
      a. The panelboard NRTL Listing is maintained.
      b. The SPD is visible from the front and is dead front.
      c. The SPD is capable of being serviced and removed from the front of the panelboard by opening hinged door or removal of screw-panel cover.
   4. An externally mounted SPD shall be installed as follows.
      a. Provide uni-strut and/or arrange conduits so that SPD may be mounted on top or side of the panelboard.
      b. Phase conductors shall be twisted around the neutral conductor to reduce inductance.
   5. Functionally test each SPD device in the system for proper operation and submit test results.

3.06 ADJUSTING AND CLEANING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges. The Engineer shall furnish the circuit breaker settings to the Contractor, and the Contractor shall be responsible for setting and testing the circuit breakers settings.

C. Upon completion of installation of panelboard(s), inspect interiors of panelboard(s); clear all blockages and remove burrs, paint splatters and other spots, dirt, and construction debris. Touch up scratches and mars of finish to match original finish

3.07 IDENTIFICATION

A. Consult plans and drawings for nameplate format, colors, and schedules. Where no instructions are provided, the following specifications and tasks are considered minimum requirements.
   1. Identify field-installed conductors, interconnecting wiring, and components complying with Section 26 05 53 "Identification for Electrical Systems."
   2. Provide proper danger, warning signs, and arc flash labels in accordance with NEC, NFPA, OSHA, and the Owner's safety standards.
   3. Clean panelboard and device surfaces before applying nameplates.
   4. Install panelboard nameplates.
   5. Install panelboard device nameplates.

B. Install clean, typed panelboard schedule(s) in pocket. The panel schedule shall identify circuits by the final room numbers.

C. Panelboard nameplate shall include panel ID, operating voltage, and the piece of equipment the panel is 'fed from'.

D. Install NEC code compliant labelling.

3.08 ACCEPTANCE TESTING

A. Initial Testing
   1. Coordinate panelboard testing with the conductor testing.
   2. Perform non-destructive insulation resistance test for each panelboard bus, component, connecting supply, feeder, and control circuit.
   3. Test continuity of each circuit.

B. Tests and Inspections
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
   3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning circuit breakers, components, controls and equipment.
   4. SPEC WRITER NOTES: TAKE OUT THIS SECTION IF NO LARGE BREAKERS. [Perform tests on all Long Time, Short Time, Instantaneous, and Ground Fault adjustable trip circuit breaker settings.]
      a. Test the ground fault operation in accordance with NEC 230.95(C). The Electrical Inspector or Authority Having Jurisdiction (AHJ) may require that he witness the ground fault test or may require a written record of the testing results. The Contractor shall contact and coordinate any ground test with the Electrical Inspector.
      b. Provide proposed testing procedure to verify functionality of circuit breakers supplied with Zone Selective Interlocking.
   5. Perform the following infrared scan tests and inspections, and prepare a report:
      a. Perform Infrared Scan after Substantial Completion, but not more than 30 days after Final Acceptance. The infrared scan of the panelboard shall include the circuit breakers, bus, bus connections, and wire connections.
      b. Use calibrated Fluke Ti32 Thermal Imager or equivalent for infrared scanning.

C. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Panelboard(s) will be considered defective and not acceptable if it does not pass tests, inspections, or corrective measures.

E. Prepare final Field Test and Inspection report(s) that identifies the location, panelboard ID, test performed, and test results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

3.09 SPARE PARTS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Keys: Two spares for each type of panelboard cabinet lock (if present).

2. Spare and space (or provision) for circuit breakers shall be as shown on drawings or schedules.
3. One spare fuse for every 10 fused circuits of each size. Provide a minimum of three spare fuses of each size.
4. Can of manufacturer touch-up paint.

3.10 GUARANTEE (WARRANTY)

A. Provide Manufacturer's warranty to repair or replace any panelboard, component, or accessory that fails in materials or workmanship within two years from date of Substantial Completion.

END OF SECTION

SECTION 26 24 16.10
LIGHTING AND APPLICANCE BRANCH CIRCUIT LOAD CENTERS

PART 1 GENERAL

The requirements of the contract contained in either, Division 01, or Division 26 shall also apply to the work/requirements of this section.

1.01 SECTION INCLUDES

A. This specification covers low voltage load centers with main circuit breakers or main lugs and plug-in circuit breaker feeders as specified below and as shown on the contract drawings.

1.02 RELATED SECTIONS

A. Not Applicable – No related sections

1.03 REFERENCES

A. As applicable to the specifics of the project drawings and the specifics of the equipment design for this project, the low voltage load centers, installed protective devices and other installed components in this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted on the project drawings or annotated in any sections below).
   1. NFPA 70, National Electrical Code
   2. UL 67, Standards for Panelboards
   3. UL 50, Standards for Cabinets and Boxes
   4. UL 489, Molded Case Circuit Breakers
   5. UL 869, Standards for Service Equipment

1.04 DEFINITIONS

A. Overcurrent Protective Device = a circuit breaker pole. Example: a 2-pole device is considered 2 protective devices.

B. Short Circuit Rating = shall be the interrupting rating of the lowest rated device in the load center or applicable UL/cUL series rating for proper main and branch device combinations.

C. Protective Devices = molded case circuit breakers.

D. Fully Rated System = The short-circuit ratings of all protective devices are equal to or exceed the available short-circuit current of the system.

E. Series-Connected System = The short-circuit rating of the upstream device is fully rated at its location, but the downstream devices are not fully rated. The downstream device has lower interruption rating than the available fault current at its location.

F. Series-Connected Rating = UL/cUL permits assigning a short-circuit rating to a combination of devices (molded-case circuit breakers and/or fuses) connected in series that is higher than the lowest rated protective device in the combination. Note:
   1. Series ratings are applicable only when the end-use equipment is so marked.
   2. The combination rating cannot exceed the rating of the protective device furthest upstream.
   3. Upstream device can be a molded-case circuit breaker or fuse.
   4. Device combinations are not limited to those in the same equipment. They can be in different equipment, such as the combination of a meter stack tenant feeder breaker or panelboard feeder breaker and a downstream load center main versus a load center main and its branches.
   5. Any distance between devices in different equipment is permitted.
   6. Total fault current magnitude must flow through all protectors. Thus, fault current contribution from motors, as well as power source fault current, must flow through upstream and downstream protectors.

1.05 SUBMITTALS

A. The contractor/installer shall provide electronic copies of the following documents in PDF format as SUBMITTAL drawings to the engineer/owner for review and evaluation. It is preferred that the drawing format be provided in letter/size "A" (8.5" x 11") or tabloid/ size "B" (11" x 17") format to facilitate easy copying. Manufacturing of the equipment will not begin until the

submitted documents are stamped/noted "approved" or "approved as noted" by the engineer/owner and officially released for manufacturer by the contractor/ installer/distributor/owner.

B. APPROVAL documents for the specified product shall include:
   1. Load Center Information Drawing – by the equipment manufacturer. This "by each type" document shall contain at least the following information for each type of load center on the project. For exactly identical types, quantities of the load center shall also be indicated.
      a. Panel Description – provide a dimensioned outline drawing, knockout configurations, ampere rating, voltage rating, aic value, bus material, enclosure rating, trim type and cable terminal data for the main lugs, neutral lugs and ground lugs.
      b. Main Description – provide ampere rating, number of poles (for main device) or number of phases (for main lugs), type of main as breaker (with details of breaker style) or lugs, and the incoming lug range
      c. Branch Devices – providing a listing of the quantity of each type of branch device and the branch breaker ampere value with number of poles
   2. Load Center Brochure – detailing the general construction of the product – by the equipment manufacturer
   3. Product Data Sheets for the breakers and any other components – by the equipment manufacturer

C. The contractor/installer shall provide electronic copies of the following documents in PDF format as AS BUILT drawings to the engineer/owner for review and evaluation. It is preferred that the drawing format be provided in letter/size "A" (8.5" x 11") or tabloid/ size "B" (11" x 17") format to facilitate easy copying. Manufacturing of the equipment will not begin until the submitted documents are stamped/noted "approved" or "approved as noted" by the engineer/owner and officially released for manufacturer by the contractor/ installer/distributor/owner.

D. AS BUILT documents for the specified product shall include:
   1. Load Center Information Drawing – by the equipment manufacturer. This "by each type" document shall contain at least the following information for each type of load center on the project. For exactly identical types, quantities of the load center shall also be indicated.
      a. Panel Description – provide a dimensioned outline drawing, knockout configurations, ampere rating, voltage rating, aic value, bus material, enclosure rating, trim type and cable terminal data for the main lugs, neutral lugs and ground lugs.
      b. Main Description – provide ampere rating, number of poles (for main device) or number of phases (for main lugs), type of main as breaker (with details of breaker style) or lugs, and the incoming lug range
      c. Branch Devices – providing a listing of the quantity of each type of branch device and the branch breaker ampere value with number of poles and cable terminal sizes
   2. Load Center Installation Instructions – by the equipment manufacturer.

1.06 QUALITY ASSURANCE (QUALIFICATIONS)

A. The manufacturer shall have specialized in the manufacture of low voltage load centers and associated circuit breakers for at least 15 years.

B. The load centers shall be listed and/or classified by Underwriters Laboratories in accordance with standards listed in the "REFERENCES" section of this specification above

1.07 DELIVERY, STORAGE, AND HANDLING

A. The contractor /installer shall receive, store, protect and handle the load centers and breakers in accordance with recommended practices listed in manufacturer's Installation Instructions and/or Maintenance Manuals.

B. The manufacturer shall ship each load center in an individual carton for ease of handling.

C. The contractor/installer shall inspect and if necessary, report any concealed damage to carrier within 48 hours of the load centers and breakers being delivered. The contractor/ installer shall be responsible for all claims with the shipper.

D. The contractor/installer shall store the load center and breakers in a clean, dry space and shall maintain factory protection and/or cover the components with heavy canvas or plastic to keep

out dirt, water, construction debris, and traffic. The contractor/installer shall refer to the manufacturer's Installation Instructions and/or Maintenance Manuals for any and all requirements to keep the equipment in compliance with the warranty.

E. The contractor/installer shall handle the load centers and breakers in accordance with all appropriate NEMA and manufacturer's written instructions to avoid damaging them.

1.08 PROJECT CONDITIONS (SITE ENVIRONMENTAL CONDITIONS)

A. The contractor/installer shall follow all appropriate standards and service conditions before, during and after the load center installation.

B. The load centers shall be located in well ventilated areas, free from excess humidity, dust and dirt and away from hazardous materials.

C. Indoor locations shall be protected to prevent moisture from entering enclosure.

1.09 WARRANTY

A. The Manufacturer warrants the load centers and breakers be free from defects in materials and workmanship for 1 year from date of installation or 18 months from date of shipment, whichever occurs first. The equipment must be received, stored and installed in accordance with the manufacturer's Installation Instructions and/or Maintenance Manuals to avoid nullifying this warranty.

B. In the event of that any warranty work needs to be performed, a representative of the manufacturer shall be notified in writing of the problem. The factory will then issue instructions and any materials to correct the problem. All warranty work must be performed by the manufacturer at the manufacturer's discretion in order to maintain the manufacturer's warranty.

1.10 FIELD MEASUREMENTS

A. The contractor/installer shall make all necessary field measurements to verify that the load centers shall fit in the allocated space in full compliance with the minimum required clearances recommended by the manufacturer, specified in National Electrical Code and required by any applicable local/facility constraints.

PART 2 PRODUCTS

2.01 MANUFACTURER & DESIGN

A. **General Electric products by ABB** have been used as the basis for design and is the *preferred provider for the equipment. Other possible acceptable manufactures are listed below. The listing of specific manufacturers does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed are not relieved from meeting these specifications in their entirety.
   1. **GE by ABB** – PowerMark Gold/Plus Load Centers (basis of design)
   2. Eaton/Cutler Hammer –CH Load Centers
   3. Siemens – PL Series Load Centers
   4. Square D – QO Load Centers

B. Request for acceptance as an approved equal manufacturer must be submitted to the engineer in writing (letter, fax or e-mail) at least 10 business days prior to the bid date. A written (letter, fax or email) response from the engineer/owner will then be issued determining the acceptance or rejection of the request.

C. Any and all exceptions to the requirements detailed in this specification shall be included in the manufacturer's proposal so that the engineer/owner can easily make a comparison to this base specification document.

D. If no exceptions or qualification are contained in the manufacturer's proposal, the manufacturer shall provide exactly what is detailed in this section of the specification. Failure to meet the requirements of the specification or to note any exceptions or qualifications will result in the technical rejection of the proposal.

E. The first source of general information shall be these general specifications; however, detailed and specific information contained in the drawings will take precedent over these general specifications as the drawings contain project specific information. In the event of a conflict the owner/engineer will determine which is correct.

2.02 EQUIPMENT INFORMATION - ITEM #9

A. Refer to the project drawings and load center schedules for the locations, layouts, breaker details and installed components. The drawings and schedules shall also include information about the current and voltage ratings of devices, the bus bars as well as other assemblies.

B. Equipment Requirements
   1. The low voltage load centers shall be designed to accept circuit breakers as the protective device. All feeder/branch breakers shall be plug-in type only.
   2. The load centers shall be UL/cUL listed and shall bear the UL/cUL label..
   3. All load centers with a main breaker shall be supplied with a means to bond the neutral to the ground in the field; so that if desired, the panel may be suitable for use as a service entrance device.
   4. Boxes shall be made from galvanized steel having multiple knockouts on the top, bottom, sides and back to offer multiple locations for the conductors to enter the enclosure. The boxes shall also be of sufficient size to provide at least a minimum code gutter space on all sides. Outdoor units shall be provided in a high scratch resistant standard gray finish.
   5. Trims shall be provided in a high scratch resistant standard gray finish. The finish paint shall be of a type to which field applied paint will adhere.
   6. The cover shall self-adjust for flush applications.

C. The supply voltage and the phase / neutral specifics of the load centers shall be as shown on the project drawings and the load center schedules.

D. Each load center assembly including breakers shall have a minimum short circuit rating of **10K RMS** symmetrical amperes at the voltage noted above. This value shall be equal to or greater than the short-circuit available from all sources. The load center shall also contain a label indicating this short circuit value at rated voltage.

E. The load centers shall be **fully** rated

F. Bussing Requirements
   1. Given the superior performance of copper as a conductor, the bus bars for the main and cross connectors shall be of tin-plated copper construction. Use of aluminum bus bars and cross connectors must be noted as an exception in all documents, bill of material, and approval drawings.
   2. Bussing shall be braced throughout to conform to industry standard practice governing short-circuit stresses in load centers.
   3. Neutral bus shall have a suitable lug for each outgoing feeder requiring a neutral connection that is the same of same ampacity as the branch circuit.

G. All interiors shall be either factory assembled with main breaker, main lugs or have field convertible mains.

H. Interiors shall be designed so that while the bus is de-energized, branch circuit breakers can be replaced without disturbing adjacent units and without removing the main bus connectors. Branch circuit should be able to be changed without machining, drilling or tapping the bus or connection straps.

I. A physical means must be provided to prevent the installation of more over-current devices than that number for which the enclosure was designed.

J. All wire connectors and terminals shall be of the solderless type and shall be suitable for copper or aluminum wire. All connectors shall meet the "Requirements for Wire Connectors and Soldering Lugs" UL 486B.

K. All load centers where marked shall be suitable for use with 60/75 degrees C rated wire.

L. Enclosure
   1. The overall unit enclosure shall be **NEMA 1** dead-front construction, intended for indoor use primarily to provide a degree of protection against contact with the enclosed equipment.

2.03 MAIN PROTECTIVE DEVICES

A. Furnish molded case circuit breakers for all load centers as the main device. All circuit breakers shall have the breaker's ampacity printed on either the handle or breaker face. The ampere rating of the main breaker shall be as indicated on the project drawings or load center schedules.

B. The circuit breaker frame shall be constructed of a high-strength, molded, glass-reinforced polyester case. Breakers shall have an overcenter, toggle handle-operated, trip free mechanism with quick make, quick break action independent of the speed of the toggle handle operation.

C. An ON and OFF position shall be clearly marked on the breaker. All breakers shall have a means to provide handle trip indication when the breaker activates during a fault.

D. The overload/short-circuit trip mechanism shall be a thermal and magnetic trip element trip unit. The breaker shall be UL/cUL listed for standard duty and shall be applied at 80% of its current rating.

E. Factory installed CU/AL mechanical lugs are to be provided with the main breaker. These lugs shall be rated for use with either 60 degree C or 75 degree C wire.

F. For convertible load centers, the factory main shall be field installable.

2.04 FEEDER PROTECTIVE DEVICES

A. The feeder or branch circuit breakers shall be molded case type. It is preferred to have 1 inch per pole breaker construction; however, ¾ inch per pole and ½ in per pole alternatives will be allowed. This deviation from the 1" per pole must be noted on all submittal documents.

B. Each pole of the circuit breaker will have inverse time delay overload and instantaneous short-circuit protection by means of both thermal and magnetic sensors.

C. The circuit breaker calibration shall not be affected by environmental changes in relative humidity. Breakers shall be calibrated after assembly.

D. All circuit breakers shall be operated by a toggle-type handle and multi-pole circuit breakers shall have an internal common trip mechanism. The circuit breakers shall incorporate trip mechanisms that are mechanically trip-free from the handle. The handle position shall provide good visual trip indication.

E. All terminals shall be listed for use with copper or aluminum conductors. Terminals shall be of the box lug design. The terminals shall meet UL 486B requirements and shall be suitable for use with either 60 degree or 75 degree C wire.

F. All single pole 15 ampere and 20 ampere breakers shall be switching duty rated (SWD) and shall be suitable for 120 volt ac fluorescent lighting loads.

G. All breakers 15 ampere through 100 ampere shall be heating, air conditioning and refrigeration rated (HACR).

H. All circuit breakers shall have the breaker's ampacity printed on either the handle or breaker face. They shall be UL /cUL listed for standard duty and are to be applied at 80% of their current rating.

I. Standard branch breakers shall have a range of 15 amperes through 125 amperes.

J. Special branch breakers shall be provided as indicated below
   1. Where indicated on the drawings, Arc-Fault protection circuit breakers shall be provided. These Combination AFCI breakers are compliant with 2008 NEC and later. These breakers are available from 15 amperes through 20 amperes in 1 pole units.

PART 3 EXECUTION

3.01 EXAMINATION

A. The following examinations shall be performed by the contractor/installer.
   1. Verify that the field measurements of the lineup are the same as shown on factory drawings.
   2. Inspect the GE by ABB PowerMark Gold/Plus Load Centers and confirm that they are ready to be installed.

3. Check walls or the mounting structure for uniformity and a level plumb surface.
4. Examine the installation area to assure there is enough clearance to install the load centers such that it will fit in the allocated space in full compliance with the minimum required clearances recommended by the manufacturer, specified in National Electrical Code and required by any applicable local/facility constraints.
5. Confirm that required utilities are available, in proper location and ready for use.

B. Beginning of installation means that the contractor/installer accepts these conditions.

3.02 LOCATION

A. Refer to the projects site layout drawings for details regarding the proper area to place the equipment.

3.03 INSTALLATION

A. The contractor/installer shall furnish and completely install the load centers and breakers per manufacturer's installation instructions. All necessary hardware to secure the equipment in place shall be provided by the contractor/installer.

B. The contractor/installer shall provide and install any required safety labels.

3.04 FIELD QUALITY CONTROL

A. The following quality control checks shall be performed by the contractor/installer.
1. Inspect the installed load centers for proper anchoring, alignment and grounding as well as inspecting for any internal and external physical damage.
2. Confirm that all shipping and packing material has been removed.
3. Check the tightness of all accessible mechanical and electrical connections with a calibrated torque wrench. The minimum acceptable values are specified in the manufacturer's instructions.
4. Refer to manufacturer's instruction sheets for any other requirements applicable to the load center and breakers.
5. Check each electrical bus for proper phasing and identification.
6. Check and test each breaker for proper mechanical and electrical operation.

3.05 ADJUSTING

A. The contractor/installer shall adjust all access doors and operating handles for free mechanical and electrical operation as described in the manufacturer's instructions.

B. The contractor/installer shall refer to the manufacturer's instruction book to make adjustments to mechanisms, doors, handles, etceteras, as required.

3.06 CLEANING

A. The contractor/installer shall clean the interior and exterior of the load centers to remove construction debris, dirt, and shipping materials.

B. The contractor/installer shall repaint scratched or marred exterior surfaces to match original finish.

3.07 TRAINING

A. Not Applicable – no training on the load centers is required.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings, the provisions of the Contract including the General and Supplementary Conditions, and the General Requirements apply to the Work of this Section.

B. The following sections have been specifically referenced in this specification:
   1. Section 26 05 00 Common Work Results for Electrical.
   2. Section 26 05 53 Identification for Electrical Systems.

1.02 SCOPE

A. This Section covers basic electrical requirements for providing labor, materials, equipment, and services necessary for the selection and installation of wiring devices, covers, and associated hardware as shown on the drawings and specified herein. In general, this consists of
   1. Straight Blade Receptacles
   2. GFCI Receptacles
   3. AFCI Receptacles
   4. USB Charger Combination Receptacles
   5. Controlled Receptacle
   6. Wall Plates
   7. Twist-lock receptacles
   8. Snap switches and wall switches
   9. Wall-box dimmers
   10. Solid-state fan and/or speed controls
   11. Pendant cord-connector devices
   12. Cord and plug sets
   13. Floor outlets, poke-through assemblies
   14. Conference table boxes and receptacles
   15. Multi-outlet assemblies - plugmold
   16. Power Poles
   17. Finishes
   18. Identification

1.03 DEFINITIONS/ABBREVIATIONS

A. Cooper Wiring Devices; a division of Cooper Industries, Inc. Cooper

B. Hubbell Incorporated; Wiring Device-Kellems Hubbell

C. Leviton Mfg. Company Inc. Leviton

D. Pass & Seymour/Legrand; Wiring Devices & Accessories P&S

E. No additional definitions/abbreviations provided.

1.04 SUBMITTALS

A. Bid. Provide the following with the bid documents.
   1. No additional submittals required; see Specification Section 26 05 00.

B. Manufacture. Provide the following prior to release for manufacture and/or purchase.
   1. Shop Drawings/Data Sheets shall be submitted for approval for the following equipment:
      a. Shop Drawing for each type of wiring device.
      b. Data sheets for steel slotted channel system components.
      c. Shop drawings for equipment supports.
   2. Samples of any or all proposed equipment or system components, in each color specified, shall be submitted for examination/approval as requested.
   3. Submit Seismic Guides and Certification to verify that the specified equipment and installation meet all requirements to withstand potential seismic forces, where required.

C. Construction. Provide the following during construction.

1. Testing Report indicating test procedure(s) and certifying that all devices are operating properly.

D. Closeout. Provide the following to complete the project.
   1. Maintenance and warranty data for wiring devices to include the Manufacturers' packing label warnings and instruction manuals that include labeling conditions.
   2. See Specification Section 26 05 00.

1.05 QUALITY ASSURANCE

A. Manufacturer. The equipment manufacturer shall be regularly engaged in the manufacture of wiring devices, cover plates, and associated hardware of the types, capabilities, and capacities required, and whose products have been in satisfactory use in similar service for not less than ten years.

B. Installer Qualifications. No additional qualifications specified.

C. Codes/Standards. The Products provided by this section shall comply with the latest editions of the following references.
   1. FS W-C-596 – Electrical Power Connector, Plug, Receptacle, and Cable Outlet.
   2. FS W-S-896 – Switch, Toggle.
   3. NEMA WD 1 – General-Purpose Wiring Devices.
   4. NEMA WD 5 – Specific-Purpose Wiring Devices.
   5. UL 498 – Attachment Plugs and Receptacles.
   6. UL 943 – Class A Ground-Fault Circuit-Interrupters.

D. Equipment Quality. Wring devices, cover plates, and associated hardware shall be “Listed” or “Labeled” as defined in NFPA 70, Article 100, by a National Recognized Testing Laboratory acceptable to authorities having jurisdiction, and marked for the intended location and use.

PART 2 PRODUCTS

2.01 GENERAL INFORMATION

A. All wring devices, cover plates, associated hardware, and materials shall be new unless otherwise specified on the plan drawings and associated notes. The type of equipment and/or material shall be approved for its planned use and environment and is so defined by NEMA/NFPA 70 standards and NRTL certifications.

B. Provide wiring devices at each outlet/opening indicated on the drawings.

C. Devices shall be installed in accordance with NEC Article 404 and 406.

D. Provide wiring device, cover plates, and associated hardware from one manufacturing source, unless otherwise pre-approved by the Engineer in writing.

2.02 ACCEPTABLE MANUFACTURERS

A. Manufacturers:
   1. Eaton/Cooper.
   2. Hubbell.
   3. Leviton.
   4. Legrand/ P&S.

2.03 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL CCN RTRT and UL 498.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Cooper; 5361 (single), 5362 (duplex).
      b. Hubbell; HBL5361 (single), 5362 (duplex).
      c. Leviton; 5361A (single), 5362A (duplex).
      d. P&S; 5361A (single), 5362A (duplex).
      e. See plan for Tamper Resistant requirements.
   2. Description: Straight blade and with one-piece brass ground, wide bodied.
   3. All receptacles shall be 20A rated unless noted otherwise.
   4. Weather resistant (WR) marked for outdoor use.

2.04 GFCI RECEPTACLES

A. Ground Fault Circuit Interrupter Convenience Receptacles, 125V, 20A: Comply with NEMA WD1, NEMA WD6 configuration 5-20R, UL CCN KCXS, UL 498, at specific locations required by the NFPA 70 (such as kitchens, shop spaces and outdoor spaces).
   1. 5mA nominal ground current trip
   2. Tamper resistant (TR) shutters.
   3. LED indication of tripped condition.
   4. Test/Reset pushbutton on front of device.
   5. Automatic self test periodically to ensure GFCI protection.
   6. Feed through connection for downstream devices.
   7. All outdoor receptacles shall be corrosion resistant and suitable for wet and damp locations. Each shall be marked with the 'WR' weather resistant marking
   8. All outdoor receptacles shall be GFCI rated.
   9. All outdoor receptacles shall be mounted in non-ferrous back box.
   10. All outdoor receptacles shall have metal 'While in use cover'. Red Dot or similar. No plastic bubble covers will be allowed.

B. Special Purpose Receptacles
   1. Single phase and / or Three Phase connected to 120VAC, 240VAC and 208VAC systems
   2. 30Amp, 40Amp and 50Amp receptacles
   3. Straight Blade or Twistlock types.
   4. At locations in shop spaces or for welding receptacles
   5. Shall be GFCI protected by the branch breaker located at the Panelboard.

2.05 AFCI RECEPTACLES (AT LOCATIONS SHOWN ON THE DRAWINGS).

A. Single duplex receptacle
   1. Configuration: NEMA 5-20R
   2. NEMA WD1, NEMA WD6 configuration.
   3. 125V, 20A, comply with UL CCN AWBZ, UL 498,UL 1699A
   4. Pushbutton reset on front of device
   5. Tamper resistant (TR) shutters
   6. LED indication of tripped condition
   7. Self test to ensure proper function
   8. Feed through connection for downstream devices.

2.06 USB CHARGER AND DUPLEX RECEPTACLE COMBINATION.

A. Combination USB charger outlet and NEMA 5-20R duplex receptacle
   1. UL CCN RTRT and UL498
   2. Tamper resistant shutters.
   3. [Two USB type A to share 2.0Amp charging capacity between both ports.]
   4. [Two USB type C to share 30 Watts capacity between both ports.] select one
   5. Self Test electronics

2.07 CONTROLLED DUPLEX RECEPTACLE

A. Duplex Receptacle NEMA 5-20R marked with a controlled outlet symbol on the face of the receptacle and the word 'Controlled' shall be engraved in the wiring device face.
   1. UL CCN RTRT and UL 498
   2. Wiring Device shall be GREEN in color.
   3. Wall plate shall be GREEN in color.
   4. Receptacle to be wired to and controlled by a power pack that is part of the lighting control system and shall be occupancy / vacancy controlled.

2.08 WALL PLATES

A. Single and combination types to match corresponding wiring devices. For existing / remodeling project, verify plates match existing / adjacent devices.
   1. Plate-Securing Screws: Metal with head color to match plate finish.
   2. Material for Finished Spaces: 0.035-inch- (1-mm-) thick, satin-finished type 302 non-magnetic stainless steel.

3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, gasketed, complying with type 3R weather-resistant impact resistant polycarbonate with stainless steel mounting screws.

2.09 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Cooper: L520R.
b. Hubbell: HBL2310.
c. Leviton: 2310.
d. P&S: L520-R.

2.10 SNAP SWITCHES AND WALL SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:
1. Products: Subject to compliance with requirements, provide one of the following:
a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
b. Hubbell; 1221 (single pole), 1222 (two pole), 1223 (three way), 1224 (four way).
c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
d. P&S; Spec grade 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).
e. See plan for keyed switch, pilot options.

C. Refer to drawings for key-switches when required.

2.11 WALL-BOX DIMMERS

A. Dimmer Switches:
1. Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
2. Control: Continuously adjustable; with single-pole or three-way switching. Comply with UL 1472.
3. Provide with control in watts as indicated on drawings.

2.12 SOLID STATE CEILING FAN CONTROLLERS

A. Full Range Electro Mechanical
1. Rotary dial ceiling fan speed controller with off detent
2. Rating: 120VAC, 5 Amps
3. SCR Type
4. Mounts into double gang back box.
5. Stainless steel cover plate.
6. Leviton 6616, Triatron ‘Quiet Fan’ Rotary speed control, OR ‘Vari-Speed’ type KBWC.

2.13 PENDANT CORD-CONNECTOR DEVICES

A. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configurations L5-20P and L5-20R, heavy-duty grade.
1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.14 CORD AND PLUG SETS

A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.

1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.15 FLOOR OUTLETS AND POKE THROUGH ASSEMBLIES

A. Floor outlet
   1. Rectangular PVC junction box. Cast into floor. Cut top flush with top of concrete. Legrand Modulink 880MP Series pvc rectangular junction box with 1” and 2” conduit openings. Use in conference rooms and meeting rooms. Use separate box for 120vac power and separate for computer network and AV.
   2. Solid Brass receptacle cover plate flange and trim ring. Legrand Modulink 880MP series.
   3. Junction box for recessed floor outlet. Evolution series, epoxy coated steel.
   4. Evolution series recessed floor outlet.
   5. Floor outlet and cover plate must be rated for floor scrubber duty.

B. Poke Through
   1. Legrand Evolution series, 6” round.
   2. Metal flush cover plate
   3. Combined 120VAC power and Data outlets under a single cover plate.

2.16 CONFERENCE TABLE BOXES AND RECEPTACLES

A. Conference table receptacle and cable management
   1. Bent metal back box, black color.
   2. Brushed anodized black color recessed flip up cover specifically designed to be flush with the table surface.
   3. 1 duplex receptacle 120VAC for top access
   4. 1 duplex receptacle 120VAC for below table power.
   5. Integrated 120VAC cord and plug to connect to building/floor power outlet.
   6. 2 – CAT6 data jacks
   7. 1 – AV jack - HDMI
   8. 2 – USB charge ports
   9. Horizontal Under Table cord management installed under table to route cords over to floor box.
   10. Vertical Under Table cord management route cords down to floor box outlet and data jack.
   11. UL listed furniture power distribution unit
   12. Wiremold/Legrand InteGreat Table Box Series

2.17 MULTI-OUTLET ASSEMBLIES

A. 5 foot long multi-outlet system (plugmold)
   1. Painted 0.040” thickness steel housing 1.25” wide x 5 feet long
   2. Snap on cover with factory installed 15A tamper resistant outlets installed every 9”
   3. Single circuit factory wired using 3 #12 THHN wire
   4. Direct conduit connection with necessary wire clearance
   5. Wiremold/Legrand G20 series, suitable for indoor dry locations only.

B. FINISHES

C. Color: Wiring device catalog numbers are inadequate to designate device color. Verify color with Drawings, Architect, and Owner.

D. Emergency Devices: Shall be red. Device cover plates shall be red.

2.18 IDENTIFICATION

A. Each receptacle shall be field marked with the panel name and the circuit number using pressure sensitive adhesive, machine printed label.

B. At each junction box that is part of the receptacle and wall switch raceway system, the jbox cover shall be marked with the panel name and circuit number using black permanent marker.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION

A. Provide all equipment, wiring, conduit, and junction boxes required for the installation of a complete and operating system in accordance with applicable local, state, national codes, and the manufacturers' recommendations, except where the plan set drawings, associated notes, schedules, and/or specifications are stricter.

3.02 EXAMINATION/COORDINATION

A. See Drawings for mounting height of devices. If not noted, mounting heights and installation locations shall comply with NECA 1 and ADA. Mount devices shown in new locations at the indicated approximate heights to the centerline of the device. Specified heights may be adjusted ±2 inches to meet masonry coursing; however, all similar devices shall be mounted at the same height. The Contractor is cautioned that in many cases obstructions occur either above or below the outlet and the drawings must be carefully checked for interference prior to adjusting any outlet height.

B. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.

C. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.

D. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.

E. Install wiring devices after all wall preparation, including painting, is complete.

F. Verify that any receptacle(s) installed for use with the Owner’s specialty equipment matches the equipment rating, duty, and plug configuration and that the equipment properly operates. The planning shall commence with the final receptacle Manufacture/Procurement submittal and shall be confirmed after installation of the receptacle(s).

G. Cord and Plug Sets: Match equipment requirements.

3.03 INSTALLATION OF WIRING DEVICES

A. Install devices in accordance with the NEC and as specified. The ground terminal of each device shall be bonded to the outlet box with an approved green bonding jumper, and connected to the green equipment grounding conductor.

B. Receptacle Orientation: Unless otherwise indicated, long dimension shall be vertical and the grounding terminal shall be on top.

C. Group adjacent switches under single, multigang wall plates.

D. Conductors
   1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
   2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
   3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
   4. Existing Conductors:
      a. Cut back and pigtail, or replace all damaged conductors.
      b. Straighten conductors that remain and remove corrosion and foreign matter.
      c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

E. Device Installation:
   1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
   2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
   3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.

4. Connect devices to branch circuits using pigtails.
5. At line voltage snap switches, bring hot, neutral and ground conductor to switch location.
6. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
7. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
8. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
9. Tighten unused terminal screws on the device.
10. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
11. In shop spaces where welding receptacles are installed at 120VAC or 208VAC or 240VAC, each receptacle shall be GFCI protected.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:
1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.04 IDENTIFICATION

A. Comply with Section 26 05 53 "Identification for Electrical Systems."
1. Receptacles/Switches: Provide printed tape label to indicate panelboard source and circuit number on cover/faceplate, unless prohibited by the Owner. If exposed label is not permitted on the cover plate, then use permanent ink marker to mark panelboard source and circuit number inside of box and/or inside of cover plate.

3.05 ACCEPTANCE TESTING

A. Perform tests and inspections and prepare test reports.
1. Test Instruments: Use instruments that comply with UL 1436, Outlet Circuit Testers and Similar Indicating Devices.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:
1. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943, Ground Fault Circuit Interrupters.
2. Using the test plug, verify that the device is wired properly.

3.06 GUARANTEE (WARRANTY)

No additional material and/or labor warranty beyond that specified in Section 26 05 00 “Common Work Results for Electrical”.

END OF SECTION

SECTION 26 28 16
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings, the provisions of the Contract including the General and Supplementary Conditions, and the General Requirements apply to the Work of this Section.

B. The following sections have been specifically referenced in this specification:
   1. Section 26 05 00 Common Work Results for Electrical.
   2. Section 26 05 29 Hangers and Supports for Electrical Systems.
   3. Section 26 05 53 Identification for Electrical Systems.

1.02 SCOPE

A. This Section covers basic electrical requirements for providing labor, materials, equipment, and services necessary for the selection and installation of enclosed switches, circuit breakers, and supports as shown on the drawings and specified herein. In general, this consists of:
   1. Fusible switches.
   2. Nonfusible switches.
   3. Receptacle switches.
   4. Shunt trip switches.
   5. Molded-case circuit breakers (MCCBs).
   6. Enclosures.
   7. Identification.

1.03 DEFINITIONS/ABBREVIATIONS

A.	CPT	Control Power Transformer.
B.	CT	Current Transformer.
C.	MCCB	Molded Case Circuit Breaker.
D.	MCP	Motor Circuit Protector.
E.	MCS	Molded Case Switch
F.	OCPD	Overcurrent Protective Device.
G.	PT	Potential Transformer.
H.	ASEA Brown Boveri Company	ABB Company
I.	Eaton Electrical Inc.; Cutler-Hammer Products	Eaton Electrical Inc.
J.	General Electric Company	GE Company
K.	Hammond Co.; Matra Electric, Inc.	Hammond Company
L.	Siemens Energy & Automation, Inc.	Siemens Company
M.	Square D; Schneider Electric	Square D Company

N. See also Specification Section 26 05 00 for additional definitions/abbreviations

1.04 SUBMITTALS

A. Bid: Provide the following with the bid documents.
   1. No additional submittals required; see Specification Section 26 05 00.

B. Manufacture: Provide the following prior to release for manufacture and/or purchase.
   1. Shop Drawings/Data Sheets shall be submitted for approval for the following equipment (confirm list with Engineer):
      a. For each type of enclosed switch, circuit breaker, accessory, and component indicated.
         1) Enclosure types and details for types other than NEMA 250, Type 1.
         2) Dimensioned elevations, sections, weights, details, wiring diagrams, attachments to other work.
         3) Current and voltage ratings.

4) Short-circuit current interrupting and withstand ratings.
5) Technical data on features (including time current curves), performance, electrical characteristics, ratings, accessories, and finishes
6) Nameplate legends
7) Features, characteristics, ratings, and factory settings of individual overcurrent protective devices in enclosed switch / circuit breaker

b. Shop drawings for equipment supports.

2. Protective Device: Data Sheets for each protective device with characteristics, ratings, for each type and rating included in the panelboard(s).
   a. Protective Device Performance Data
      1) Complete verified SKM format electronic library models for each type and size protective device.
      2) Time Current Curve in electronic pdf format. Website links will not be accepted.
   b. Complete detailed catalog number including numbers reflecting the type, rating, configuration, characteristics, features, and auxiliary components to be furnished with the protective device.
      1) Include a guide to identify (decode) the protective device characteristics conveyed by the detailed catalog number. This guide will be used to interpret and verify the proposed protective device ratings and features. Where this guide does not exist, the information shall be included in the tabulated detailed list of the ratings and features for the protective device description in the submittal.
   c. Circuit Breaker control power, status, and network wiring diagram where applicable.
3. No samples requested.
4. Seismic Qualification Certificates: Submit certification that the enclosed switches, circuit breakers, overcurrent protective devices, accessories, and components will withstand potential seismic forces, where required.
5. See also Specification Section 26 05 00.

C. Construction: Provide the following during construction.
1. Planned field Test procedure(s) to Engineer prior to energizing and testing the enclosed switches, circuit breakers, and associated equipment.
2. Provide results of field testing of the enclosed switches, circuit breakers, protective devices, and all associated equipment in the final Field Test Report.
3. See also Specification Section 26 05 00.

D. Closeout: Provide the following to complete the project.
1. No additional submittals required; see Specification Section 26 05 00

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: The equipment manufacturer shall be regularly engaged in the manufacture of enclosed switches, circuit breakers, protective devices, and accessories of the types, capabilities, and capacities required, and whose products have been in satisfactory use in similar service for not less than ten years.

B. Installer Qualifications: The National Electrical Contractors Association installation and maintenance guide NECA 407 Standard for Installing and Maintaining Panelboard(s) is hereby identified to define workmanship related to the installation of equipment and/or materials specified by this Specification section, where applicable.

C. Codes/Standards: The products provided by this section shall comply with the latest editions of the following references
1. NEMA AB 1 – Molded Case Circuit Breakers.
2. NEMA KS 1 – Heavy Duty Enclosed and Dead-Front Switches.
3. NEMA PB 1.1 – Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600V or Less.
4. NEMA 250 - Enclosures for Electrical Equipment (1000V Maximum).
5. UL 489 - Molded Case Circuit Breakers Marking and Application Guide.
6. UL 1244 – Standard for Electrical and Electronic Measuring and Testing.

D. Equipment Quality: Electrical panelboards, components, and accessories shall be “Listed” or “Labeled” as defined in NFPA 70, Article 100, by a National Recognized Testing Laboratory acceptable to authorities having jurisdiction, and marked for the intended location and use

PART 2 PRODUCTS

2.01 GENERAL INFORMATION.

A. All electrical equipment shall be new unless otherwise specified in the plan drawings and associated notes. The type of equipment and/or material shall be approved for its planned use and environment and is so defined by NEMA/NFPA 70 standards and NRTL certifications.

Enclosed switches and enclosed breakers shall be constructed with the following default features, unless otherwise noted on the drawings, schedules, and/or associated notes.

B. Enclosure
1. Rated for environmental conditions at installed location typical.
   a. Rate equipment capable of continuous operation under the following ambient temperature conditions (unless otherwise indicated): 32°F to 104°F
   b. Indoor Dry and Clean Locations: NEMA 250, Type 1, Gasketed
   c. Indoor Dusty or Dirty Locations: NEMA 250, Type 12.
   d. Outdoor Locations (Falling Water): NEMA 250, Type 3R.
   e. Wet or Damp Locations (Directed Water): NEMA 250, Type 4.
   f. Wet Corrosive Locations: NEMA 250, Type 4X stainless steel.
2. Structure:
   a. Ambient: Inside Building Conditioned Space.
   b. Enclosure: NEMA 1.
   c. Dimensions:
      1) Width: Cabinet/Section Manufacturer Std.
      2) Depth: Cabinet/Section Manufacturer Std.
      3) Height: Cabinet/Section Manufacturer Std.
      4) Oversized Cabinet: Provide wall mounted enclosed switches and enclosed breakers with oversized cabinet if both incoming and outgoing conductors both enter from either the top or bottom of the cabinet.
   d. Mounting: Wall Mounted.
   e. Incoming Conduit Access: Top/Bottom.
   f. Outgoing Conduit Access: Top/Bottom.
   g. Infrared Windows: None Required.
   h. Color: Mfg. Standard ANSI Gray.

C. Ratings:
1. Enclosed switches and enclosed breakers are to be provided with the following default voltage, current, phase, and frequency rating unless otherwise noted on the drawings, schedules, and/or associated notes.
   a. Voltage: See Drawings/Schedules.
   b. Phase: See Drawings/Schedules.
   c. Frequency: 60 HZ
   d. Current: See Drawings/Schedules.
   e. Service Rated: See Drawings/Schedules.
   f. Enclosed switch and breakers to be horse power rated where unit is to be applied to motor loads.

D. Phase, Neutral, and Ground Buses:
1. Material: Silver Plated Copper.
2. Fault Rating: Bus Minimum 100KAIC Symmetric RMS.
3. Phase Bus: See Drawings/Schedules.
4. Neutral Bus: Same Size as Phase Bus.
   If panelboard loads are more than 25% computer, server, network, or similar nonlinear loads, then neutral bus is to be sized 200% of phase bus.
5. Ground Bus: Separate from neutral terminals,

6. Isolated Ground Bus: See Drawings/Schedules.

E. Conductor Connections: Furnished with the panelboard and suitable for use with conductor material and sizes.
   1. Material: Silver Plated Copper.
   2. Main and Neutral Lugs: Mechanical or compression type, minimum 75◦C rating.
   3. Ground Lugs: Mechanical or compression type, minimum 75◦C rating.
   4. Load Lugs: Mechanical or compression type, minimum 75◦C rating.

F. Service Equipment Rated: Provide enclosed switches and enclosed breakers with features and appropriate NRTL (UL) label for use as service entrance equipment. Enclosed switches and enclosed breakers shall be constructed for service entrance use where required by the drawings, associated notes, schedules, and/or Project use.

G. Enclosed switches and enclosed breakers shall be constructed and installed to withstand the effects of potential earthquake motions. The term “withstand” means that the unit will remain in place without separation of any parts from the device when subjected to potential seismic forces and the unit will be fully operational after the seismic event, so that the equipment can operate immediately after an earthquake. Fabricate and test panelboards according to IEEE 344 to withstand potential seismic forces as applicable to the Project location and codes.

2.02 ACCEPTABLE MANUFACTURERS

A. The enclosed switches, circuit breakers, and accessories are to be from a single source from single manufacturer Manufacturers subject to compliance with requirements, provide enclosed switches, circuit breakers, and accessories by one of the following:
   1. Eaton Electrical Inc.
   2. Square D Company.

2.03 FUSIBLE / NON FUSIBLE SWITCH CONSTRUCTION AND RATINGS

A. See drawings for ratings including number of poles, throw, voltage, current, AIC ratings, mounting, nameplates, environmental conditions, etc.).

B. General Fusible Switch Construction shall be:
   1. Compliant with UL 98 and NEMA KS 1.
   2. Heavy Duty, Single Throw, Horsepower rated
   3. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position. Interlock capable of being defeated.
   4. Fuse Kit: Provide Fuse Kit, unless enclosed switch is specified as non-fusible. Fuse kit will reject other Class fuse types
   5. Equipment Ground Kit: Provide internally mounted, labelled lug for copper grounding conductors for all switches.
   6. Equipment nameplate as specified in Section 26 05 53 "Identification for Electrical Systems".

C. Accessories:
   1. Neutral Kit: Provide internally mounted, insulated lug labeled for copper neutral conductors, where switch is specified for a four wire circuit. Neutral lug to be capable of being bonded.
   2. Auxiliary Contact Kit: Provide one NO and one NC auxiliary contact, arranged to activate before switch blades open, when auxiliary contact is specified for enclosed switch.

2.04 MOLDED-CASE CIRCUIT BREAKERS

A. See drawings for ratings including number of poles, throw, voltage, current, AIC ratings, mounting, nameplates, environmental conditions, etc.).

B. Comply with UL 489

C. Standard frame sizes, trip ratings, and number of poles. Fixed mounting, unless otherwise specified.

D. Compression or mechanical style lugs, suitable for number, size, trip ratings, and conductor materials.

E. Protective device rating minimum default shall be as follows, unless otherwise specified on the drawings, associated notes, and/or schedules.

1.	Main Circuit Breaker or Fuse	100% Rated
2.	Feeder Circuit Breaker 600A and above	100% Rated
3.	Feeder Circuit Breaker Below 600A	80% Rated
4.	Feeder Fuse 1000A and above	100% Rated
5.	Feeder Fuse Below 1000A	80% Rated
6.	Branch Circuit Breaker or Fuse	80% Rated

F. Short Circuit Rating
1. Full Rating: Panelboard protective devices shall be Fully Rated to interrupt symmetrical short-circuit current available at terminals, unless otherwise noted on drawings, associated notes, and/or schedules.
2. Series Rating: Where the panelboard protective devices are permitted to be Series Rated, include the size and type of allowable upstream and branch devices labeled on the panelboard and with labeling indicating NRTL approvals for the series-connected short-circuit rating as approved by NRTL listing or label. Provide a sheet summarizing this information with the Submittal.

G. Molded Case Circuit Breakers (MCCB): See Drawings and Schedules.
1. MCCB type and rating shall be as indicated on the drawings, associated notes, and in the panelboard schedules.
2. Motor Circuit Protection (MCP): **Any (Non VFD) Size Motor Starter**
   a. Use MCP for motor protection when motor circuit provided with motor controller and overload protection.
   b. Provide MCP with adjustable magnetic trip using easily accessible dial(s). Minimum 3X to 10X range of MCP nominal rating.
   c. The trip units and/or plugs shall be field changeable.
   d. Do not use MCP with Variable Frequency Drives (VFD); use MCCB with Thermal-Magnetic Trip for VFD.
3. MCCB Thermal-Magnetic Trip: **15A to 225A**
   a. Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
   b. Additional MCCB Application Listing per Application:
      1) Type SWD for switching fluorescent lighting loads.
      2) Type HID for fluorescent and high-intensity discharge lighting loads.
   c. Exception: Where the circuit breaker is within the current range from 45A to 225A and is used as the primary protection for a transformer and that transformer secondary and/or the connected transformer panelboard main is protected by a MCCB with electronic trip unit, then the primary breaker shall be equipped as MCCB Electronic Trip with LCD display as noted below.
4. MCCB Thermal-Magnetic w/Adjustable Instantaneous Trip: **250A to 350A**
   a. Inverse time-current element for low-level overloads and adjustable instantaneous magnetic trip element for short circuits. The magnetic trip element shall be front-mounted, field-adjustable trip setting for short circuits.
   b. Exception: Where the circuit breaker is within the current range from 45A to 225A and is used as the primary protection for a transformer and that transformer secondary and/or the connected transformer panelboard main is protected by a MCCB with electronic trip unit, then the primary breaker shall be equipped as MCCB Electronic Trip with LCD display as noted below.
   c. The trip units and/or plugs shall be field changeable.
5. Current-Limiting Circuit Breakers:None Specified.
6. GFCI Circuit Breakers See Schedules.
   a. Personnel Protection: Single and two pole configurations with Class A ground-fault protection (6-mA trip).
   b. Equipment Protection (GFEP): Single and two pole configuration with Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: See Schedules.

a. Comply with UL 1699; 120/240-V, single-pole configuration.

8. MCCB Features/Accessories: See Above and Schedules.
   a. Where required in the drawings, schedules, associated notes, or above, the following features shall be provided as noted:
   b. Instantaneous Override: Provide for all new power circuit and molded case electronic circuit breakers, where available for circuit breakers (a) 1200A and more and (b) on new selected “downstream” breakers as indicated in schedule, drawings, and/or associated notes.
   c. Zone Selective Interlocking: Provide for all new circuit breakers (a) 1200A and more and (b) on new selected “downstream” breakers as indicated in schedule, drawings, and/or associated notes.
   d. Maintenance Override Switch: Provide for all new circuit breakers 1200A and larger as indicated on schedule, drawings, and/or associated notes. The maintenance override switch shall eliminate any programmed intentional tripping delay.
   e. Ground-Fault Protection shall be integral to circuit breaker or externally mounted relay for fused switch and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
   f. Shunt Trip with trip coil energized from separate circuit and set to trip at 75 percent of rated voltage. Provide circuit breaker or switch with coil to trip circuit breaker or switch mechanism when coil is energized or de-energized, depending on planned shunt trip function (i.e., trip on event or trip on loss of signal) as indicated in specification, drawings, associated notes, or schedules.
   g. Circuit Breaker Lockable handle with capability to accept three padlocks.
   h. Equipment Ground Kit: Internally mounted and labeled for copper ground conductors for all enclosed breakers.
   i. Neutral Kit: Provide internally mounted, insulated lug labeled for copper neutral conductors, where switch is specified for four wire circuit. Neutral lug to be capable of being bonded.
   j. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact, arranged to activate before switch blades open, unless otherwise specified.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION

A. Provide all labor, material, lugs, protective devices, equipment, and components necessary for the installation of complete and functional enclosed switch and/or breaker unit(s) in accordance with applicable federal, state, local building and electrical codes, and the manufacturers' recommendations, except where the plan set drawings, associated notes, schedules, and/or specifications are stricter.

3.02 INSTALLATION OF ENCLOSED SWITCHES AND ENCLOSED BREAKERS

A. Examine conditions for compliance with enclosure and ambient-temperature requirements for each enclosed switch or enclosed breaker.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where enclosed switch/circuit breaker will be installed. Coordinate installation of wall-mounting and structure-hanging supports with actual enclosure provided. Coordinate layout and installation of enclosed switch/circuit breaker with other construction including conduit, piping, equipment, and adjacent surfaces.

D. Mount enclosure(s) plumb and rigid without distortion of box.

E. Where the enclosed switch or enclosed breaker will be floor-mounted, provide concrete base, 4-inch nominal thickness. Comply with requirements for concrete base specified in Section 26 05 29 “Hangers and Supports for Electrical Systems.”
   1. Coordinate size of equipment bases with actual unit sizes provided. Fabricate base 4 inches larger in front and to the sides than the overall dimensions of the supported unit. Chamfer top edge and corners of pad.

2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded. Anchoring hardware shall meet floor-mounted unit loading and potential seismic event requirements to comply with any vibration or seismic control requirements.
5. Remove any temporary lifting eyes, channels, brackets, blocking, and similar moving part components from panelboard(s).

F. Provide mounting hardware to meet wall mounted unit loading and potential seismic event requirements to comply with any vibration or seismic control requirements.

G. Verify that ground connections are in place and functioning properly.

H. Install fuses in fusible devices.

I. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

J. Upon completion of installation of enclosed switch and/or enclosed breaker, inspect interiors and verify that they are clear all blockages and remove burrs, paint splatters and other spots, dirt, and construction debris. Touch up scratches and mars of finish to match original finish.

K. Adjust Circuit Breaker trip settings to values as instructed by the Engineer.

3.03 IDENTIFICATION

A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."
1. Identify field-installed conductors, interconnecting wiring, and components.
2. Provide warning signs.
3. Label each enclosure with engraved metal or laminated-plastic nameplate.
4. See drawings, schedules, and associated notes for additional requirements.

3.04 ACCEPTANCE TESTING

A. Inspect Completed Installation for physical damage, proper alignment, anchorage, and grounding.

B. Check Tightness of accessible bolted bus joints using calibrated torque wrench per manufacturer's recommended torque values.

C. Tests and Inspections:
1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Perform tests on all Long Time, Short Time, Instantaneous, and Ground Fault adjustable trip circuit breaker settings.
   a. Test the ground fault operation in accordance with NEC 230.95(C). The Electrical Inspector or Authority Having Jurisdiction (AHJ) may require that he witness the ground fault test or may require a written record of the testing results. The Contractor shall contact and coordinate any ground test with the Electrical Inspector.
   b. Provide proposed testing procedure to verify functionality of circuit breakers supplied with Zone Selective Interlocking.
3. Perform the following infrared scan tests and inspections, and prepare a report:
   a. Perform Infrared Scan after Substantial Completion, but not more than 30 days after Final Acceptance. The infrared scan of the panelboard shall include the circuit breakers, bus, bus connections, and wire connections.
   b. Use calibrated Fluke Ti32 Thermal Imager or equivalent for infrared scanning.
4. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest
5. Prepare test and inspection reports, including a certified report that identifies each enclosed switch/circuit breaker included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action

6. Submit test results to Engineer and include test results in Operation, Maintenance and Warranty Data Manuals.

3.05 SPARE PARTS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Three power fuses for each type and size installed.
   2. Can of manufacturer touch-up paint, where six or more enclosed switches and enclosed breakers provided.

3.06 GUARANTEE (WARRANTY)

A. No additional material and/or labor warranty beyond that specified in Section 26 05 00 “Common Work Results for Electrical”.

END OF SECTION

SECTION 26 29 13
ENCLOSED MOTOR CONTROLLERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings, the provisions of the Contract including the General and Supplementary Conditions, and the General Requirements apply to the Work of this Section.

B. The following sections have been specifically referenced in this specification:
   1. Section 26 05 00 Common Work Results for Electrical.
   2. Section 26 05 29 Hangers and Supports for Electrical Systems.
   3. Section 26 05 53 Identification for Electrical Systems.

1.02 SUMMARY

A. Section includes the following enclosed controllers rated 600 V and less:
   1. Fractional Horsepower Manual Motor Controller
   2. Integral Horsepower Manual Motor Controller
   3. Magnetic Motor Controller
   4. Combination Magnetic Motor Controller
   5. Multispeed Magnetic Motor Controller.

1.03 DEFINITIONS

A. CPT: Control power transformer.

B. MCCB: Molded-case circuit breaker.

C. MCP: Motor circuit protector.

D. N.C.: Normally closed.

E. N.O.: Normally open.

F. TM: Thermal Magnetic circuit breaker

G. ET: Electronic Trip circuit breaker

H. LSI: Long time, short time, instantaneous trip electronic trip characteristics

I. OCPD: Overcurrent protective device.

J. Eaton Electrical Inc.; Cutler-Hammer Products Eaton Electrical Inc.

K. Rockwell Automation, Inc.; Allen-Bradley brand Allen-Bradley Company

L. Square D; Schneider Electric Square D Company

1.04 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed controllers shall withstand the effects of potential earthquake motions as determined according to ASCE and/or SEI 7. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event for essential facilities where equipment must operate immediately after an earthquake.

1.05 SUBMITTALS

A. Product Data: For each type of enclosed controller.

B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.
   1. Wiring Diagrams: For power, signal, and control wiring.

C. Seismic Qualification Certificates: For enclosed controllers, accessories, and components, from manufacturer.

D. Field quality-control reports.

E. Operation and maintenance manual and data.

1.06 QUALITY ASSURANCE

A. Electrical enclosed motor controllers and accessories shall be listed or labeled as defined in NFPA 70, Article 100, by a National Recognized Testing Laboratory acceptable to authorities having jurisdiction, and marked for intended location and use.

B. IEEE Compliance: Fabricate and test enclosed controllers according to IEEE 344 to withstand potential seismic forces.

PART 2 PRODUCTS

2.01 GENERAL INFORMATION

A. All enclosed motor controllers and associated equipment shall be new. The type of equipment and/or material shall be designated by the location where it will be installed and so defined by NEMA / NFPA 70 standards.

B. See plan set drawings, schedules, and associated notes for required protective device/disconnect, operator device requirements, etc.

C. Motor controller configuration shall be Non-reversing, Reversing, and/or Multi-speed as noted on drawings.

D. Full-Voltage Controllers shall comply with NEMA ICS 2, general purpose, Class A

2.02 ACCEPTABLE MANUFACTURERS

A. Manufacturers subject to compliance with requirements, provide enclosed motor controllers, components, and accessories by one of the following:
   1. Eaton Electrical Inc.
   2. Allen-Bradley Company
   3. Schneider Electric / Square D

2.03 FRACTIONAL HORSEPOWER MANUAL MOTOR CONTROLLER

A. Motor-Starting Switches: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on or tripped.
   1. Motor controller configuration shall be Non-reversing (FVNR) as noted on drawings.
   2. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 (Class 20 or Class 30 as required) tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; bimetallic type or melting alloy type.
   3. Surface mounted enclosure rated as shown below.
   4. LED jewel pilot light.

2.04 INTEGRAL HORSEPOWER MANUAL MOTOR CONTROLLER

A. Integral Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.
   1. Motor controller configuration shall be Non-reversing (FVNR), Reversing (FVR) as noted on drawings.
   2. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 (Class 20 or Class 30 as required) tripping characteristics; heaters and sensors in each phase, matched to nameplate full-load current of actual protected motor and having appropriate adjustment for duty cycle; external reset push button**;** bimetallic type.
   3. Surface mounted enclosure rated as shown below.
   4. LED jewel pilot light.

2.05 MAGNETIC MOTOR CONTROLLER

A. Full voltage, across the line, electrically held.
   1. Motor controller configuration shall be Non-reversing (FVNR) or Reversing (FVR) as noted on drawings.
   2. Contactor Coils: Pressure-encapsulated type.
      a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
   3. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.

4. Control Circuits: Provide control power transformer (CPT) at 120 VAC with primary and secondary fusing of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices, unless otherwise specified on the drawing.
5. Solid-State Overload Relay:
    a. Switch or dial selectable for motor running overload protection.
    b. Sensors in each phase.
    c. Class 10 (Class 20 or Class 30 as required) tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
6. External overload reset push button.
7. Hand – OFF – Auto selector switch mounted on door.
8. Red Running LED pilot light.
9. Surface mounted enclosure rated as shown below.

2.06 COMBINATION MAGNETIC CONTROLLER

A. Factory-assembled combination of an enclosed magnetic controller, OCPD, and disconnecting means.
1. Magnetic Motor Controller: see above.
2. External overload reset push button.
3. Hand –OFF- Auto selector switch mounted on door.
4. Red Running LED pilot light.
5. Surface mounted enclosure rated as shown below
6. Fusible Disconnecting Means:
    a. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate Class R fuses, unless otherwise noted on the drawings.
    b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
    c. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.
7. ENCLOSURES

B. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.
1. Dry and Clean Indoor Locations: Type 12.
2. Outdoor Locations: Type 3R.
3. Indoor Wet and Direct Spray: Type 4;
4. Indoor Wet and Direct Spray Corrosive: Type 4X stainless steel, unless otherwise indicated on the drawings.

2.07 ACCESSORIES

A. Push Buttons, Pilot Lights, and Selector Switches: NEMA ICS 5; heavy-duty type; factory installed in controller enclosure cover unless otherwise indicated.

B. Control Relays: Auxiliary and adjustable time-delay relays.

C. 7 position terminal blocks used to connect field wiring and controls.

PART 3 EXECUTION

3.01 INSTALLATION

A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height, and with disconnect operating handles not higher than 79 inches above finished floor, unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 26 05 29 "Hangers and Supports for Electrical Systems."

B. Floor-Mounted Controllers: Install enclosed controllers on 4-inch nominal-thickness concrete base. Submit materials and proposed installation procedures to Engineer for approval.
1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Seismic Bracing: Provide seismic bracing as required. Provide materials and installation procedures to Engineer for approval where seismic bracing is required.

D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

E. Install fuses in each fusible-switch enclosed controller.

F. Consult Engineer for circuit breaker settings.

G. Install Class CC fuses in control circuits if not factory installed.

H. Set motor overload relays based on actual motor nameplate full load current after motors have been installed.

I. Comply with NECA 1.

3.02 IDENTIFICATION

A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved nameplate, listing motor/equipment name, horsepower, fed from panel and circuit.
3. Label each enclosure-mounted control and pilot device.

3.03 CONTROL WIRING INSTALLATION

A. Install wiring between enclosed controllers, remote devices, and facility control system.

B. Bundle, train, and support wiring in enclosures.

C. Connect selector switches and other automatic-control selection devices where applicable.
1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
2. Connect selector switches with enclosed-controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.04 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:
1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:
1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment as required.
2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Owner and Engineer before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

8. Test and adjust local/remote controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed controllers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports. Include notation of deficiencies detected, remedial actions taken, and observations after remedial action.

3.05 ADJUSTING

A. Set field-adjustable switches and overload-relay pickup and trip ranges.

B. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes or 11 times for NEMA Premium Efficient motors if required. Where these maximum settings do not allow starting of a motor, notify Owner and Engineer before increasing settings. In no case shall the MCP/TMCB maximum instantaneous trip settings exceed NFPA 70 code limits for motor inrush.

3.06 GUARANTEE (WARRANTY)

A. No additional material and/or labor warranty beyond that specified in Section 26 05 00 “Common Work Results For Electrical.”

END OF SECTION

SECTION 26 29 23
VARIABLE-FREQUENCY DRIVE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings, the provisions of the Contract including the General and Supplementary Conditions, and the General Requirements apply to the Work of this Section.

B. The following sections have been specifically referenced in this specification:
   1. Section 26 05 00 Common Work Results for Electrical.
   2. Section 26 24 16 Panelboards.
   3. Section 26 05 53 Identification for Electrical Systems.

1.02 SUMMARY

Section includes separately enclosed, pre-assembled, VFDs, rated 600 V and less, for speed control of three-phase motors.

A. Variable Frequency Drive
   1. Basic Enclosure
   2. Custom Assembled Enclosure
   3. Motor Control Center

B. Line Side Reactor, Line Side Filter

C. DC Choke

D. Load Side Reactor, Load Side dV/dT Clamp

E. Variable Frequency Drive with FVNR Bypass Starter

1.03 DEFINITIONS/ABBREVIATIONS

A. BAS. Building automation system.

B. CE. Conformite Europeene (European Compliance).

C. CPT. Control power transformer.

D. EMI. Electromagnetic interference.

E. IGBT. Insulated-gate bipolar transistor.

F. LAN. Local area network.

G. LED. Light-emitting diode.

H. MCP. Motor-circuit protector.

I. NC. Normally closed.

J. NO. Normally open.

K. OCPD. Overcurrent protective device.

L. PID. Control action, proportional plus integral plus derivative.

M. PWM. Pulse-width modulated.

N. RFI. Radio-frequency interference.

O. VFD. Variable-frequency drive.

P. Rockwell Automation, Inc.; Allen-Bradley brand	Allen-Bradley Company
Q. ASEA Brown Boveri Company	ABB Company
R. Eaton Electrical Inc.; Cutler-Hammer Products	Eaton Electrical Inc.
S. Square D; Schneider Electric	Square D Company

T. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified[and the unit will be fully operational after the seismic event]."

1.04 SUBMITTALS

A. Bid. Provide the following with the bid documents.
   1. No additional submittals required; see Specification Section 26 05 00.

B. Manufacture. Provide the following prior to release for manufacture and/or purchase.
   1. Variable Frequency Drive: Shop Drawings/Data Sheets shall be submitted for approval for each VFD and related equipment.
      a. Dimensioned plans, elevations, and sections; and conduit entry locations and sizes, mounting arrangements, and details.
      b. Product data for each type and rating of VFD, including In/Out Voltage, In/Out Current, In/Out Power, Short Circuit Current Rating, etc.
      c. Tabulations of installed devices, equipment features, and ratings.
      d. Schematic and Connection Wiring Diagrams for power, signal, and control wiring.
      e. Coordination floor plans, drawn to scale, showing dimensioned layout, required working clearances, and required area above and around VFDs. Show support strictures where VFD not floor or wall mounted including type of support and weight on each support. Indicate field measurements.
      f. Include time-current coordination curves for each type and rating of overcurrent protective device included to protect the VFDs.

C. Construction. Provide the following during construction.
   1. Field Test Plan procedure(s) prior to energizing and testing VFD and associated equipment.
   2. Field Test Report summarizing the results of field testing of the VFD, protective devices, and all associated equipment.
   3. See also Specification Section 26 05 00.

D. Closeout. Provide the following to complete the project
   1. Energy Certificates, where required.
      a. LEED Submittals, where required for Product Data for Credit EA 5. For continuous metering equipment for energy consumption.
      b. Xcel documents for rebate credits, where required.
   2. Seismic Qualification Certificates. Submit certification that the VFD electronics, assembly, devices, accessories, and components will withstand potential seismic forces, where required.
   3. No additional submittals required; see Specification Section 26 05 00.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: The equipment manufacturer shall be regularly engaged in the manufacture of VFD(s), components, and accessories of the types, capabilities, and capacities required, and whose products have been in satisfactory use in similar service for not less than ten years.

B. Installer Qualifications: The National Electrical Contractors Association installation and maintenance guide NECA 407 Standard for Installing and Maintaining Panelboard(s) is hereby identified to define workmanship related to the installation of equipment and/or materials specified by this Specification section.

C. Codes/Standards: The products provided by this section shall comply with the latest editions of the following references:
   1. IEEE 519-1992 – Guide for Harmonic Content and Control.
   2. NEC 430.120 Adjustable-Speed Drive Systems.
   3. NEMA ICS 7.0 AC Adjustable Speed Drives.
   4. IEEE 508 Standard for Industrial Control Equipment.

D. Equipment Quality: Variable Frequency Motor Controllers and accessories shall be listed or labeled as defined in NFPA 70, Article 100, by a National Recognized Testing Laboratory acceptable to authorities having jurisdiction, and marked for intended location and use.

PART 2 PRODUCTS

2.01 GENERAL INFORMATION

A. All variable frequency motor controllers and associated equipment shall be new. The type of equipment and/or material shall be designated by the location where it will be installed and so defined by NEMA / NFPA 70 standards.

B. Summary Features. See plan set drawings, schedules, and associated notes for additional information. Note the following summary general requirements:

1.	VOLTAGE	See drawings/schedules for HP
2.	CAPACITY	See drawings/schedules for HP
3.	DISCONNECT	Integral to VFD
4.	PROTECTIVE DEVICE(S)	Integral MCCB Supplemental Fuses as Required by Manufacturer to Protect IGBTs and/or Improve Short Circuit Withstand Rating.
5.	SHORT CIRCUIT	Match MCC KAIC
6.	LOAD APPLICATION	Variable Torque
7.	DRIVE TYPE	6 Pulse
8.	ENCLOSURE	VFD built into NEMA 1, Gasketed MCC Compartment/Structure VFD, reactors, choke, and controls are to be built into the Project Motor Control Center structures.
9.	POWER CONDITIONING	Line Side Reactor DC Link Choke Load Side Reactor
10.	ENVIRONMENT	Clean, Dry, Mild Dust
11.	AMBIENT TEMPERATURE	85F
12.	CONTROL (Door Mounted)	HMI Operator Interface HOA (On, Off, Local, Remote) (4) DIN (Stop, Start, Forward, Auto) (4) DOUT (Running, Alarm) (2) AIN (Speed CMD) (2) AOUT (Current OUT, KW OUT)
13.	CONTROL POWER	Integral 120VAC Control Power Transformer
14.	COMMUNICATION	Ethernet IP

2.02 ACCEPTABLE MANUFACTURERS

A. Manufacturers subject to compliance with requirements, provide VFDs by one of the following:
   1. ABB Company
   2. Allen Bradley Company
   3. Eaton Electrical Inc.
   4. Square D Company

2.03 VARIABLE FREQUENCY DRIVES

A. VFD Description. Variable-frequency drive (rectifier, dc bus, and IGBT, PWM inverter) factory packaged in an enclosure, overcurrent and overload protection; listed and labeled by an NRTL as a complete unit; arranged to provide self-protection, protection, and variable-speed control of one or more three-phase induction motors by adjusting output voltage and frequency.
   1. Units suitable for operation of inverter-duty motors as defined by NEMA MG 1, Section IV, Part 30 “Application Considerations” and Part 31, "Definite-Purpose Inverter-Fed Polyphase Motors."
   2. Listed and labeled for integrated short-circuit current (withstand) rating by UL or an approved NRTL acceptable to authorities having jurisdiction.

B. Design and Rating. Match load type, such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.

C. Output Rating. Three-phase; 0-500 Hz

D. Unit Operating Requirements

1. Input AC Voltage Tolerance. Plus 10 and minus 10 percent of VFD input voltage rating.
2. Input AC Voltage Unbalance. Not exceeding 3 percent.
3. Input Frequency Tolerance. Plus or minus 3 percent of VFD frequency rating.
4. Minimum Efficiency. 97 percent at 60 Hz, full load.
5. Minimum Displacement Primary-Side Power Factor 0.98 at nominal speed.
6. Min Short-Circuit Current (Withstand) Rating, unless otherwise specified: 100 kA.
7. Ambient Temperature Rating. Not less than 14 deg F and not exceeding 122 deg F.
8. Ambient Storage Temperature Rating. Not less than minus 4 deg F and not exceeding 140 deg F
9. Humidity Rating. Less than 95 percent (noncondensing).
10. Altitude Rating. Not exceeding 3300 feet.
11. Vibration Withstand. Comply with IEC 60068-2-6.
12. Overload Capability. 1.10 times the base load current for 60 seconds, minimum;

    1.35 times the base load current for 02 seconds, minimum.
13. Speed Regulation. Plus or minus 5 percent.
14. Output Carrier Frequency. Selectable from 1 to 12 kHz (minimum 4 steps).
15. Stop Modes. Programmable; includes fast, free-wheel, controlled deceleration, and dc injection braking.

E. Inverter Logic. Microprocessor based, 16 bit, isolated from all power circuits.

F. Isolated Control Interface. Allows VFDs to follow remote-control electrical signal over a minimum 40:1 speed range.

G. Internal Adjustability Capabilities
1. Minimum Speed. 5 to 25 percent of maximum rpm.
2. Maximum Speed. 80 to 100 percent of maximum rpm.
3. Acceleration. 0.1 to 999.9 seconds.
4. Deceleration. 0.1 to 999.9 seconds.
5. Current Limit. 30 to minimum of 135 percent of maximum rating.

H. Self-Protection and Reliability Features
1. Input transient protection by means of surge suppressors to provide three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage. Input transient protection (MOVs) shall be provided line to line of all 50 plus line to ground AU39.
2. Loss of Input Signal Protection. Selectable response strategy, including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.
3. Under- and overvoltage trips.
4. Inverter overcurrent trips.
5. VFD and Motor Overload/Over temperature Protection. Microprocessor-based thermal protection system for monitoring VFDs and motor thermal characteristics, and for providing VFD over temperature and motor overload alarm and trip; settings selectable via the keypad.
6. Critical frequency rejection, with three selectable, adjustable dead bands.
7. Instantaneous line-to-line and line-to-ground overcurrent trips.
8. Loss-of-phase protection. Selectable to either fault VFD or to alarm and continue to operate.
9. Short-circuit protection.
10. Motor over temperature fault.

I. Automatic Reset/Restart Capability. Select attempt five restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts.

J. Power-Interruption Protection. To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Auto-speed Search" feature is engaged.

K. Bidirectional Auto-speed Search. Capable of starting VFD into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.

L. Torque Boost. Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.

M. Motor Temperature Compensation at Slow Speeds. Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.

N. Seismic Performance: VFCs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7. The designated VFCs shall be tested and certified by an NRTL as meeting the ICC-ES AC 156 test procedure requirements

2.04 CONTROLS AND INDICATION

A. Status Lights. Door-mounted LED indicators displaying the following conditions:
   1. Power on.
   2. Run.
   3. Overvoltage.
   4. Line fault.
   5. Overcurrent.
   6. External fault.

B. Panel-Mounted Operator Station. Manufacturer's standard front-accessible, sealed keypad and plain-English language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.
   1. Keypad. In addition to required programming and control keys, include selector switch for OFF, ON, LOCAL and REMOTE modes.
      a. Control Authority. Supports at least four conditions.
         1) OFF
         2) ON (using HMI for speed only)
         3) LOCAL (using HMI for start/stop and speed control)
         4) REMOTE (using PLC for start, stop, and speed control)

C. Historical Logging Information and Displays
   1. Running log of total power versus time.
   2. Total run time.
   3. Fault log, maintaining last three faults with time and date stamp for each.

D. Indicating Devices. Digital display mounted flush in VFD door and connected to display VFD parameters including, but not limited to:
   1. Output frequency (Hz).
   2. Motor speed (rpm).
   3. Motor status (running, stop, fault).
   4. Motor current (amperes).
   5. Motor torque (percent).
   6. Fault or alarming status (code).
   7. PID feedback signal (percent).
   8. DC-link voltage (V dc).
   9. Set point frequency (Hz).
   10. Motor output voltage (V ac).

E. Control Signal Interfaces
   1. Electric Input Signal Interface:
      a. A minimum of two programmable analog inputs. 0 to 10 VDC and 4 to 20 mA DC.
      b. A minimum of six multifunction programmable digital inputs.
   2. Remote Signal Inputs. Capability to accept any of the following speed-setting input signals from the BAS or other control systems:

a. 0 to 10 VDC.
b. 4 to 20 mA DC.
c. Potentiometer using up/down digital inputs.
d. Fixed frequencies using digital inputs.

3. Output Signal Interface. A minimum of two programmable analog output signal(s) 4 to 20 mA DC, operator-selectable "x"- to "y" mA DC which can be configured for any of the following:
   a. Output frequency (HZ).
   b. Output current (load).
   c. DC-link voltage (VDC).
   d. Motor torque (%).
   e. Motor speed (RPM).
   f. Set point frequency (HZ).
4. Remote Indication Interface. A minimum of three programmable dry-circuit relay outputs (120 VAC, 1A) for remote indication of the following:
   a. Motor running.
   b. Set point speed reached.
   c. Fault and warning indication (Over temperature or Over current).
   d. PID high- or low-speed limits reached.

F. PID Control Interface. Provides closed-loop set point, differential feedback control in response to dual feedback signals. Allows for closed-loop control of pumps for pressure, flow.
   1. Number of Loops. Four

G. Communication Interface. Factory-installed hardware and software to enable, monitor, control, and display VFD status and alarms and energy usage. Allows VFD to be used with an external computer system for configuration changes; settings to be retained within VFD's nonvolatile memory.
   1. Standard Network Communications Ports. Ethernet IP and RS-422/485.
   2. Optional Industrial PLC Network Protocols. Allen Bradley Ethernet, TCP/IP, RIO, Device Net, Control Net, Modbus.

2.05 LINE CONDITIONING

A. Input Line Conditioning. 3% line reactor unless otherwise noted on drawings.

2.06 LOAD CONDITIONING

A. Output Load Conditioning. 5% line reactor unless otherwise noted on drawings.

2.07 ENCLOSURES

A. VFD Enclosure rating. NEMA 250, to comply with environmental conditions at installed location.
   1. Dry Clean Indoor NEMA Type 12
   2. Dry Dusty Indoor NEMA Type 12, Gasketed
   3. Outdoor Locations NEMA Type 3R
   4. Indoor Locations Subject to Water or Moisture NEMA Type 4

B. VFD shall be mounted in one of the following enclosure types as noted in the Summary Features above, on the plan set drawings, schedules, and/or associated notes:
   1. Standard Manufacturer VFD Enclosure
   2. VFD in Custom Manufacturer Enclosure
   3. VFD in Motor Control Center Compartment/Section

C. Plenum Rating. UL 1995; or approved NRTL certification label on enclosure, clearly identifying VFD as "Plenum Rated" when applicable.

D. Ventilation/Cooling: Provide cooling as required to maintain internal enclosure temperature within safe temperature operating range for the VFD and other enclosed sensitive electronics (Maximum 100F, 90F Preferred). Fans are to be readily accessible without removal of other components to access, service, or remove fans. Provide filters to minimize dust within the enclosure.

E. Integral Input Disconnecting Means and/or Over Current Protective Device based on plan set drawings and schedules or as required by the Manufacturer to protect the VFD solid state

electronics or to protect the VFD from high available short circuit fault current. Protective device to be UL 489, molded case circuit breaker, molded case switch, disconnect switch, power fuse block and/or current-limiting fuses with pad-lockable, door-mounted handle mechanism.

1. Protective device to be assigned the VFD as follows:
   a. 15A to 225A — MCCB TM
   b. 250A to 350A — MCCB TM with AT
   c. 400A and Above — MCCB ET with LSI
   d. See Specification Section 26 24 16 “Panelboards” for specific additional Molded Case Circuit Breaker requirements.
2. Disconnect Rating: Not less than 125 percent of NFPA 70 motor full-load current rating or VFD input current rating, whichever is larger.
   a. NO/ NC contacts arranged to activate before disconnect blades open.
   b. Auxiliary contacts "a" and "b" arranged to activate with circuit-breaker handle.
   c. NC/NO alarm contact that operates only when circuit breaker has tripped.

2.08 BYPASS SYSTEM (WHEN SPECIFIED)

A. Bypass Control: System configured from a VFD, external FVNR motor controller, and two isolating disconnects. The Bypass System allows motor operation to continue while the VFD is being repaired or serviced. The input and output isolating switches provide a barrier arranged to isolate the VFD from the operating motor. using the bypass motor starter and permit safe troubleshooting and testing both with the VFD energized and de-energized.
   1. Bypass Starter: NEMA-rated contactor and overloads in separate external enclosure or custom integrated enclosure as noted in plan drawings and schedules.
   2. Isolating Switches: NEMA horse power rated switches arranged to isolate the VFD and permit safe troubleshooting and testing of the VFD (both energized and de-energized), while the motor is operating from the bypass starter. Isolating switches to be pad-lockable, door-mounted handle mechanism.
   3. Provide oneline of the bypass system power equipment and instructions to transfer to the bypass starter and re-transfer back to the VFD.

B. Bypass Operation: The bypass operation is manually transferred. The bypass motor controller is to be capable of stable operation (starting, stopping, and running) with motor completely disconnected from power converter.

C. VFD/Bypass Motor Starter Control: The VFD and starter are to be controlled locally with Operator buttons or remotely by a PLC/SCADA system. See the plan set drawings, schedules, and associated notes.
   1. Provide LOCAL/OFF/REMOTE and VFD/BYPASS mode control switches,
   2. Provide a local LED pilot light to indicate that the Bypass motor starter is operating the motor.
   3. Provide Control Power Transformer or local branch circuit as required for the Bypass System control power.
   4. Provide an HMI for the VFD.
   5. Provide Overload Relays for the motor controller: NEMA ICS 2.
   6. Provide control wiring, programming, and PLC hardware as required to complete the Remote PLC/SCADA system control.

2.09 ACCESSORIES

Where required, provide the these accessories with the following minimum ratings:

A. General Requirements for Control-Circuit and Pilot Devices. NEMA ICS 5; factory on the drive control panel, enclosure, or MCC door unless otherwise indicated.
   1. Industrial Operator Devices as required.
      a. Momentary Push Button Allen Bradley 800H, 1-7/32” typical.
      b. Selector Switch Maintained Allen Bradley 800H, 1-7/32” typical.
      c. LED Pilot Light, push to test Allen Bradley 800H, 1-7/32”, typical

B. Control Relays. Auxiliary and adjustable solid-state time-delay relays.
   1. DIN rail mounted relay base.
   2. Ice Cube, enclosed 10A, 120VAC/VDC rated contacts.

C. Phase-Failure, Phase-Reversal, and Under-voltage, Over-voltage, and Time Delay Relays. Solid-state sensing circuit with isolated output contacts for hard-wired connections.
   1. Sensing relays to have adjustable under-voltage, over-voltage, and time-delay settings.
   2. Current Transformers. Continuous current rating, basic impulse insulating level (BIL) rating, burden, and accuracy class suitable for connected circuitry. Comply with IEEE C57.13.

D. Metering
   1. Elapsed time meter.
   2. Kilowatt meter.
   3. Kilowatt-hour meter.

E. Cooling Fan and Exhaust System. For NEMA 250, Type 1, Type 12 UL 508 component recognized. Supply fan, with composite intake and exhaust grills and filters; 24-120 -V ac/dc.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION

A. Provide all labor, material, lugs, protective devices, equipment, and components necessary for the installation of a complete and functional VFD in accordance with applicable federal, state, local building electrical codes, and the manufacturers' recommendations, except where the plan set drawings, associated notes, schedules, and/or specifications are stricter. This work will include any required power, control, or signal wiring for equipment. Install according to the Manufacturer's and NECA 1 standards.

B. INSTALLATION OF VFDS
   1. MCC Mounted: MCCs to be provided with removable lifting eyes. Remove lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components after equipment secured in place.
   2. Wall Mounted: Where not mounted within an MCC compartment/section, install wall mounted enclosures on walls with tops at uniform height and with disconnect operating handles not higher than 7'-6" inches above finished floor unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks.
   3. Provide fuses and overloads where required including fusible-switches, VFD fuse holders, control power circuits, etc.
   4. Provide enclosure filters where requires.
   5. Provide heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.
   6. Connect motor thermal-protector sensors to VFD monitoring relays furnished with motor-driven equipment.
   7. Provide control wiring between VFDs and local/remote operator stations, PLC control panels, etc. as required to complete VFD control system.
   8. Bundle, train, and support wiring neatly in all system enclosures. Separate VFD In from VFD Out cabling and VFD power wiring form control wiring.

3.02 IDENTIFICATION

A. Identify VFDs, components, and control wiring.
   1. Label field-installed conductors, interconnecting wiring, and components; provide warning signs. See Section 26 05 53 "Identification for Electrical Systems."
   2. Provide nameplate for each VFD with equipment name and power source. See Section 26 05 53 "Identification for Electrical Systems" or Owner labelling guidelines for this Project.
   3. Provide nameplate or legend ring for each enclosure-mounted control and pilot device. See Section 26 05 53 "Identification for Electrical Systems" or Owner labelling guidelines for this Project.

3.03 ADJUSTING AND CLEANING

A. Carefully wipe down all surfaces of the internal and external surfaces of the VFD from dust and dirt prior to energizing the VFD and associated components.

B. Paint all damaged and marred equipment finishes prior to energizing the VFD and associated components.

C. Program VFD microprocessors for required configuration, VFD and motor parameters, operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing.

D. Record all VFD parameters and incorporate into Operation and Maintenance manual.

E. Set Field-Adjustable Switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

F. Where applicable, adjust the Trip Settings of thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to six times the motor nameplate full-load amperes. If tripping occurs on motor inrush, notify Owner and Engineer and adjust settings in increments upon approval until motors start without tripping. Do not exceed the NEC maximum protective device setting limit. Where these maximum settings do not allow starting of a motor, notify Owner and Engineer to determine.

G. Where applicable, adjust the settings for electronic trip circuit breakers LSI parameters furnished by the Engineer. If tripping occurs on motor inrush, notify Owner and Engineer to adjust the settings. Do not exceed the NEC maximum protective device setting limit. Where these maximum settings do not allow starting of a motor, notify Owner and Engineer to determine.

3.04 ACCPTANCE TESTING

A. Visually inspect and test the VFDs according to requirements in NEMA ICS 61800-2.
   1. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   2. Test each VFD while connected to its specified motor.
   3. Verify the performance of each VFD according to the planned/programmed operation of functions and features specified.
   4. VFDs will be considered defective if they do not pass tests and inspections.

B. Testing Agency. Owner will engage a qualified testing agency to perform tests and inspections.

C. Perform Tests and inspections.

D. Acceptance Testing
   1. Inspect VFD, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
   2. Test continuity of each circuit.
   3. Test insulation resistance for each VFD element, bus, component, connecting supply, feeder, and control circuit. Verify the testing procedure with the Manufacturer to prevent damage to the VFD components.
   4. Verify that voltages at VFD locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Owner or Engineer before starting the motor(s).
   5. Test each motor for proper phase rotation.
   6. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
   7. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

E. Prepare Test and inspection reports, including a certified report that identifies the VFD and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.05 TRAINING

A. Train Owner's maintenance personnel to adjust, operate, reprogram, and maintain VFDs.

3.06 GUARANTEE (WARRANTY)

A. Provide Manufacturer's warranty to repair or replace any VFD that fails in materials or workmanship within three years.

END OF SECTION

SECTION 26 32 00
DIESEL-DRIVEN GENERATOR

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings, the provisions of the Contract including the General and Supplementary Conditions, and the General Requirements apply to the Work of this Section.

B. The following sections have been specifically referenced in this specification:
   1. Section 26 05 00 Common Work Results for Electrical.
   2. Section 26 36 00 Automatic Transfer Switch.
   3. Section 26 24 13 Switchboards.

1.02 SUMMARY

A. This Section covers basic electrical requirements for providing labor, materials, equipment, and services necessary for the selection and installation of the diesel electric generating set(s) as shown on the drawings and specified herein. In general, this consists of:
   1. Diesel Engine, Alternator, and Frame,
   2. Tank and Fuel Delivery System.
   3. Ventilation and Cooling.
   4. Exhaust and Ventilation.
   5. Accessories: Battery Charging and Engine Heaters.
   6. Control and Monitoring.
   7. Generator Enclosure
   8. Installation, Testing, and Operation.

1.03 DEFINITIONS/ABBREVIATIONS

A. No additional definitions/abbreviations provided.

1.04 SUBMITTALS

A. Bid: Provide the following with the bid documents.
   1. No additional submittals required; see Specification Section 26 05 00.

B. Manufacture: Provide the following prior to release for manufacture and/or purchase.
   1. Data sheets shall be submitted for approval for the alternator specifications and operation.
      a. Preliminary generator data sheet including parameters to model electrical performance of generator of similar size and operation of specified generator(s). Typical required electrical data includes If, Ifg, Ra, Tdc, Td', Td'', Xd Sat, Xd' Sat, Xd'' Sat; X'' positive, negative, zero sequence impedance, and X/R ratio.
      b. Typical weight, fuel consumption, heating-cooling rates, and emissions to facilitate mechanical design.
      c. Technical data for accessories including muffler, remote annunciator, base tank, etc.
   2. Shop Drawings shall be submitted for approval for engine generator set and all accessories.
      a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
      b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
      c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements
      d. Show tabulation of Bill of Materials for installed devices, equipment features, and ratings.
      e. Detail enclosure layout and details for types other than NEMA 250, Type 1.
      f. Detail bus configuration, current, and voltage ratings.
      g. Electrical ratings, dimensions, location, and clearance requirements for planned accessories including battery charger, hose heaters, fuel oil heaters, engine block heaters, fuel pump, and field control and power wiring.

h. Include circuit breaker rating and time-current coordination curves for each type and rating of overcurrent protective device supplied with the generator.
i. Control power, internal and external control/interlock/interface schematics, remote annunciator, and/or network diagram(s) with clear indication of necessary field wiring and connection points.
j. Include required clearances and service space around equipment for installation, conduit entries, operation, and maintenance.
k. When a closed cooling system, including a remote roof-mounted liquid-to-air radiator, shop drawings shall include a complete description of all components including the radiator, controls, flow rates, temperature of the solutions entering and leaving the system and the pressure drop across each component at design conditions.

3. Protective Device: Data Sheets for each protective device with characteristics, ratings, for each type and rating included in the automatic transfer switch(s).
   a. Protective Device Performance Data
      1) Complete verified SKM format electronic library models for each type and size protective device.
      2) Time Current Curve in electronic pdf format. Website links will not be accepted.
   b. Complete detailed circuit breaker catalog number including numbers reflecting the type, rating, configuration, characteristics, features, and auxiliary components to be furnished with the protective device.
      1) Include a guide to identify (decode) the protective device characteristics conveyed by the detailed catalog number. This guide will be used to interpret and verify the proposed protective device ratings and features. Where this guide does not exist, the information shall be included in the tabulated detailed list of the ratings and features for the protective device description in the submittal.
4. No samples requested.
5. See also Specification Section 26 05 00.

C. Construction: Provide the following during construction.
1. Final Factory Generator Performance Test. Document to include fuel consumption, heating-cooling rates, emissions, and parameters to model electrical performance of the furnished generator(s). Typical required electrical data includes parameters If, Ifg, Ra, Tdc, Td', Td'', Xd Sat, Xd' Sat, Xd'' Sat; X'' positive, negative, zero sequence impedance, and respective X/R ratios.
2. See also Specification Section 26 05 00.

D. Closeout: Provide the following to complete the project.
1. As-Built Drawings. Final drawings shall include corrected and certified shop drawings as installed. Additional drawings shall be furnished as necessary to cover all aspects of the total installation.
2. Field Test and Calibration documentation.
3. Installation and Maintenance Manuals. The manual set shall include parts lists, troubleshooting methods, lubrication recommendations, and calibration instructions. Catalog sheets are not acceptable.
4. See also Specification Section 26 05 00.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: The equipment manufacturer shall be regularly engaged in manufacture of generator(s), enclosures, and accessories of the types, capabilities, and capacities required, and whose products have been in satisfactory use in similar service for not less than ten years.

B. Installer Qualifications: The National Electrical Contractors Association installation and maintenance guide NECA 404 Standard for Installing Generator Sets is hereby identified to define workmanship related to the installation of equipment and/or materials specified by this Specification Section.

C. Codes/Standards: The products provided by this section shall comply with the latest editions of following references:

1. BS5514-1 - Reciprocating Internal Combustion Engines Performance. Standard Reference Conditions, Declarations of Power, Fuel, and Lubricating Oil Consumptions and Test Methods.
2. DIN6271 – Reciprocating Internal Combustion Engines; Performance, Power Tolerances, Supplementary Stipulations to DIN ISO 3046 Part 1
3. ISO3046-1 – Reciprocating Internal Combustion Engines Performance, Part 1 Declarations of Power, Fuel, and Lubricating Oil Consumptions, and Test Methods - Additional Requirements for Engines for General Use.
4. ISO8528-5 – Reciprocating Internal Combustion Engine Driven Alternating Current Generating Sets, Part 5 Generating Sets.
5. NFPA 37 Standards for the Installation and Use of Stationary Combustion Engines and Gas Turbines
6. NFPA 101 – Life Safety Code
7. NFPA 110 – Emergency and Standby Power Systems
8. SAEJ1349 – Engine Power Test Code, Spark Ignition and Compression Ignition-As Installation Net Power Rating
9. UL2200 – Standard for Stationary Engine Generator Assemblies.
10. Federal EPA and MN EPA Engine Exhaust Emissions to comply with current EPA New Source Performance Standards and applicable federal, state, and local government requirements.

D. Equipment Quality: The power generation equipment, components, and accessories shall be "Listed" or "Labeled" as defined in NFPA 70, Article 100, by a National Recognized Testing Laboratory acceptable to authorities having jurisdiction, and marked for the intended location and use.

PART 2 PRODUCTS

2.01 GENERAL INFORMATION

A. All generator(s), enclosure(s), accessories, and materials shall be new unless otherwise specified in the plan drawings, associated notes, and/or riser/oneline diagrams. The type of equipment and/or material shall be designated by the location where it will be installed and so defined by NEMA/NFPA 70 standards.

B. All system equipment, materials, and components shall be of current production models and types, produced and marketed by an acceptable Manufacturer.

C. The coordination of all required equipment and material shall be the responsibility of one manufacturer, who has had an approved experience record in furnishing similar equipment

D. The engine generator equipment selection shall be coordinated and compatible with Section 26 36 00 "Automatic Transfer Switch".

E. Rating of the generator set shall be based on operation of the system when equipped with all necessary operating accessories such as radiator, fan, air cleaners, lubricating oil pump, jacket water pump, governor, charging alternator, etc.

F. The system shall be capable of producing rated output at 0.8 pf without injurious load being placed on the engine or alternator under standard rating conditions

G. Capacity and voltage characteristics shall be as shown on the drawings, associated notes, and specified herein.

2.01 GENERATOR SET SPECIFICATION SUMMARY

EQP NAME	ELECTRICAL SUMMARY DESCRIPTION	MECHANICAL/ENCLOSURE SUMMARY DESCRIPTION
GEN-1	350kW, 480/277V, 60HZ, 0.8pF Standby Duty	Diesel Fueled.

2.01 GENERATOR SET SPECIFICATION SUMMARY

EQP NAME	ELECTRICAL SUMMARY DESCRIPTION	MECHANICAL/ENCLOSURE SUMMARY DESCRIPTION
	Power: Alternator power output Circuit Breaker Protection is provided in Generator Switchboard; see Riser. Control: Remote Annunciator (Compliance with NFPA 101 Life Safety required signal set), Control: Local Alarm for Low Base Tank level. Control: Dry contact relay outputs for generator status to site BMS/SCADA System. Control: Base Tank level sensor for independent low fuel alarm to BMS/SCADA system. Control: Additional Base Tank level sensor for site fuel oil tank delivery system pump control to maintain Base Tank level. Electrical enclosures: NEMA 1 gasketed where available.	12 hour base tank with double wall, leak detection and piping connections for site fuel oil tank delivery system. "Hospital" Grade Muffler. Unit mounted cooling system with radiator cooling air ducted to the roof with roof mounted damper. Generator located indoors. Tier 3 level pollution control or as required to meet MN EPA requirements for Emergency use defined as operation only during power loss or for weekly maintenance run testing. Sound level to be minimized inside the room and no greater than 65-70 dBA outside generator room. Coordinate with Architectural and Structural for generator room wall and door construction. No reach-in or walk-in enclosure required.
NOTES: The engine generator equipment selection and installation shall be coordinated and compatible with the Project Switchboard as set forth in Section 26 24 13 "Switchboards" and drawings.		

2.02 ACCEPTABLE MANUFACTURERS.

A. Caterpillar, Inc.

B. Cummins, Inc., Cummins Power Generation (Formerly Onan).

C. Kohler Power Systems.

2.03 DIESEL FUEL ENGINE APPLICABLE WHEN DIESEL FUEL IS SPECIFIED

A. Engine shall be a diesel, heavy duty, stationary, liquid-cooled, 4-cycle, compression-ignition type, with not less than 4 or more than 16 cylinders. Cylinders shall embody removable cylinder liners. The engine may be either normally aspirated or Turbo charged – after-cooled. The engine shall be a standard product of the manufacturer, complete with all appurtenances normally furnished and any other devices required herein. The engine shall be suitable for driving the alternator specified herein without excessive smoke, overheating, or mechanical damage when operating under the specified conditions.

The required horsepower shall be developed when operating on ultra-low sulfur winter blended fuel conforming to Federal Specification VV-F-00 or ASTM D975, and with lubricating oil of the type and grade as recommended by the engine manufacturer. The engine shall have a standard published net available continuous rating, which, when corrected for specified operating conditions, shall be not less than that required to drive the alternator at 100% of full load, and to ensure operating stability as specified hereinafter. Engine speed shall not exceed 1800 rpm at normal full load operation. A governor that maintains alternator speed within +/- .025% of 60hz from no load to full load alternator output shall control speed.

Filtering shall be provided for governor control circuits such that operation will not be affected by solid state switching and conversion equipment such as variable frequency type motor speed controllers, lighting dimmers, etc.

B. Fuel System. Provide a double walled base fuel tank sized for running the power system for required hours at rated load; see Generator Set Specification Summary, Article 2.01 above for fuel tank size information. Provide leak detection contact in interstitial space with LED indicator on control panel. The tank shall have a DPDT adjustable contact float switch and a sight gauge. The fuel filter shall be a full flow, two-stage replaceable element type; and provide two spare filter elements. **Owner shall provide fuel.**

C. Engine Fuel Pump shall be a positive displacement, engine driven type, and shall be capable of supplying an adequate quantity of fuel under all conditions of operation. A relief valve shall be provided to prevent the buildup of excessive pressures upon obstruction of the discharge line.

2.04 LUBRICATION SYSTEM

A. The engine shall have one or more engine driven, gear-type lubricating oil pumps for supplying oil under pressure to main bearings, crankpin bearings, pistons, piston pins, timing gears, camshaft bearings, and valve rocker mechanism. Pressure shall be regulated by an appropriate relief valve or other approved means. Means for pressure adjustments shall be provided. The engine shall have a gauge or bayonet for oil-level indication with engine running.

B. A full-flow filtering system in series with the lubrication oil pump(s) shall be provided. All oil that enters the pressurized parts of the engine shall pass through this system. A pressure-relief valve shall be provided to bypass lube-oil back to the engine sump or to the suction side of the lube-oil pump when the filter attains maximum pressure differential recommended by the filter manufacturer. The filter shall have inlet and outlet connections plainly marked; shall be mounted in an accessible location, and shall be so arranged as to permit changing filter elements without interference from piping or other engine components.

2.05 COOLING SYSTEM

A. The engine cooling system shall be of sufficient capacity to maintain recommended running temperature at full load under any expected ambient conditions.

B. An engine-mounted radiator with blower type fan shall be sized to maintain a safe operation at 100°F maximum ambient temperature. Provide fan guard, engine driven centrifugal type water pump, and thermostatic valve to maintain the engine at recommended temperature.

C. Furnish a jacket coolant heater, thermostatically-controlled, thermal circulation type, to maintain coolant temperature of 80°-100°F with a minimum of 3 watts per cubic inch of displacement. The heater shall be 120 volts, single phase. Vee-type engines of 8 cylinders or more shall have one heater for each bank of cylinders. Metal braided hoses and isolation valves shall be used. The heater thermostat shall be adjustable.

1. The heater shall be ~~a Kim Hotstart Industrial Engine Pre-heater,~~ Update Manufacturer or approved equal.

D. Connections to engines, pumps, and liquid coolers shall be made through flexible connectors as required and furnished by the manufacturer. Connections shall be made with welded flanges having standard 150# ratings.

E. The engine cooling system shall be filled with a 50-50 water ethylene/glycol solution with rust inhibitor.

2.06 REMOTE RADIATOR

Applicable when Remote Cooling is Specified

A. None Specified.

2.07 INTAKE/EXHAUST SYSTEM.

A. Air Intake Filter/Silencer. The engine air intake opening shall be equipped with an effective, easily cleaned, combination air filter and silencer capable of removing dirt and abrasives from the combustion air supplied to the engine and of reducing the noise level of the entering intake air to a point below the normal mechanical noise level of the engine.

B. The filter unit may be of the dry type; either type shall provide an effective filtering medium with means for quick and easy removal for cleaning or replacement. Each unit shall be of ample capacity for the service and shall be suitable for connection to the air intake opening of the engine.
1. One spare filter element shall be provided with dry filter units.

C. “Critical Grade” muffler. Provide accessories as detailed on the drawings, schedules, and associated notes, including but not limited to:
1. Stainless steel roof thimble
2. Exhaust flexible connector and piping
3. Rain guard and stainless steel raincap.

D. Automatic System Protection. Engine shall be equipped with automatic safety controls which will shut down the engine in the event of low lubricating oil pressure, high coolant temperature, engine overspeed, and make electrical contacts for alarm lights on the engine control panel.

2.08 ALTERNATOR/CONTROLLER SYSTEM.

A. The alternator shall be a 4-pole revolving field type, 12 lead, rated for standby electrical service. See Generator Set Specification Summary above, 1,800 rpm rating at 125 degree C Continuous Temperature Rise to support the required SKVA with a brushless, PMG exciter. The maximum voltage dip shall be limited to 15% of nominal. Photosensitive components will not be permitted in the rotating exciter. The stator shall be direct connected to the engine to insure permanent alignment. The generator shall meet temperature rise standards for Class "H" insulation. All leads must be extended into an AC connection panel.
1. The alternator shall be protected by an over excitation protection circuit integral to the voltage regulator.
2. See the Project oneline, schedules, and associated notes for location, rating, and provision of circuit breaker protection.

B. One step load acceptance shall be 100% of nameplate rating.

C. The generator set and regulator must sustain at least 300% short circuit current for 10 seconds during a 3 phase fault.

D. A solid state voltage regulator designed and built by the engine-generator set manufacturer must be used to control output voltage by varying the exciter magnetic field to provide + or - 0.25% regulation during stable load conditions. Should an extremely heavy load drop the output frequency, the regulator shall have an active engine unload (voltage reduction) algorithm. The engine unload algorithm shall reduce voltage at a rate greater than the standard Volts per Hertz under-frequency protection. The regulator shall also support Volts per Hertz under-frequency protection. The frequency at which under-frequency protection begins must be adjustable. The regulator set-points shall be adjustable with raise/lower push buttons on the regulator and be accessible without entering the generator connection box.

E. The voltage regulator must contain an over-voltage shutdown circuit to protect the generator and the loads from over-voltage conditions. This circuit shall activate by 115% of rated voltage for 0.75 seconds. On loss of the voltage sensing signal, the voltage regulator must be capable of shutting down to prevent an overvoltage condition from occurring. This function must not inhibit the generator from supplying 300% short circuit fault current for 10 seconds.

F. A panel that is an integral part of the generator set must be provided to allow the installer a convenient location in which to make electrical output connections. An isolated neutral lug must be included by the generator set manufacturer to insure proper sizing.

G. Provide the following items installed at the factory:
   1. An additional coating shall be applied to the alternator windings to exclude the entrance of moisture and inhibit the growth of fungus and moss.

H. Performance
   1. Frequency Regulation. maximum, no load to rated load 1% maximum
   2. Voltage Regulation. +/-0.5%
   3. Steady State Operation. Frequency variation shall not exceed +/-0.5% and voltage variation shall not exceed +/-1% of mean value for constant load from no load to full load.
   4. Voltage Dip on Applied Load.
      a. Instantaneous voltage dip shall be less than 15% of rated voltage upon application of rated load at 0.8 pf.
      b. Recovery to stable operation shall occur within 4 seconds.

2.09 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Comply with UL 489 or UL 1066 as appropriate.

B. Generator Circuit Breaker. Breaker ratings shall be as shown on the Generator Set Specification Summary, or the drawings, schedules, and associated notes.

C. Tripping Characteristic. Designed specifically for generator protection.
   1. Trip Rating. Matched to generator rating.

D. Shunt Trip. Connected to trip breaker when generator set is shut down by other generator protective devices.

E. Circuit Breaker(s) for emergency (life safety) loads shall be mounted in separate enclosures (switchboard sections) from other non-life safety circuit breakers per NEC.

F. Ground-Fault Indication. Comply with NFPA 70, "Emergency System" signals for ground-fault where applicable or as noted on drawings. Integrate ground-fault alarm indication with other generator-set alarm indications.

G. Mounting:
   1. Power CB: Drawout or Fixed mounting as noted on schedule.
   2. Molded Case CB: Fixed mounting or as noted on schedule.

H. Compression or mechanical style lugs, suitable for number, size, trip ratings, and conductor materials.

I. Protective device rating minimum default shall be as follows, unless otherwise specified on the drawings, associated notes, and/or schedules.
   1. Circuit Breaker 100% Rated

J. Short Circuit Rating
   1. Full Rating: Protective devices shall be Fully Rated to interrupt symmetrical short-circuit current available at terminals.

K. Power Circuit Breakers (PCB): PCB type and rating shall be as indicated on the drawings, schedule, and associated notes.
   1. PCB Electronic Trip with LCD Display: Applicable to All PCB
      a. Electronic RMS type sensing equipped with field-replaceable rating plug or field-replicable electronic trip unit. The circuit trip unit shall be equipped with the following adjustable settings that shall be separate independently adjustable values through a LCD display. These circuit breakers shall be provided with (a) network communication capability (Modbus, Ethernet) and (b) concentrators/gateway

equipment, wiring and connections ready for a potential future connection to an Ethernet IP based computer or SCADA system. A DC power supply shall be provided to power the circuit breaker LCD displays, any required associated power meter, and the network equipment/wiring. The following trip features shall be provided as noted in the schedule, drawings, and/or associated notes:

1) Long Time Pickup (LTPU).
2) Long Time Delay (LTD).
3) Short Time Pickup (STPU).
4) Short Time Delay with I^2t In/Out response.
5) Instantaneous (INST).
6) Ground-fault Pickup (GFPU).
7) Ground Fault Delay (GFD) with I^2t In/Out response.

b. Ground Fault protection only for 480V generators, unless otherwise noted.
c. The trip units and/or plugs shall be field changeable.
d. Provide clear, transparent, tamper cover to prevent unauthorized access or inadvertent changes to the circuit breaker settings. The cover shall be removable and equipped with a loop to fit a wire seal in order to lock the cover in place confirming the integrity of the circuit breaker settings per NEC.
e. Provide hardware for locking the breaker in the racked out position and the breaker contacts open for lock out tag out safety procedures.
f. See schedule, drawings, and/or associated notes for required locations where these circuit breakers and the selected features are to be provided

L. Molded Case Circuit Breakers (MCCB): See Drawings and Schedules.

1. MCCB type and rating shall be as indicated on the drawings, associated notes, and in the switchboard schedules.
2. MCCB Thermal-Magnetic Trip: 15A to 175A
   a. Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
3. MCCB Electronic Trip with LCD Display: 200A and Above
   a. Electronic RMS type sensing equipped with field-replaceable rating plug or field-replicable electronic trip unit. The circuit trip unit shall be equipped with the following adjustable settings that shall be separate independently adjustable values through a LCD display. These circuit breakers are to be provided with (a) network communication capability (Modbus, Ethernet) and (b) concentrators/gateway equipment, wiring and connections ready for a potential future connection to an Ethernet IP based SCADA system. A DC power supply is to be provided to power the circuit breaker LCD displays, any required associated power meter, and the network equipment/wiring. The following trip features are to be provided as noted in the schedule, drawings, and/or associated notes:
      1) Long Time Pickup (LTPU).
      2) Long Time Delay (LTD).
      3) Short Time Pickup (STPU).
      4) Short Time Delay with I^2t In/Out.
      5) Instantaneous (INST).
      6) Ground Fault Pickup (GFPU).
      7) Ground Fault Delay (GFD) with I^2t In/Out.
   b. Ground Fault protection only for 480V generators, unless otherwise noted.
   c. The trip units and/or plugs shall be field changeable.
   d. Provide clear, transparent, tamper cover to prevent unauthorized access or inadvertent changes to the circuit breaker settings. The cover shall be removable and equipped with a loop to fit a wire seal in order to lock the cover in place confirming the integrity of the circuit breaker settings per NEC.
   e. Provide hardware for locking the breaker contacts open for lock out tag out safety procedures.
   f. See schedule, drawings, and/or associated notes for required locations where these circuit breakers and the selected features are to be provided.

4. MCCB Features/Accessories:
    a. Where required in the drawings, schedules, associated notes, or above, the following features shall be provided as noted:
        1) Instantaneous Override: Provide for all new power circuit and molded case electronic circuit breakers, where available for circuit breakers (a) 1200A and more and (b) on new selected “downstream” breakers as indicated in schedule, drawings, and associated notes
        2) Zone Selective Interlocking: Provide for all new circuit breakers (a) 1200A and more and (b) on new selected “downstream” breakers as indicated in schedule, drawings, and/or associated notes.

2.10 CONTROLS

A. The control cabinet shall be vibration-isolation mounted to the system base at generator end and shall include the items listed below.

B. Control/Status
1. Digital Voltmeter Display
2. Digital Ammeter Display
3. Instrumentation shall be True RMS type and be unaffected by VFD loads
4. Digital Frequency Meter Display
5. Running Time Meter
6. Output Voltage Adjustment Control
7. Oil Pressure Gauge
8. Coolant Temperature Gauge
9. Run-Off-Auto switch.
10. Lamp test

C. Alarm
1. Low Oil Pressure.
2. Low Coolant Level Alarm.
3. Coolant high-temperature alarm.
4. Coolant low-temperature alarm.
5. Main fuel tank low-level alarm.
6. Control switch not in automatic position alarm.
7. High Inlet Air Temperature alarm.
8. Low lube oil pressure alarm.
9. Overcrank alarm.
10. Overspeed alarm.
11. Low cranking voltage alarm.
12. Battery-charger malfunction alarm.
13. Battery low-voltage alarm.
14. Battery high-voltage alarm.

D. Alarm/Stastus/User Contacts
1. Contacts for local and remote common alarm
2. Form C Dry contacts to be minimum 5 amp at 125VAC/VDC rated

E. Remote Annunciator.
1. Required when Specified in Generator Set Specification Summary table.
2. Provide an enclosure with labeled alarm LEDs to alert Operator to a generator set alarm event. The annunciator shall sound a common audible signal for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface or flush mounting type to suit mounting conditions. Comply with NFPA 101 – Life Safety Code for required alarm/status signals.
    a. Overcrank alarm.
    b. Coolant low-temperature alarm.
    c. High engine temperature prealarm.

d. High engine temperature alarm.
e. Low lube oil pressure alarm.
f. Overspeed alarm.
g. Low fuel main tank alarm.
h. Low coolant level alarm.
i. Low cranking voltage alarm.
j. Contacts for local and remote common alarm.
k. Audible-alarm silencing switch.
l. Control switch not in automatic position alarm.
m. Fuel tank derangement alarm.
n. Fuel tank high-level shutdown of fuel supply alarm.
o. Lamp test.
p. Low cranking voltage alarm.
q. Generator overcurrent protective device not closed.

F. Generator Status/Alarm Signals to SCADA/BAS/BMS.
1. Required when Specified in Generator Set Specification Summary table.
2. Provide alarm/status signals used in Remote Annunciator in addition to those listed below:
a. No additional generator set status/alarm signals required for the BMS/SCADA system.

G. Provide supporting Items with generator set including sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items.

H. Provide Emergency-Stop Switch: Wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation

2.11 GENERATOR STARTER, CHARGING, AND BATTERIES

A. Starting System. An electric starting system, consisting of a starting motor, battery, charger, and automatic control equipment shall be provided. The system shall operate at not less than 24 volts and shall be sized and designed to deliver no less than 3 cranking cycles of 15 seconds each, spaced at intervals of 30 seconds at a block temperature of 50°F.

B. The battery shall be a lead-acid type, in hard rubber or fiberglass case, with solid one-piece top especially intended for the starting duty required by this application. Ampere-hour capacity shall be adequate for operation of all pilot devices required for operation of the automatic start system, as well as any alarms or signals, in addition to operation of the starting motor. It shall have sufficient capacity to start the engine a minimum of three times. Cables from battery to engine starter and control shall be of ample size and properly insulated. Provide a substantial acid resistant stand or bracket for the starting batteries, together with a hydrometer, water dispenser, and other necessary battery maintenance equipment.

C. Engine shall be equipped with a 45 ampere DC alternator. A battery disconnect switch shall be provided for maintenance purposes.
Provide a battery charger with the following features:

1. 120vac powered.
2. High-low Charging Rates. High current for charging and low current to maintain charged voltage.
3. Short-circuit Protection. Limit current during short circuit or engine cranking without blowing fuses or tripping circuit breaker. Return to normal operation when condition has cleared.
4. Overvoltage protection if the charger becomes disconnected from the batteries.
5. Normal operation over +/-10% voltage, +/-5hz input variation and 32°-100°F.
6. Capable of charging a completely dead battery, 10 ampere minimum DC output.
7. Voltmeter and ammeter.
8. Battery heater

2.12 OUTDOOR REACH-IN ENCLOSURE

Applicable When Reach-In Enclosure is Specified

A. Provide an Outdoor sound attenuated weatherproof enclosure for the generator. The enclosure shall have a sound level as shown in the Generator Set Specification Summary above. The housing shall be constructed of minimum 14 gauge steel and shall include fixed intake louver design. The housing shall be insulated and soundproof 1-1/2-inch minimum foam insulation and include air discharge of radiator and exhaust to assure sound attenuation of 72dB measured at 7 meters from the source. Louvers: fixed engine, cooling air inlet and discharge. Storm proof and drainable louvers prevent entry of rain, snow, and vermin. The enclosure shall have at least four lockable doors for access to the generator with standard key utilization. Doors shall be vertically hinged to allow 180 deg opening rotation.

B. Lube Oil and coolant drains shall be plumbed to enclosure exterior.

C. Oil Fill, coolant and battery shall only be reached via a lockable access.

D. Enclosure Steel shall be no less than 14 gauge. All hardware shall be zinc plated or stainless steel to prevent rust and corrosion. The exhaust silencer shall be located inside of the enclosure and shall discharge upwards to minimize sound. The intake and discharge openings shall utilize airflow directional routing to maintain interior temperatures in cold weather. The radiator discharge airflow shall also discharge upwards to minimize sound and allow for placement in confined areas. Paint shall be polyester powder baked per customer’s choice of color.

E. Enclosure shall be pre-wired to all accessories and a single shore power connection point with disconnect shall be provided.

F. Operator Platforms shall be provided on three sides of the enclosure for maintenance of generator if the tank is higher than 24 inches. Platforms shall be self supported off the enclosure fuel tank. Platform shall not be supported off the ground. Railings on steps and platform shall be provided. Platform walkways shall utilize a non skid galvanized material for safety

2.13 WALK-IN ENCLOSURE

Applicable When Walk In Enclosure is Specified

A. Description: Vandal-resistant, sound-attenuating, weatherproof steel housing, wind resistant up to 100 mph. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.

B. Description: Prefabricated or pre-engineered galvanized-steel-clad, integral structural-steel-framed, walk-in enclosure, erected on concrete foundation.
   1. Structural Design and Anchorage: Comply with ASCE 7 for wind loads up to 100 mph.
   2. Seismic Design: Comply with seismic requirements.
   3. Fire Protection: Provide dry-pipe fire protection sprinkler system. Provide smoke detector in enclosure; mounted according to NFPA 72.
   4. Hinged Doors: With padlocking provisions.
   5. Space Heater: Thermostatically controlled and sized to prevent condensation.
   6. Lighting: Provide weather resistant LED lighting with 30 foot candles average maintained.
   7. Thermal Insulation: Manufacturer's standard materials and thickness selected in coordination with space heater to maintain winter interior temperature within operating limits required by engine-generator-set components.
   8. Muffler Location: External to enclosure.

C. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.
   1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.
   2. Automatic Dampers: At engine cooling-air inlet and discharge. Dampers shall be closed to reduce enclosure heat loss in cold weather when unit is not operating.
   3. Ventilation: Provide temperature-controlled exhaust fan interlocked to prevent operation when engine is running.

D. Interior Lights with Switch: Factory-wired, vapor-proof fixtures within housing; arranged to illuminate controls and accessible interior. Arrange for external electrical connection.
   1. AC lighting system and connection point for operation when remote source is available.
   2. DC lighting system for operation when remote source and generator are both unavailable.

E. Convenience Outlets: Factory wired, GFCI. Arrange for external electrical connection.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION

A. Provide all labor, material, lugs, protective devices, equipment, and components necessary for the installation of a complete and functional ATS-generator system in accordance with applicable federal, state, local electrical codes, and the manufacturers' recommendations, except where the plan set drawings, associated notes, schedules, and specifications are stricter. This work will include any required ATS-generator start/stop, control power, and SCADA status communication wiring.

B. The engine generator equipment installation shall be coordinated and compatible with Section 26 36 00 “Automatic Transfer Switches.”

C. Provide a Factory Trained and Authorized representative of the generator set manufacturer to advise the Contractor in the proper installation of the generator set and to lead in the inspection and testing of the generator set.

D. Provide a properly trained field service technician to perform any required generator circuit breaker, control, communication, and infrared testing.

3.02 FACTORY TESTING.

A. Prior to shipment, the generator set shall be tested as a unit for a minimum of 2 continuous hours of operation at rated load and 0.8 pf. Normal preliminary engine and alternator tests shall have been performed before unit assembly. A certified copy of the manufacturer’s test logs shall be sent to the Engineer which shall show that the generator set performance tests have been successfully conducted. The generator set shall not be shipped without the Engineer’s approval of the test results.

3.03 RECEIVE, INSPECT, STORE

A. Environmental Limitations
   1. Do not deliver or install the generator set until the Project work area spaces are enclosed and weather tight, wet work in spaces is complete and dry, work above panelboard(s) is complete, and temporary or permanent HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Examine generator set before installation. Reject equipment and components that are moisture or physically damaged.

C. Examine elements and surfaces to receive engine generator set for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving engine-generator into place.

E. Proceed with the installation only after unsatisfactory conditions have been corrected.

F. Do not interrupt electric service to occupied facilities without notifying and receiving the approval of the Owner. The preparations shall include:
   1. Notify Construction Manager, Engineer, Owner, four weeks in advance of proposed interruption of electric service.
   2. Allow sufficient time to develop the outage plan, to review and modify outage plan with the Owner, to notify the affected employees/workers, to arrange temporary power if necessary, and to implement outage plan.
   3. Do not proceed with any electrical outage without the explicit permission from the Owner or the Owner’s Representative.
   4. Arrange to provide temporary electric service according to requirements indicated by the Owner. Indicate method of providing temporary electric service.

3.04 INSTALLATION OF ENGINE GENERATOR SET

A. The generator set shall be installed in accordance with manufacturer's recommendations and UL (NRTL) requirements.

B. See drawings and associated notes for other installation requirements and equipment layout.

3.05 INSTALLATION OF CONCRETE BASES

A. Construct concrete bases of dimensions indicated on drawings and/or as required to meet these specifications.

B. Concrete mix design shall meet the following minimum requirements:
   1. Concrete fc' = 4,000 PSI min. after 28 days.
   2. Maximum slump shall be 3 inches plus or minus 1 inch before addition of super-plasticizer, max. 7 inches after.
   3. All concrete, except concrete used for interior slabs, shall be air entrained to 6% plus or minus 1.5%. Interior floor concrete shall not be air entrained.
   4. Cement water ratio shall not exceed 0.45.
   5. Concrete reinforcement shall be ASTM A615, Grade fy=60,000 PSI.

C. Anchor equipment to concrete base.
   1. Anchors shall be a minimum of 10 bolt diameters from edge of the base.
   2. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   3. Install anchor bolts to elevations required for proper attachment to supported equipment.
   4. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

D. See Division 03, where applicable, for additional information on the material and installation requirements for concrete bases. Where the specifications are in conflict, the more stringent requirement will be enforced. Consult the Engineer for clarification and/or resolution of any conflict between Division 03 and this Specification Section.

3.06 ADJUSTING AND CLEANING

A. Adjust moving parts and operable components to function smoothly, and lubricate the equipment as recommended by manufacturer.

B. Set field-adjustable performance and circuit-breaker trip settings. The Engineer shall furnish the circuit breaker settings to the Contractor, and the Contractor shall be responsible for setting and testing the circuit breakers settings.

C. Upon completion of the installation of the engine generator set, inspect interiors of equipment and control panels; clear any packing material, blockages, dirt, and construction debris. Install components that were shipped loose and require mounting and/or connections. Touch up scratches and mars of finish to match original finish

3.07 IDENTIFICATION

A. Consult drawings, schedules, and associated notes for nameplate format, colors, and text content. Where no instructions are provided, consult specification Section 26 05 53 "Identification for Electrical Systems," and the following general guidelines.
   1. Clean panel surfaces before applying nameplate(s) and signage.
   2. Label field-installed conductors.
   3. Provide equipment nameplate.
   4. Provide printed basic operating instructions for the engine generator set, including normal operating functions, engine performance instrumentation status, and alarm conditions, control functions, and emergency procedures. Mount near the engine generator operator control panel.

3.08 ACEPTANCE TESTING

A. Test Preparation and Implementation
   1. Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning sub-systems, components, controls, and equipment.
4. Before beginning the test schedule, the manufacturer, or his authorized representative, shall furnish a tabulation of typical operating values (temperatures, pressures, etc.) for the particular machine under the specified conditions. These values shall be within safe limits insofar as effect on machine life is concerned, and shall not be exceeded. The Contractor shall be responsible for safeguarding the machine against damage due to abnormal or unsafe operating conditions arising from, or encountered during, the specified tests.
5. If any condition necessitates termination of the test procedure prior to satisfactory completion, the Engineer shall decide whether the test may be resumed or must be re-run, depending upon the circumstances.

B. Tests and Inspections
1. Perform tests recommended by manufacturer and each visual and mechanical inspection and electrical and mechanical test listed in the first two subparagraphs as specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
    a. Visual and Mechanical Inspection
        1) Compare equipment nameplate data with drawings and specifications.
        2) Inspect physical and mechanical condition.
        3) Inspect anchorage, alignment, and grounding.
        4) Verify the unit is clean.
    b. Electrical and Mechanical Tests
        1) Perform insulation-resistance tests in accordance with IEEE 43.
            (a) Machines larger than 200 horsepower. Test duration shall be 10 minutes. Calculate polarization index.
            (b) Machines 200 horsepower or less. Test duration shall be one minute. Calculate the dielectric-absorption ratio.
        2) Test protective relay devices.
        3) Verify phase rotation, phasing, and synchronized operation as required by the application.
        4) Functionally test engine shutdown for low oil pressure, over-temperature, over-speed, and other protection features as applicable.
        5) Conduct performance test in accordance with NFPA 110.
        6) Verify correct functioning of the governor and regulator.
2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
    a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
    b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
    c. Verify acceptance of charge for each element of the battery after discharge.
    d. Verify that measurements are within manufacturer's specifications.
4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
6. Exhaust System Back Pressure Test: Use a manometer with a scale exceeding 40-inch wg. Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
7. Exhaust Emissions Test: Comply with applicable government test criteria.

8. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
9. Harmonic-Content Tests: Measure harmonic content of output voltage at 25 percent and 100 percent of rated linear load. Verify that harmonic content is within specified limits.
10. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at four locations 5 to 15 feet from edge of the generator within the generator room and four locations outside the generator room, and compare measured levels with required values.

C. Coordinate tests with tests for Automatic Transfer Switches and run them concurrently.

D. Test instruments shall have been calibrated within the last 12 months, traceable to NIST Calibration Services, and adequate for making positive observation of test results. Make calibration records available for examination on request.

E. Leak Test: After installation, charge exhaust, coolant, and fuel systems and test for leaks. Repair leaks and retest until no leaks exist.

F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.

G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

H. Remove and replace malfunctioning units and retest as specified above.

I. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

K. Perform primary current injection tests on all Long Time, Short Time, Instantaneous, and Ground Fault adjustable trip circuit breaker settings.
1. Test the ground fault operation in accordance with NEC 230.95(C). The Electrical Inspector or Authority Having Jurisdiction (AHJ) may require that he witness the ground fault test or may require a written record of the testing results. The Contractor shall contact and coordinate any ground test with the Electrical Inspector.
2. Provide proposed testing procedure to verify functionality of circuit breakers supplied with Zone Selective Interlocking.

L. Perform the following infrared scan tests and inspections and prepare a report.
1. Perform Infrared Scan after Substantial Completion, but not more than 30 days after Final Acceptance. The infrared scan of the switchboard shall include the circuit breakers, bus, bus connections, and wire connections.
2. Use calibrated Fluke Ti32 Thermal Imager or equivalent for infrared scanning.

M. Correct malfunctioning sub-systems, components, controls, remote monitoring and safeties on-site, where possible, and retest to demonstrate compliance.

N. Engine generator set will be considered defective and not acceptable if it does not pass tests, inspections, or corrective measures.

O. Prepare final Field Test and Inspection report(s) that identifies the tests performed and test results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

3.09 TRAINING

A. The generator supplier shall furnish training for the operating and maintenance personnel of the Owner in the recommended and proper operation and maintenance of the equipment installed under this Contract. The Contractor shall include the cost of this training in the base price for this Contract. Training shall be both of the classroom type and the on-the-job type, and shall cover all areas of maintenance and operation.

B. The training period may be either concurrent with the system start-up period at the Contractor's option; however, if it is given concurrent to the start-up, then the instructing personnel shall be furnished in addition to the start-up personnel, and one shall not interfere with the other.

C. The training period shall occur over a period of at least two working days and not exceed 8 hours total. Scheduling of participation of the Owner's personnel shall be mutually agreed upon between the Contractor and the Project Engineer.

3.10 GUARANTEE (WARRANTY)

Provide Manufacturer's warranty to repair or replace any generator set, sub systems, components, or accessory that fail in materials or workmanship within two years from date of Substantial Completion. The Contractor shall have available, within 24 hour notice, a factory-trained engineer or technician to determine and carry out such corrective work as may prove necessary.

END OF SECTION

SECTION 26 33 53
STATIC UNINTERRUPTIBLE POWER SUPPLY

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings, the provisions of the Contract including the General and Supplementary Conditions, and the General Requirements apply to the Work of this Section.

B. The following sections have been specifically referenced in this specification:
   1. Section 26 05 00 Common Work Results for Electrical.
   2. Section 26 05 29 Hangers and Supports for Electrical Systems.
   3. Section 26 24 16 Panelboards.
   4. Section 26 22 00 Low Voltage Transformers.
   5. Section 26 05 53 Identification for Electrical Systems.

1.02 SUMMARY

A. This Section covers basic electrical requirements for providing labor, materials, equipment, and services necessary for the selection and installation of uninterruptible power supplies, batteries, cabinets, external maintenance bypass switches, components, and accessories as shown on the drawings and specified herein. In general, this consists of:
   1. Uninterruptible Power Supply: Three-phase, on-line, double-conversion, static-type, units with the following features:
      a. Surge suppression.
      b. Rectifier-charger.
      c. Inverter.
      d. Internal Static bypass transfer switch.
      e. Battery and battery disconnect device.
      f. Battery monitoring.
      g. Status/Alarm Communication.
   2. External Maintenance Bypass Switch
      a. Isolation switches
      b. Bypass switch
      c. Keyed safety interlock to prevent external maintenance bypass unless UPS is not in internal static bypass.

1.03 DEFINITIONS/ABBREVIATIONS

A. IBS Internal Static Bypass Switch. The IBS is an integral subsystem in the Uninterruptible Power Supply which allows the UPS to be disconnected from the batteries and internal inverter electronics for startup, shutdown, and emergency operation purposes. In this mode the UPS is operating strictly on the AC power line.

B. MBS External Maintenance Bypass Switch. The unit is external to the Uninterruptible Power Supply and allows the UPS to be completely disconnected from the electrical distribution system without any power interruption to the connected sensitive electronic loads. In this switching configuration the sensitive electronic loads are operated from a alternate AC power line. The disconnection allows the UPS to be isolated from the AC power line and DC batteries for safe maintenance procedures while maintaining power to the electrical loads.

C. UPS Uninterruptible Power Supply.

1.04 SUBMITTALS

A. Bid. Provide the following with the bid documents.
   1. No additional submittals required; see Specification Section 26 05 00.

B. Manufacture. Provide the following prior to release for manufacture and/or purchase.
   1. UPS, MBS, Enclosures, Wiring, Protective Devices, Batteries, and Components: Shop Drawings/Data Sheets shall be submitted for approval.
      a. Dimensioned plans, elevations, sections, weights, and details.
      b. Show access, workspace, and clearance requirements.
      c. Show location and identification of each component and field connection.

d. Details of any controls and battery arrangement.
e. Show tabulations of installed devices, equipment features, and ratings.
f. Detail enclosure types and details for types other than NEMA 250, Type 1.
g. Detail configuration, current, and voltage ratings.
h. Detail rating of battery electrical charge and discharge performance and associated hydrogen gas production levels.
i. Safe battery handling, installation, connection, testing, and operation requirements, including any containment, gas monitoring, fire detection, and/or ventilation requirements.
j. Short-circuit current rating of the UPS, MBS, and associated equipment.
k. Wiring diagrams for power, signal, and control wiring.
l. SCADA/PLC network control/monitoring wiring hardware, protocol, and cable specification requirements and connections.

2. Protective Device: Data Sheets for each protective device with characteristics, ratings, for each type and rating included.
   a. Protective Device Performance Data
      1) Complete verified SKM format electronic library models for each type and size protective device.
      2) Time Current Curve for each type and rating of overcurrent protective device included in electronic pdf format. Website links will not be accepted.
   b. Complete detailed catalog number including numbers reflecting the type, rating, configuration, characteristics, features, and auxiliary components to be furnished with the protective device.
      1) Include a guide to identify (decode) the protective device characteristics conveyed by the detailed catalog number. This guide will be used to interpret and verify the proposed protective device ratings and features. Where this guide does not exist, the information shall be included in the tabulated detailed list of the ratings and features for the protective device description in the submittal.
   c. Circuit Breaker control power, status, and network wiring diagram where applicable.
3. Seismic Qualification Certificates. Submit certification that the UPS and MBS, enclosure(s), overcurrent protective devices, controller(s), accessories, and components will withstand potential seismic forces, where applicable.
4. Equipment Nameplate
   a. New Equipment: Provide nameplate schedule with text, sizes, and colors shown and images of proposed nameplates as each would appear once engraved.
   b. Existing Equipment: Document with images of proposed nameplates as each would appear once engraved.
5. Concrete materials, reinforcement, and placement requirements where concrete work is required on drawings.
6. No samples requested.
7. See also Specification Section 26 05 00.

C. Construction. Provide the following during construction.
1. Planned field Test procedure(s) to Engineer prior to energizing and testing UPS, MBS, and associated equipment.
2. Provide results of field testing of the UPS, MBS, protective devices, and all associated equipment in the final Field Test Report.
3. See also Specification Section 26 05 00.

D. Closeout. Provide the following to complete the project.
1. No additional submittals required; see Specification Section 26 05 00.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: The equipment manufacturer shall be regularly engaged in the manufacture of uninterruptible power supplies, batteries, cabinets, external maintenance bypass switches, components, and accessories of the types, capabilities, and capacities required, and whose products have been in satisfactory use in similar service for not less than ten years.

B. Installer Qualifications: The National Electrical Contractors Association installation and maintenance guide is hereby identified to define workmanship related to the installation of equipment and/or materials specified by this Specification section.

C. Codes/Standards: The products provided by this section shall comply with the latest editions of the following references:
   1. IEEE 587 Standard for Surge Withstand Ability.
   2. NFPA 75 Standard for the Fire Protection of Information Technology Equipment suitable for installation in a computer room.
   3. NEMA 250 - Enclosures for Electrical Equipment (1000V Maximum)
   4. UL 489 - Molded Case Circuit Breakers Marking and Application Guide
   5. UL 1244 – Standard for Electrical and Electronic Measuring and Testing
   6. UL 1778 – Uninterruptible Power Systems.

D. Equipment Quality: Electrical UPS, batteries, cabinets, MBS, components, and accessories shall be “Listed” or “Labeled” as components and assemblies as defined in NFPA 70, Article 100, by a National Recognized Testing Laboratory acceptable to authorities having jurisdiction, and marked for the intended location and use.

PART 2 PRODUCTS

2.01 GENERAL INFORMATION

A. All electrical equipment shall be new unless otherwise specified in the plan drawings and associated notes. The type of equipment and/or material shall be approved for its planned use and environment and is so defined by NEMA/NFPA 70 standards and NRTL certifications.

B. Provide the equipment as noted on the plan set drawings and the following summary of basic Clean Power System features for this Project:
   1. UPS 480V In, 480V Out, 80KVA
   2. MBS 480V, Min 150A, Separate Cabinet
   3. Batteries 30 Minute, Separate Cabinet
   4. Remote Annunciator mounted in Control Room (including conduit and cable).
   5. Dry Contacts for status/alarm signals for remote SCADA PLC.
   6. Electrical Distribution Equipment: Harmonic Canceling Power Transformer, Enclosed Circuit Breakers, and new and existing Panelboards.

C. Electronic Equipment: Solid-state devices using hermetically sealed, semiconductor elements. Devices include rectifier-charger, inverter, static bypass transfer switch, and system controls.

D. Enclosures: Comply with NEMA 250, Type 1, unless otherwise indicated.

E. Control Assemblies: Mount on modular plug-ins, readily accessible for maintenance.

F. Surge Suppression: Protect internal UPS components from surges that enter at each ac power input connection including main disconnect switch, static bypass transfer switch. Protect rectifier-charger, inverter, controls, and output components.
   1. Use factory-installed surge suppressors tested according to IEEE C62.41.1 and IEEE C62.41.2, Category B.

G. Seismic-Restraint Design: UPS assemblies, subassemblies, and components (and fastenings and supports, mounting, and anchorage devices for them) shall be designed and fabricated to withstand static and seismic forces.

2.02 ACCEPTABLE MANUFACTURERS

A. The UPS system equipment, components, and accessories to be from a single source from single manufacturer Manufacturers subject to compliance with requirements, provide UPS system equipment and components by one of the following:
   1. Liebert-Emerson Network Power
   2. Mitsubishi Electric
   3. Toshiba International Corporation
   4. Protective devices (circuit breakers and fuses) selected for the UPS and associated equipment shall comply with the applicable Overcurrent Protective Device selection, acceptable manufacturer limitations, installation, and testing requirements in specification Section 26 24 16 “Panelboards”, unless otherwise pre-approved by the Engineer.

B. Battery Manufacturer
   1. C&D Technologies
   2. EnerSys
   3. As Approved by the Engineer

2.03 UNINTERRUPTIBLE POWER SUPPLY OPERATION

A. Automatic operation includes the following:
   1. Normal Conditions: Load is supplied with power flowing from the normal power input terminals, through the rectifier-charger and inverter, with the battery connected in parallel with the rectifier-charger output.
   2. Abnormal Supply Conditions: If normal supply deviates from specified and adjustable voltage, voltage waveform, or frequency limits, the battery supplies energy to maintain constant, regulated inverter power output to the load without switching or disturbance.
   3. If normal power fails, energy supplied by the battery through the inverter continues supply-regulated power to the load without switching or disturbance.
   4. When power is restored at the normal supply terminals of the system, controls automatically synchronize the inverter with the external source before transferring the load. The rectifier-charger then supplies power to the load through the inverter and simultaneously recharges the battery.
   5. If the battery becomes discharged and normal supply is available, the rectifier-charger charges the battery. On reaching full charge, the rectifier-charger automatically shifts to float-charge mode.
   6. If any element of the UPS system fails and power is available at the normal supply terminals of the system, the static bypass transfer switch switches the load to the normal ac supply circuit without disturbance or interruption.
   7. If a fault occurs in the system supplied by the UPS, and current flows in excess of the overload rating of the UPS system, the static bypass transfer switch operates to bypass the fault current to the normal ac supply circuit for fault clearing.
   8. When the fault has cleared, the static bypass transfer switch returns the load to the UPS system.
   9. If the battery is disconnected, the UPS continues to supply power to the load with no degradation of its regulation of voltage and frequency of the output bus.

B. Manual operation includes the following:
   1. Turning the inverter off causes the static bypass transfer switch to transfer the load directly to the normal ac supply circuit without disturbance or interruption.
   2. Turning the inverter on causes the static bypass transfer switch to transfer the load to the inverter.

C. Maintenance Bypass/Isolation Switch Operation: Switch is interlocked so it cannot be operated unless the UPS static bypass transfer switch is in the bypass mode. Device provides manual selection among the three conditions in subparagraphs below without interrupting supply to the load during switching:
   1. Full Isolation: Load is supplied, bypassing the UPS. Normal UPS ac input circuit, static bypass transfer switch, and UPS load terminals are completely disconnected from external circuits.
   2. Maintenance Bypass: Load is supplied, bypassing the UPS. UPS ac supply terminals are energized to permit operational checking, but system load terminals are isolated from the load.
   3. Normal: Normal UPS ac supply terminals are energized and the load is supplied through either the static bypass transfer switch and the UPS rectifier-charger and inverter, or the battery and the inverter.

D. Environmental Conditions: The UPS shall be capable of operating continuously in the following environmental conditions without mechanical or electrical damage or degradation of operating capability, except battery performance.
   1. Normal Ambient Conditions Slightly dusty, 80°F
   2. Ambient Temperature for Electronic Components: 60 to 104°F.
   3. Ambient Temperature for Battery: 60 to 104°F
   4. Relative Humidity: 0 to 95% (Non-cond)

5. Altitude: Sea level to 4000Ft

2.04 UNINTERRUPTIBLE POWER SUPPLY PERFORMANCE

A. The UPS shall perform as specified in this article while supplying rated full-load current, composed of any combination of linear and nonlinear load, up to 100 percent nonlinear load with a load crest factor of 3.0, under the following conditions or combinations of the following conditions:
   1. Inverter is switched to battery source.
   2. Steady-state ac input voltage deviates up to +/-10% from nominal voltage.
   3. Steady-state input frequency deviates up to +/-5% from nominal frequency.
   4. THD of input voltage is 15% or more with a minimum crest factor of 3.0, and the largest single harmonic component is a minimum of 5% of the fundamental value.
   5. Load is 40% unbalanced continuously.

B. The battery shall be rated to maintain the full rated UPS load current at 80% power factor for a minimum of 30 minutes or as noted on the plan set drawings, schedule, and/or associated notes.

C. The system steady-state and transient output performance remain within the specified UPS tolerances when steady-state ac input voltage varies +10% to -25% from nominal voltage.

D. The UPS system shall be compatible with and operate without any problems with the onsite standby diesel generator source alternator and control electronics. Any conflicts in performance with either the UPS or generator system shall be identified and corrected.

E. The overall UPS efficiency shall be equal to or greater than 90% at all ranges from 25% load to 100% load.

F. The maximum acoustical noise shall not exceed 70dB emanating from any UPS component under any condition of normal operation, measured 6 feet from the nearest surface of the component enclosure.

G. The maximum energizing inrush current shall not exceed six times the full-load current.

H. The AC output voltage shall be regulated to +/-2% over the full range of battery voltage for loads up to 50% unbalanced.

I. The output frequency shall be regulated to 60 Hz, +/-0.5% over the full range of input, load, and battery voltages.

J. The reflected input current harmonic distortion shall be limited 3% at 100% load and 5% at 50% harmonic load for power sources with X/R ratio between 2 and 30.

K. The maximum output voltage waveform harmonic content shall be limited to 2% for 100% linear loads or 5% for 100% non-linear loads.

L. The minimum overload capacity of the UPS at the rated voltage shall be 125 percent of rated full load for 10 minutes; and 150 percent, for 30 seconds in all operating modes.

M. The maximum output voltage transient excursions from the rated value shall be limited for the following instantaneous load changes, stated as percentages of rated full UPS load. For these conditions the voltage shall remain within stated percentages of rated value and recover to, and remain within, +/-2% of that value within 100ms:
   1. 50 Percent: +/- 5%
   2. 100 Percent: +/- 5%
   3. Loss of AC Input Power: +/- 1%
   4. Restoration of AC Input Power: +/- 1%

N. The input power factor shall maintain a minimum of 0.85 lagging when supply voltage and current are at nominal rated values and the UPS is supplying less than rated full-load current.

O. EMI emissions shall comply with FCC Rules and Regulations and with 47CFR15.

2.05 UNINTERRUPTIBLE POWER SUPPLY RECTIFIER-CHARGER

A. The capacity shall be adequate to supply the inverter during rated full output load conditions and simultaneously recharge the battery from fully discharged condition to 95 percent of full

charge within 10 times the rated discharge time for duration of supply under battery power at full load.

B. The output ripple shall be limited by output filtration to less than 0.5 percent of rated current, peak to peak.

C. The control circuits shall be immune to frequency variations within the rated frequency ranges of normal and emergency power sources.

D. The battery float-charging conditions shall comply with the battery Manufacturer's written instructions for battery terminal voltage and charging current required for maximum battery life.

2.06 UNINTERRUPTIBLE POWER SUPPLY INVERTER

A. The inverter output shall be sinusoidal pulse-width modulated.

2.07 UPS INTERNAL STATIC BYPASS TRANSFER SWITCH

A. The internal UPS bypass switch shall be a solid-state switching device providing uninterrupted transfer. A contactor or electrically operated circuit breaker automatically provides electrical isolation for the switch.

B. The switch shall be rated continuous duty at a minimum of the UPS full load rated current.

2.08 UNINTERRUPTIBLE POWER SUPPLY BATTERY

A. The battery shall be valve-regulated, premium heavy-duty, recombinant, lead-calcium units. The batteries shall be factory assembled in a separate matching cabinet, complete with battery disconnect switch. The cabinet shall be arranged with draw-out tray for removal of battery assembly from cabinet for testing and inspecting.

B. Seismic-Restraint Design: Battery racks, cabinets, assemblies, subassemblies, and components (and fastenings and supports, mounting, and anchorage devices for them) shall be designed and fabricated to withstand static and seismic forces.

2.09 UNINTERRUPTIBLE POWER SUPPLY CONTROLS AND INDICATIONS

A. The displays, indications, and basic system controls shall be grouped into a common control panel on front of UPS enclosure. The LED backlit display shall present instructions, performance, and alarms in simple English messages.

B. The displays, indicating devices, and controls shall include the features and content listed below. Provide the sensors, transducers, terminals, relays, and wiring required to support the listed items. Alarms include audible signals and visual displays.
   1. Quantitative indications shall include the following:
      a. Input voltage, each phase, line to line.
      b. Input current, each phase, line to line.
      c. Bypass input voltage, each phase, line to line.
      d. Bypass input frequency.
      e. System output voltage, each phase, line to line.
      f. System output current, each phase.
      g. System output frequency.
      h. DC bus voltage.
      i. Battery current and direction (charge/discharge).
      j. Elapsed time discharging battery.
   2. Basic status condition indications shall include the following:
      a. Normal operation.
      b. Load-on bypass.
      c. Load-on battery.
      d. Inverter off.
      e. Alarm condition.
   3. Alarm indications shall include the following:
      a. Bypass ac input overvoltage or undervoltage.
      b. Bypass ac input overfrequency or underfrequency.
      c. Bypass ac input and inverter out of synchronization.
      d. Bypass ac input wrong-phase rotation.

e. Bypass ac input single-phase condition.
f. Bypass ac input filter fuse blown.
g. Internal frequency standard in use.
h. Battery system alarm.
i. Control power failure.
j. Fan failure.
k. UPS overload.
l. Battery-charging control faulty.
m. Input overvoltage or under-voltage.
n. Input transformer over-temperature.
o. Input circuit breaker tripped.
p. Input wrong-phase rotation.
q. Input single-phase condition.
r. Approaching end of battery operation.
s. Battery under-voltage shutdown.
t. Maximum battery voltage.
u. Inverter fuse blown.
v. Inverter transformer over-temperature.
w. Inverter over-temperature.
x. Internal static bypass transfer switch over-temperature.
y. Inverter power supply fault.
z. Inverter transistors out of saturation.
aa. Identification of faulty inverter section/leg.
bb. Inverter output over-voltage or under-voltage.
cc. UPS overload shutdown.
dd. Inverter current sensor fault.
ee. Inverter output contactor open.
ff. Inverter current limit.

4. Controls shall include the following:
   a. Inverter on-off.
   b. UPS start.
   c. Battery test.
   d. Alarm silence/reset.
   e. Output-voltage adjustment.

C. Provide dry-form "C" contacts for connection to SCADA PLC for remote indication of the following conditions:
   1. UPS on battery.
   2. UPS on-line.
   3. UPS load-on bypass.
   4. UPS in alarm condition.
   5. UPS off (maintenance bypass closed).

D. Provide Emergency-Power-Off (EPO) Switch capable of local operation and operation by means of activation by external dry contacts.

2.10 MONITORING BY REMOTE STATUS AND ALARM PANEL

A. Provide manufacturers standard panel with labeled LEDs for remote monitoring and alarming of key UPS conditions. Panel to provide audible signal to indicate alarm conditions. Button(s) in face of panel silences signal without altering visual indication.
   1. Cabinet to be surface or flush mounted to suit control room wall mounting conditions.

2.11 BATTERY MONITORING

A. Battery Ground-Fault Detector: Initiates alarm when resistance to ground of positive or negative bus of battery is less than 5000 ohms.

B. Battery compartment smoke/high-temperature detector initiates an alarm when smoke or a temperature greater than 75°C occurs within the compartment.

C. Annunciation of alarms at UPS control panel and Control Room.

D. Monitor and store charge/discharge cycle history. Automatically measure and record each discharge event and classify it according to duration and severity.

E. Additional monitoring functions and features shall include the following:
   1. Measuring and Recording: Total voltage at battery terminals. Initiate alarm for excursions outside the proper float-voltage level.
   2. Monitor ambient temperature at battery. Initiate alarm if temperature deviates from normally acceptable range.
   3. Keypad on Device Front Panel: Provides access to monitored data using front panel display.
   4. Alarm Contacts: Arranged to initiate local and remote alarm for battery discharge events, abnormal battery voltage, and temperature.
   5. Store recorded data in nonvolatile electronic memory.
   6. Provide RS-232 communication port to permit downloading of data to a portable PC.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION

A. Provide all labor, material, lugs, protective devices, equipment, and components necessary for the installation of a complete and functional uninterruptible power supply system including UPS, batteries, cabinets, external maintenance bypass switches, components, and accessories in accordance with applicable federal, state, local building electrical codes, and the manufacturers' recommendations, except where the plan set drawings, associated notes, schedules, and/or specifications are stricter. This work will include any required power, control, or signal wiring for equipment. Install according to the Manufacturer’s and NECA 1 standards

3.02 FACTORY TESTING

A. Factory test complete UPS system before shipment. Use simulated battery testing. Include the following:
   1. Test and demonstration all functions, controls, indicators, sensors, and protective devices.
   2. Full-load test.
   3. Transient-load response test.
   4. Overload test.
   5. Power failure test.

B. Report test results.

3.03 INSTALLATION OF UPS SYSTEM

A. Floor-Mounting Controllers: Install UPS, MBS, and Battery Cabinets on 4-inch nominal thickness concrete base. Comply with requirements for concrete base specified in Section 26 05 29 “Hangers and Supports for Electrical Systems".
   1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
   2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
   3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   4. Install anchor bolts to elevations required for proper attachment to supported equipment.

B. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

C. Provide power, control, and signal wiring to interconnect system components including UPS, MSB, Batteries, Battery Monitor, and Remote Annunciator. Make connections per the Manufacturer's wiring diagrams unless otherwise indicated.

D. Provide grounding for separately derived systems where applicable for power, harmonic reduction, and/or isolation transformers. Coordinate grounding conductor connection destination with Engineer or install as noted on plan set drawings. Comply with NFPA 70 requirements for connecting to grounding electrodes and for bonding to metallic piping near transformer(s).

E. Provide grounding for clean power supplementary ground system ground bar(s), conductors, connections, and grounding electrodes as noted on plan set drawings, schedules, and associated notes. Comply with NFPA 70 requirements for connecting to grounding electrodes and for bonding to metallic piping near transformer(s).

F. Identify components and wiring according to Section 260553 "Identification for Electrical Systems."

G. Equalize charging of battery cells according to manufacturer's written instructions. Record individual-cell voltages.

H. Seismic Bracing: Comply with requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."

I. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

J. Where required, install fuses in each fusible power and control circuit if not factory installed.

K. Install the UPS system protective devices according to the applicable Overcurrent Protective Device selection, acceptable manufacturer limitations, installation, and testing requirements in specification Section 26 24 16 “Panelboards”, unless otherwise pre-approved by the Engineer.

3.04 IDENTIFICATION

A. Identify UPS system equipment, components, and control wiring.
   1. Label field-installed conductors, interconnecting wiring, and components; provide warning signs. See Section 26 05 53 “Identification for Electrical Systems.”
   2. Provide nameplate for each UPS, MBS, and Battery Cabinet with equipment name and power source. See Section 26 05 53 “Identification for Electrical Systems” or Owner labelling guidelines for this Project.
   3. Provide nameplate or legend ring for each enclosure-mounted control and pilot device. See Section 26 05 53 “Identification for Electrical Systems” or Owner labelling guidelines for this Project.

3.05 ADJUSTING AND CLEANING

A. Carefully wipe down all surfaces of the internal and external surfaces of the UPS and associated equipment from dust and dirt prior to energizing the UPS and associated equipment.

B. Paint all damaged and marred equipment finishes prior to energizing the UPS and associated equipment.

C. Program/configure UPS microprocessors as required for equipment parameters, operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing. Set any field-adjustable components, auxiliary relays, time-delay relays, timers, and/or alarm/trip setting thresholds.

D. Where applicable, adjust the trip settings of molded case circuit breakers. Adjust the settings for electronic trip circuit breakers LSI parameters furnished by the Engineer. If tripping occurs on inrush, notify Owner and Engineer to adjust the settings. Do not exceed the NEC maximum protective device setting limit. Where these maximum settings do not allow operating equipment, notify Owner and Engineer to determine.

E. Record all changeable parameters and incorporate into Operation and Maintenance manual.

3.06 ACCEPTANCE TESTING

A. General Requirements: Visually inspect and test the UPS and associated equipment according to the manufacturer’s recommended testing and the following general requirements.
   1. Engage a factory qualified testing agency to perform tests and inspections.
   2. Perform each electrical test and visual/mechanical inspection according to the Manufacturer’s recommendations and as stated in NETA Acceptance Testing Specification. Where the testing requirements are in conflict, the Contractor shall defer to the Manufacturer’s recommendations. Certify compliance with test parameters.
   3. Test the UPS and each component individually and as a system.

4. Verify the performance of the UPS according to the planned/programmed operation of functions and features specified.
5. Test the UPS system protective devices according to the applicable Overcurrent Protective Device selection, acceptable manufacturer limitations, installation, and testing requirements in specification Section 26 24 16 “Panelboards”, unless otherwise pre-approved by the Engineer.
6. The UPS System, UPS, MBS, and/or Batteries will be considered defective if they do not pass tests and inspections.

B. Acceptance Testing
1. Inspect the UPS system wiring, components, connections, and equipment installation.
2. Inspect interiors of enclosures, including the following:
   a. Integrity of mechanical and electrical connections.
   b. Component type and labeling verification.
   c. Ratings of installed components.
3. Test continuity of each circuit.
4. Test insulation resistance for each field assembled/connected source conductor, internal bus, switch, interconnecting power conductors, and power connections. Verify the testing procedure with the Manufacturer to prevent damage to the equipment electronic components.
5. Verify that voltages at UPS system input, output, and test points are within 10 percent of Manufacturer established nameplate and component rated voltages. If outside this range notify the Engineer before operating the unit.
6. Test each source, bus, component, battery, transformer, and/or panelboard for proper phasing.
7. Test manual and automatic operational features and system protective and alarm functions
8. Test charging circuits and batteries.
9. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
10. Correct malfunctioning units on-site, where possible, and re-test to demonstrate compliance; otherwise, replace with new units and retest

C. Prepare Test and inspection report, including a certified report that identifies the UPS component equipment describes inspection/testing results. Include notation of deficiencies detected, corrective action taken, and observations made verifying corrective measures.

3.07 TRAINING

A. Train Owner's maintenance personnel to adjust, operate, and maintain the UPS system.

3.08 GUARANTEE (WARRANTY)

A. Provide Manufacturer's warranty to repair or replace any UPS, MBS, and associated equipment that fails in materials or workmanship within three years.

B. Provide Manufacturer special battery warranty so that the Manufacturer/Contractor will repair or replace the UPS system storage batteries that fail in materials or workmanship within a five year warranty period. Warranted Cycle Life for Premium Valve-Regulated, Lead-Calcium Batteries: Equal to or greater than that represented in Manufacturer's published table, including figures corresponding to the following, based on annual average battery temperature of 80°F.

Discharge Rate	Discharge Duration	Discharge End Voltage	Cycle Life
8 hours	8 hours	1.67	40 cycles
30 minutes	30 minutes	1.67	125 cycles
15 minutes	1.5 minutes	1.67	750 cycles

END OF SECTION

SECTION 26 36 00
AUTOMATIC TRANSFER SWITCHES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings, the provisions of the Contract including the General and Supplementary Conditions, and the General Requirements apply to the Work of this Section.

B. The following sections have been specifically referenced in this specification:
   1. Section 26 05 00 Common Work Results for Electrical.

1.02 SUMMARY.

A. This Section covers basic electrical requirements for providing labor, materials, equipment, and services necessary for the selection and installation of automatic transfer switch(s) as shown on the drawings and specified herein. In general, this consists of:
   1. Automatic Transfer Switch.
   2. Control and Monitoring.
   3. Identification.
   4. Completely installed, tested, and operative.

1.03 DEFINITIONS/ABBREVIATIONS

A.	ATS	Automatic Transfer Switch
B.	BAS/BMS	Building Automation System
C.	BMS	Building Management System
D.	SCADA	Supervisory Control and Data Acquisition
E.	Eaton Electrical Inc.; Cutler-Hammer	Eaton Electrical Inc.
F.	Emmerson Network Power, Technologies	ASCO - Automatic Switch Company Power

G. No additional definitions/abbreviations provided.

1.04 SUBMITTALS.

A. Bid: Provide the following with the bid documents.
   1. No additional submittals required; see Specification Section 26 05 00.

B. Manufacture: Provide the following prior to release for manufacture and/or purchase.
   1. Data sheets shall be submitted for approval for the ATS specifications and operation.
   2. Shop Drawings shall be submitted for approval for engine-generator set and all accessories.
      a. Dimensioned plans, elevations, sections, and details.
      b. Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location and size of each field connection.
      c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
      d. Show tabulations of installed devices, equipment features, and ratings.
      e. Detail enclosure types and details for types other than NEMA 250, Type 1.
      f. Remote Annunciator interior/exterior panel layout including status lamp labels, functions, and wiring. Identify specified NFPA compliance as appropriate for application.
      g. Detail bus configuration, current, and voltage ratings.
      h. Control power, internal and external control/interlock/interface schematics, and/or network diagram(s) with clear indication of necessary field wiring and connection points.
      i. Include required clearances and service space around equipment for installation, conduit entries, operation, and maintenance.
   3. Protective Device: Data Sheets for each protective device with characteristics, ratings, for each type and rating included in the automatic transfer switch(s).

a. Protective Device Performance Data
   1) Complete verified SKM format electronic library models for each type and size protective device.
   2) Time Current Curve in electronic pdf format. Website links will not be accepted.
b. Complete detailed circuit breaker catalog number including numbers reflecting the type, rating, configuration, characteristics, features, and auxiliary components to be furnished with the protective device.
   1) Include a guide to identify (decode) the protective device characteristics conveyed by the detailed catalog number. This guide will be used to interpret and verify the proposed protective device ratings and features. Where this guide does not exist, the information shall be included in the tabulated detailed list of the ratings and features for the protective device description in the submittal.

4. No samples requested.
5. See also Specification Section 26 05 00.

C. Construction: Provide the following during construction.
1. No additional submittals required; see Specification Section 26 05 00.

D. Closeout: Provide the following to complete the project.
1. Test Reports of final adjustment and completed calibration sheets.
2. See also Specification Section 26 05 00.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: The equipment manufacturer shall be regularly engaged in manufacture of automatic transfer switch(s), components, and accessories of the types, capabilities, and capacities required, and whose products have been in satisfactory use in similar service for not less than ten years.

B. Installer Qualifications: - No additional qualifications specified.

C. Codes/Standards: The products provided by this section shall comply with the latest editions of following references:
1. UL 1008 - Standard for Transfer Switch Equipment
2. UL 489 - Molded Case Circuit Breakers Marking and Application Guide.
3. UL1008 - Standard for Transfer Switch Equipment
4. UL 1066 – Standard for Low Voltage AC and DC Power Circuit Breakers.

D. Equipment Quality: The automatic transfer switches, components, and accessories shall be “Listed” or “Labeled” as defined in NFPA 70, Article 100, by a National Recognized Testing Laboratory acceptable to authorities having jurisdiction, and marked for the intended location and use.

PART 2 PRODUCTS

2.01 GENERAL INFORMATION

A. All electrical equipment and material shall be new unless otherwise specified in the plan drawings, associated notes, and/or riser/oneline diagrams. The type of equipment and/or material shall be approved for its planned use and environment and is so defined by NEMA / NFPA 70 standards and NRTL certification.

B. See plans, schedules, and oneline diagrams for additional information regarding the requirements for the automatic transfer switches(s). The following chart summarizes the features required for the Project equipment including the number of poles, amperage, voltage, AIC withstand, and close-on ratings. Each automatic transfer shall consist of an inherently double throw operation and a microprocessor based control to provide automatic operation. All transfer switches and controllers shall be the products of the same manufacturer, unless approved by the Engineer.

ATS SPECIFICATION SUMMARY			
EQP NAME	**VOLTAGE**	**OPERATION**	**NOTES**

EXISTING ATS 1-1	480Y/277V 2000A 65KAIC	Four Pole Open Transition (Optional Standby)	Contactor Based with UL 1008 ASCO CAT# G9404200097XC S/N126310 Retrofit Load Shedding Control Ethernet IP Communication
ATS 1-2	480Y/277V 200A 42KAIC	Four Pole Open Transition Emergency (Life Safety)	Contactor Based with UL 1008 ASCO Preferred Load Shedding Control Ethernet IP Communication
ATS 4-1	480Y/277V 800A 42KAIC	Four Pole Open Transition (Optional Standby)	Contactor Based with UL 1008 ASCO Preferred Load Shedding Control Ethernet IP Communication

NOTES:

1. Staggered load control of the ATS-Generator system is not required.
2. Load shedding control of three ATS is required.

Priority	ATS 1-2
Secondary	ATS 1-1
Tertiary	ATS 4-1

See drawings and associated notes for additional information.

C. Enclosure. The transfer switch shall be furnished in a Type 1 enclosure unless otherwise noted on drawings ore the Summary chart.

D. Withstand and Closing Ratings
   1. The transfer switch shall be rated to close on and withstand the available RMS symmetrical short circuit current at the transfer switch terminals. Certified independent laboratory test data on a switch of the same design and rating shall be provided to confirm the withstand current tests per Paragraph 25 of UL 1008 for 65,000 amp rms symmetrical at 480vs and an X/R ratio of 6.6 unless otherwise specified on drawings.
   2. The transfer switch shall be UL listed in accordance with UL 1008 and be labeled in accordance with that standard's 1-1/2 and 3 cycle, long-time ratings. Transfer switches which are not tested and labeled with 1-1/2 and 3 cycle (any breaker) ratings and have series, or specific breaker ratings only, are not acceptable.

E. Manual Control. A three-position momentary-type test switch shall be provided for the ***test/automatic/reset*** modes. The test position will simulate a normal source failure. The reset position shall bypass the time delays on either transfer to emergency or retransfer to normal

2.02 ACCEPTABLE MANUFACTURERS

A. The automatic transfer switch(s), overcurrent protective devices, components, and accessories shall be from a single source from single manufacturer Manufacturers subject to compliance with requirements, provide ATS(s), components, and accessories by one of the following:
   1. ASCO.
   2. Eaton Electrical Inc.
   3. Square D (As Applicable).

2.03 TRANSFER SWITCH – CONTACTOR BASED SWITCH

A. General. The contactor based transfer switch shall be an MHEO inherently double throw, mechanically interlocked type which is operated by a solenoid mechanism energized from the source to which the load is to be transferred.
   1. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. Switches rated 600

amps and higher shall have front removable and replaceable contacts. All stationary and moveable contacts shall be replaceable without removing power conductors and/or bus bars.

2. Switching contactors shall be continuous duty, repetitive switching, for transfer between two active power sources.
3. Where neutral conductors are to be solidly connected, a neutral conductor plate with fully rated AL-CU pressure connectors shall be provided.
4. Where the neutral conductor is to be switched, the neutral contact shall be overlapped if required by the manufacturer for the ATS to operate properly.
5. Where specified, the ATS shall be capable of bypassing and isolating the ATS switching contactor to permit its removal for maintenance procedures while maintaining power to the connected ATS equipment loads (from either the normal or emergency source).

2.04 TRANSFER SWITCH – POWER CIRCUIT BREAKER BASED SWITCH

A. The circuit breaker based transfer switch shall be inherently double throw, mechanically interlocked, which is electrically operated by circuit breaker coils and energized from the source to which the load is to be transferred.
   1. The power circuit breakers used for switching shall be draw-out for easy replacement and testing.
   2. The switching power circuit breakers shall be rated for continuous duty and repetitive switching.
   3. Where neutral conductors are to be solidly connected as shown on the plans, a neutral conductor plate with fully rated AL-CU pressure connectors shall be provided.
   4. Where the neutral conductor is to be switched, the neutral pole shall be overlapped if required by the manufacturer for the ATS to operate properly.
   5. Where specified, the ATS shall be capable of bypassing and isolating the ATS switch to permit its removal for maintenance procedures while maintaining power to the connected ATS equipment loads (from the normal source).

2.05 TRANSFER SWITCH CONTROLLER

A. The controller's sensing and logic shall be provided by a single built-in microprocessor with the ability to communicate serially through an optional serial communication module.
   1. The panel shall be capable of operating over a temperature range of -20 to +60°C and storage from -55 to +85°C.
   2. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance. Sensing and control logic shall be provided on multi-layer printed circuit boards. Interfacing relays shall be industrial grade plug-in type with dust covers. The panel shall be enclosed with a protective cover and be mounted separately from the transfer switch unit for safety and ease of maintenance. The protective cover shall include a built-in pocket for storage of the operator's manuals.
   3. All customer connections shall be wired to common, grouped terminal block(s).

B. Controller Display and Keypad. An LCD display and keypad shall be an integral part of the controller for viewing all available data and setting desired operational parameters. Operational parameters shall also be available for viewing and limited control through the communications input port.
   1. Nominal line voltage and frequency
   2. Single or three phase sensing

C. Voltage, Frequency, and Phase Rotation Sensing Controls
   1. Voltage and frequency on both the normal (N) and emergency (E) sources (as noted below) shall be continuously monitored, with the following pickup, dropout, and trip setting capabilities (values shown as % of nominal unless otherwise specified):

Parameter	Sources	Dropout/Trip	Pickup/Reset
Undervoltage	N&E,3ϕ	70 to 98%	85 to 100%

Underfrequency	N&E	85 to 98%	90 to 100%

D. Time Delays
   1. An adjustable time delay of 0 to 10 seconds shall be provided to override momentary normal source outages and delay all transfer and engine starting signals.
   2. A time delay shall be provided on transfer to emergency, adjustable from 0 to 60 minutes, for controlled timing of transfer of loads to emergency.
      a. If specified, provide hardware and field wiring necessary for adequate control and coordination between the planned Project ATS(s) and generator(s) to permit staggered starting of the ATS loads through the provided timers, interlocks, and field wiring.
   3. A time delay shall be provided on re-transfer to normal. The time delay shall be adjustable from 0 to 60 minutes.
   4. If the emergency source fails and the normal source is acceptable the controller can automatically, if not disabled, re-transfer back to the normal source.
   5. A time delay shall be provided on shut down of engine generator for cool down, adjustable from 0 to 60 minutes.
   6. The shedding of loads shall be sequenced through the ATS controller(s) such that the Life Safety loads take precedence over all other loads, through control and communication wiring between multiple ATS controllers.
      a. If specified, provide adequate control capacity and capability to implement the load shedding control operation for the number of ATS units planned in the Project. Provide all controllers, optional control cards, hardware, and field wiring necessary to implement the prescribed sequence of load shedding.

E. The following features shall be built into the controller, but capable of being activated through keypad programming or the communication port only when required by the user:
   1. An In-Phase Monitor shall be provided in the controller.
   2. Engine Start Signal. A set of DPDT gold-flashed contacts rated 10 amps, 32 VDC shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred.
   3. Auxiliary Contacts, rated 10 amps, 250 VAC shall be provided consisting of one contact closed when the transfer switch is connected to the normal source and one contact closed when the transfer switch is connected to the emergency source. Provide available contacts for customer use which show generator and utility source availability.
   4. Engine Exerciser. The controller shall provide an internal engine exerciser for use under load or non-loaded. The user shall be able to enable or disable the exercising routine.
   5. LED Indicating Lights
      a. Green to indicate when the transfer switch is connected to the normal source.
      b. Red to indicate when the transfer switch is connected to the emergency source.
      c. Lights energized by controller outputs. The lights shall provide true source availability of the normal and emergency sources, as determined by the voltage sensing trip and reset settings for each source.
      d. Provide available contacts for customer use that show generator availability.
      e. Provide available contacts for customer use that show utility source availability
   6. Provide remote annunciator for each ATS.
   7. Communications Interface. The ATS controller shall be capable of bidirectional communication through provided communication port(s). The communications to/from the ATS shall permit full access to the configuration parameters, status parameters in order to allow remote monitoring, control, and setup of the ATS from a SCADA, BMS. or BAS system.
      a. Provide Modbus communication port.
      b. Provide Ethernet communication port.

8. Data Logging. The controller shall have the ability to log events and statistical data even in the event of total power loss. The information shall be time and date stamped and maintained in a non-volatile memory.

2.06 TRANSFER SWITCH OVERCURRENT PROTECTIVE DEVICES

A. Comply with UL 489 or UL 1066 as appropriate.

B. Mounting:
   1. Power CB: Drawout or Fixed mounting as noted on schedule.
   2. Molded Case CB: Fixed mounting or as noted on schedule.

C. Compression or mechanical style lugs, suitable for number, size, trip ratings, and conductor materials.

D. Protective device rating minimum default shall be as follows, unless otherwise specified on the drawings, associated notes, and/or schedules.
   1. Circuit Breaker 100% Rated

E. Short Circuit Rating
   1. Full Rating: Protective devices shall be Fully Rated to interrupt symmetrical short-circuit current available at terminals, unless otherwise noted on drawings, associated notes, and/or schedules.

F. Power Circuit Breakers (PCB): PCB type and rating shall be as indicated on the drawings, associated notes, and in the switchboard drawings and/or schedules.
   1. PCB Electronic Trip with LCD Display: Applicable to All PCB
      a. Electronic RMS type sensing equipped with field-replaceable rating plug or field-replicable electronic trip unit. The circuit trip unit shall be equipped with the following adjustable settings that shall be separate independently adjustable values through a LCD display. These circuit breakers shall be provided with (a) network communication capability (Modbus, Ethernet) and (b) concentrators/gateway equipment, wiring and connections ready for a potential future connection to an Ethernet IP based computer or SCADA system. A DC power supply shall be provided to power the circuit breaker LCD displays, any required associated power meter, and the network equipment/wiring. The following trip features shall be provided as noted in the schedule, drawings, and/or associated notes:
         1) Long Time Pickup (LTPU).
         2) Long Time Delay (LTD).
         3) Short Time Pickup (STPU).
         4) Short Time Delay with I^2t In/Out response.
         5) Instantaneous (INST).
         6) Ground-fault Pickup (GFPU).
         7) Ground Fault Delay (GFD) with I^2t In/Out response.
      b. Ground Fault protection only for 480V service equipment/conductors and 480V feeders, unless otherwise noted.
      c. The trip units and/or plugs shall be field changeable.
      d. Provide clear, transparent, tamper cover to prevent unauthorized access or inadvertent changes to the circuit breaker settings. The cover shall be removable and equipped with a loop to fit a wire seal in order to lock the cover in place confirming the integrity of the circuit breaker settings per NEC.
      e. Provide hardware for locking the breaker in the racked out position and the breaker contacts open for lock out tag out safety procedures.
      f. See schedule, drawings, and/or associated notes for required locations where these circuit breakers and the selected features are to be provided

G. Molded Case Circuit Breakers (MCCB): See Drawings and Schedules.
   1. MCCB type and rating shall be as indicated on the drawings, associated notes, and in the switchboard schedules.
   2. MCCB Thermal-Magnetic Trip: 15A to 225A
      a. Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.

b. Additional MCCB Application Listing:
   1) Type SWD for switching fluorescent lighting loads.
   2) Type HID for fluorescent and high-intensity discharge lighting loads.
c. Exception: Where the circuit breaker is within the current range from 45A to 225A and is used as the primary protection for a transformer, and that transformer secondary and/or the connected transformer panelboard main is protected by a MCCB with electronic trip unit, then the primary breaker shall be equipped as MCCB Electronic Trip with LCD display as noted below.

3. MCCB Thermal-Magnetic w/Adjustable Instantaneous Trip: 250A to 350A
   a. Inverse time-current element for low-level overloads and adjustable instantaneous magnetic trip element for short circuits. The magnetic trip element shall be front-mounted, field-adjustable trip setting for short circuits.
   b. Exception: Where the circuit breaker is used as the primary protection for a transformer and that transformer secondary and/or the connected transformer panelboard main is protected by a MCCB with electronic trip unit, then the primary breaker shall be equipped as MCCB Electronic Trip with LCD display as noted below.
   c. The trip units and/or plugs shall be field changeable.
4. MCCB Electronic Trip with LCD Display: 400A and Above
   a. Electronic RMS type sensing equipped with field-replaceable rating plug or field-replicable electronic trip unit. The circuit trip unit shall be equipped with the following adjustable settings that shall be separate independently adjustable values through a LCD display. These circuit breakers are to be provided with (a) network communication capability (Modbus, Ethernet) and (b) concentrators/gateway equipment, wiring and connections ready for a potential future connection to an Ethernet IP based SCADA system. A DC power supply is to be provided to power the circuit breaker LCD displays, any required associated power meter, and the network equipment/wiring. The following trip features are to be provided as noted in the schedule, drawings, and/or associated notes:
      1) Long Time Pickup (LTPU).
      2) Long Time Delay (LTD).
      3) Short Time Pickup (STPU).
      4) Short Time Delay with I^2t In/Out.
      5) Instantaneous (INST).
      6) Ground Fault Pickup (GFPU).
      7) Ground Fault Delay (GFD) with I^2t In/Out.
   b. Ground Fault protection only for 480V service equipment/conductors and 480V feeders, unless otherwise noted.
   c. The trip units and/or plugs shall be field changeable.
   d. Provide clear, transparent, tamper cover to prevent unauthorized access or inadvertent changes to the circuit breaker settings. The cover shall be removable and equipped with a loop to fit a wire seal in order to lock the cover in place confirming the integrity of the circuit breaker settings per NEC.
   e. Provide hardware for locking the breaker contacts open for lock out tag out safety procedures.
   f. See schedule, drawings, and/or associated notes for required locations where these circuit breakers and the selected features are to be provided.
5. MCCB Features/Accessories:
   a. Where required in the drawings, schedules, associated notes, or above, the following features shall be provided as noted:
      1) Instantaneous Override: Provide for all new power circuit and molded case electronic circuit breakers, where available for circuit breakers (a) 1200A and more and (b) on new selected “downstream” breakers as indicated in schedule, drawings, and/or associated notes
      2) Zone Selective Interlocking: Provide for all new circuit breakers (a) 1200A and more and (b) on new selected “downstream” breakers as indicated in schedule, drawings, and/or associated notes.

3) Maintenance Override Switch: Provide for all new circuit breakers 1200A and larger as indicated on schedule, drawings, and/or associated notes. The maintenance override switch shall eliminate any programmed intentional tripping delay. (Note: The maintenance override cannot be provided with ZSI due to space limitations in the circuit breakers).
4) Handle Padlocking Device: Fixed attachment for locking circuit-breaker handle in on or off position.

2.07 TRANSFER SWITCH - CONTROL UTILITY COORDINATION

A. Provide instrumentation, protection relays, timers, and controls as necessary to meet utility interconnect agreement requirements corresponding to switching method selected (i.e., open transition, closed transition, soft transition, limited or extended paralleling, etc.).

PART 3 EXECUTION

3.01 GENERAL INSTALLATION

A. Provide all labor, material, lugs, protective devices, equipment, and components necessary for the installation of a complete and functional generator-ATS system in accordance with applicable federal, state, local building electrical codes, and the manufacturers' recommendations, except where the plan set drawings, associated notes, schedules, and/or specifications are stricter. This work will include any required ATS-generator start/stop control, control power wiring, SCADA status communication wiring for the equipment, including communication wiring between circuit breakers for zone selective interlock control.

B. Provide a Factory Trained and Authorized representative of the ATS manufacturer to advise the Contractor in the proper installation of the ATS and to participate in the inspection and testing of the ATS.

C. Provide a properly trained field service technician to perform the required ATS circuit breaker, control, communication, and infrared testing.

3.02 RECEIVE, INSPECT, STORE

A. Environmental Limitations
1. Do not deliver or install ATS(s) until Project work area spaces are enclosed and weather tight, wet work in spaces is complete and dry, work above panelboard(s) is complete, and temporary or permanent HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Examine ATS(s) before installation. Reject ATS(s) that are moisture or physically damaged.

C. Examine elements and surfaces to receive ATS(s) for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving ATS(s) into place.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

F. Do not interrupt electric service to occupied facilities without notifying and receiving the approval of the Owner. The preparations shall include:
1. Notify Construction Manager, Engineer, Owner, four weeks in advance of proposed interruption of electric service.
2. Allow sufficient time to develop the outage plan, to review and modify outage plan with the Owner, to notify the affected employees/workers, to arrange temporary power if necessary, and to implement outage plan.
3. Do not proceed with any electrical outage without the explicit permission from the Owner or the Owner’s Representative.
4. Arrange to provide temporary electric service according to requirements indicated by the Owner. Indicate method of providing temporary electric service

3.03 INSTALLATION OF ATS

A. Verify layout and clearances as indicated on drawings or provide proposed layout and clearances for the ATS to the Engineer for final approval.

B. Provide proposed mounting height for top of ATS(s) above finished floor to the Engineer for final approval

C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboard(s) with fronts uniformly flush with wall finish and mating with cabinet.

D. Floor Mounted Equipment: Provide concrete base, 4-inch nominal thickness. Comply with requirements for concrete base specified in Section 26 05 29 “Hangers and Supports for Electrical Systems.”
   1. Coordinate size of equipment bases with actual unit sizes provided. Fabricate base 4 inches larger in both directions than the overall dimensions of the supported unit. Chamfer top edge and corners of pad.
   2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
   3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
   4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   5. Install anchor bolts to elevations required for proper attachment of the switchboard(s).

E. Provide mounting and anchoring hardware to meet switchboard loading and potential seismic event requirements to comply with any vibration or seismic control requirements.

F. Temporary Lifting Provisions: Remove any temporary lifting eyes, channels, brackets, blocking, and similar moving part components from switchboard(s).

G. Arrange/route conductors grouped in feeder sets through the switchboard, associated pull sections, top hats, gutters, and wire way(s) in uniform, trained bundles that are supported to the structure with approved wire wraps to prevent uncontrolled movement during a fault

3.04 ADJUSTING AND CLEANING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges. The Engineer shall furnish the circuit breaker settings to the Contractor, and the Contractor shall be responsible for setting and testing the circuit breakers settings.

C. Upon completion of installation of the ATS(s), inspect interiors of ATS(s); clear all blockages and remove burrs, paint splatters and other spots, dirt, and construction debris. Touch up scratches and mars of finish to match original finish

3.05 IDENTIFICATION

A. Consult drawings, schedules, and associated notes for nameplate format, colors, and text content. Where no instructions are provided, consult specification Section 26 05 53 “Identification for Electrical Systems.” and the following general guidelines:
   1. Clean ATS(s) surfaces before applying nameplate(s) and signage.
   2. Label field-installed conductors.
   3. Provide equipment nameplate.
   4. Provide printed basic operating instructions for the ATS, including normal automatic and manual operation, and emergency procedures. Mount on the front of the ATS(s).
   5. Provide oneline placard

3.06 ACCEPTANCE TESTING.

A. Prior to shipment, the transfer switch shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency, and time delay settings are in compliance with the specification requirements.

B. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards, and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.

C. Tests and Inspections
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
   3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning circuit breakers, components, controls, and equipment.
   4. Perform primary current injection tests on all Long Time, Short Time, Instantaneous, and Ground Fault adjustable trip circuit breaker settings.
      a. Test the ground fault operation in accordance with NEC 230.95(C). The Electrical Inspector or Authority Having Jurisdiction (AHJ) may require that he witness the ground fault test or may require a written record of the testing results. The Contractor shall contact and coordinate any ground test with the Electrical Inspector.
      b. Provide proposed testing procedure to verify functionality of circuit breakers supplied with Zone Selective Interlocking.
   5. Perform the following infrared scan tests and inspections and prepare a report.
      a. Perform Infrared Scan after Substantial Completion, but not more than 30 days after Final Acceptance. The infrared scan of the switchboard shall include the circuit breakers, bus, bus connections, and wire connections.
      b. Use calibrated Fluke Ti32 Thermal Imager or equivalent for infrared scanning.

D. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

E. ATS(s) will be considered defective and not acceptable if it does not pass tests, inspections, or corrective measures.

F. Prepare final Field Test and Inspection report(s) that identifies the location, ATS identification number, tests performed, and test results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

3.07 TRAINING

A. The generator and ATS supplier shall furnish training for the operating and maintenance personnel of the Owner in the recommended and proper operation and maintenance of the equipment installed under this Contract. The Contractor shall include the cost of this training in the base price for this Contract. Training shall be both of the classroom type and the on-the-job type, and shall cover all areas of maintenance and operation.

B. The training period may be either concurrent with the system start-up period at the Contractor's option; however, if it is given concurrent to the start-up, then the instructing personnel shall be furnished in addition to the start-up personnel and one shall not interfere with the other.

C. The training period shall last for a period of at least one (1) working day. Scheduling of participation of the Owner's personnel shall be mutually agreed upon between the Contractor and the Project Engineer.

3.08 GUARANTEE (WARRANTY)

Provide Manufacturer's warranty to repair or replace any switchboard, component, or accessory that fails in materials or workmanship within two years from date of Substantial Completion. The Contractor shall have available, within 24 hour notice, a factory-trained engineer or technician to determine and carry out such corrective work as may prove necessary.

END OF SECTION

SECTION 26 51 00
INTERIOR LIGHTING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings, the provisions of the Contract including the General and Supplementary Conditions, and the General Requirements apply to the Work of this Section.

B. The following sections have been specifically referenced in this specification:
   1. Section 26 05 00 Common Work Results for Electrical.

1.02 SCOPE

A. This Section covers basic electrical requirements for providing labor, materials, equipment, and services necessary for the selection and installation of luminaires (fixtures) as shown and specified herein with lamps, supporting devices, and other appurtenances as required for a complete installed and functional unit. This includes:
   1. Interior Lighting Luminaires.
   2. Lighting Fixtures and Components.
   3. LED Systems.
   4. Luminaire Support Components.
   5. Identification.

1.03 DEFINITIONS/ABBREVIATIONS

A. No additional definitions\abbreviations provided.

1.04 SUBMITTALS

A. Bid: Provide the following with the bid documents.
   1. No additional submittals required; see Specification Section 26 05 00.

B. Manufacture: Provide the following prior to release for manufacture and/or purchase.
   1. Substitution Pre-Approvals
      a. Complete Luminaire specification with photometric data.
      b. Substituted luminaires may be required to provide “Point-By-Point” layouts.
      c. Substituted luminaire manufacturers may require additional luminaires
      d. Samples of any proposed luminaire substitutions for examination/approval.
   2. Shop Drawings/Data Sheets shall be submitted for approval for the following equipment (confirm list with Engineer):
      a. Approval for each type of lighting Luminaire (Fixture) arranged in order of fixture designation. Include data on features, accessories, and finishes.
      b. Details of nonstandard or custom luminaires. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.
      c. Luminaire (Fixture) supports.
   3. Samples only as requested.

C. Closeout: Provide the following to complete the project.
   1. Maintenance and warranty data for each type of fixture. Include the following:
      a. Emergency operation, maintenance and warranty data manuals.
      b. Routine maintenance requirements for interior lighting and all installed components.
      c. Manufacturer's written instructions for testing and adjusting emergency / battery backed up lighting
   2. Contractor shall submit Lighting Rebate documentation as required (itemized invoices, fixture cut sheets, proof of demolished fixtures, etc.) to satisfy program requirements
   3. See also Specification Section 26 05 00.

1.05 QUALITY ASSURANCE.

A. Manufacturer: The equipment manufacturer shall be regularly engaged in the manufacture of luminaires, lamps, supports, and accessories of the types and capacities required, and whose products have been in satisfactory use in similar service for not less than ten years.

B. Installer Qualifications: No additional qualifications specified.

C. Codes/Standards: The Products provided by this section shall comply with the latest editions of the following references:
   1. ASHRAE – Noise Criterion Curves
   2. IES – Illuminating Engineering Society
   3. NEMA LE 4 – Recessed Luminaires
   4. UL 924 – Emergency Lighting and Power Equipment
   5. UL 1598 – Luminaires

D. Equipment Quality: Luminaires, lamps, supports, and accessories shall be “Listed” or “Labeled” as defined in NFPA 70, Article 100, by a National Recognized Testing Laboratory acceptable to authorities having jurisdiction, and marked for the intended location and use.

PART 2 PRODUCTS

2.01 GENERAL INFORMATION.

A. All luminaires, lamps, support, accessories, and materials shall be new unless otherwise specified on the plan drawings and associated notes. The type of equipment and/or material shall be approved for its planned use and environment and is so defined by NEMA/NFPA 70 standards and NRTL certifications.

B. Provide quick disconnects for each light luminaires (fixtures) for wiring.

C. Provide Luminaires with lamps for each outlet shown on the Drawings and as specified herein. See Luminaire (Fixture) Schedule on the Drawings.

D. Type, Grade, quality and photometric data of luminaires are indicated on the Luminaire Schedule on the drawings by manufacturers specified Catalog Numbers.

E. The Type Luminaires required are as noted by a capital letter on the Drawings. Contractor shall be solely responsible for the exact quantities. Any outlets not specifically noted on the Drawings shall be equipped with luminaires similar to those in rooms used for like purposes. No extra compensation will be allowed for luminaires for lighting outlets required, but not noted with luminaire type.

2.02 ACCEPTABLE MANUFACTURERS

A. No Manufacturers specified other than those listed in the Luminaire Schedule.
   1. Provide products by one of the manufacturers shown in schedule.
   2. All approved Manufacturers and those Manufacturers seeking approval are subject to compliance with requirements specified herein, on the drawings, and the associated notes,

B. Substitutions. Manufacturers meeting the specified luminaires for type, grade, quality and photometrics may seek approval as an “equal” substitution. This request for approval must be submitted prior to the product submittal for approval of luminaires on the Project.

2.03 LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures. Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Component Access. Accessible and replaceable from below the finished ceiling.

C. Metal Parts. Free of burrs and sharp corners and edges.

D. Sheet Metal Components. Steel unless otherwise indicated. Form and support to prevent warping and sagging.

E. Doors, Frames, and Other Internal Access. Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during maintenance and when secured in operating position.

F. Wire Leads: Minimum 14 AWG.

G. Provide Wire Guard. Heavy-chrome-plated wire guard protects luminaires in locations subjected to physical damage (i.e. gymnasiums, mechanical rooms, etc.) where shown on plans / schedule.

2.04 LED SYSTEMS

A. Provide driver as required for proper operation of fixture:
   1. The Driver's maximum case temperature shall not be exceeded at the maximum operating ambient temperature. Thermal management shall be passive by design.
   2. The use of fans or other mechanical devices is prohibited.

B. Technical requirements:
   1. Fixtures shall be tested and rated per most recent edition of IES LM-79, IES LM-80, and IES TM-21 with rated life of 70,000 hours or greater.
      a. Assume each luminaire will operate at an average operating time of twelve hours per day.
      b. Each luminaire is expected to have a minimal operational life of 120 months (ten years).
   2. The thermal management (of the heat generated by the LEDs) shall be of sufficient capacity to ensure proper operation of the luminaire over the rated life.
      a. The maximum junction temperature for the rated life shall not be exceeded at the average operating ambient.
      b. The maximum junction temperature for the catastrophic failure shall not be exceeded at the maximum operating ambient temperature.
   3. The individual LEDs shall be connected such that a catastrophic loss or the failure of one LED will not result in the loss of the entire luminaire.
   4. Power Factor: The luminaire shall have a power factor of 90% or greater at all standard operating voltages.
   5. THD: Total harmonic distortion (current and voltage) induced into an AC power line by a luminaire shall not exceed 20 percent at any standard input voltage.
   6. Surge Suppression: The luminaire shall include surge protection to withstand high repetition noise and other interference.
      a. The surge protection, which may reside within the driver, shall protect the luminaire from damage and failure for transient voltages and currents as defined in ANSI/IEEE C62.41 for Location Category A Low. Where failure does not mean a momentary loss of light during the transient event.
      b. Surge protection performance shall be tested per the procedures in ANSI/IEEE C62.45 based on ANSI/IEEE C62.41 definitions for standard and optional waveforms for Location Category A-Low.
   7. Operational Performance: The LED circuitry shall prevent perceptible flicker to the unaided eye over the voltage range specified above.
   8. RF Interference: The luminaire and associated on-board circuitry must meet Class A emission limits referred in Federal Communications Commission (FCC) Title 47, Subpart B, Section IS regulations concerning the emission of electronic noise.
   9. Dimming (where indicated): The luminaire shall be capable of continuous dimming without perceivable flicker over a range of 100% to 1% of rated lumen output. Dimming shall be controlled by a 0-10V signal, unless otherwise indicated in the drawings.
   10. Lumen Management (where indicated): The luminaire shall be capable of continuously monitoring system performance to allow for constant lumen management/compensation function.
   11. Whenever available the manufacturer shall provide universal voltage luminaries with a range from 120V to 277V.

2.05 LUMINAIRE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers. 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Twin-Stem Hangers. Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single luminaire. Finish same as luminaire.

D. Wires. ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gauge (2.68 mm).

E. Wires for Humid Spaces. ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gauge (2.68 mm).

F. Air – Craft Cable. Equivalent to a No. 2 (cable of 10-45kg or 22-100lbs) Gripple cable. Cable shall be rated for more weight if shown on plans.

G. Rod Hangers. 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

H. Hook Hangers. Integrated assembly matched to luminaire and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION

A. Provide all equipment, wiring, conduit, and junction boxes required for the installation of a complete and operating system in accordance with applicable local, state, national codes, and the manufacturers' recommendations, except where the plan set drawings, associated notes, schedules, and/or specifications are stricter.

3.02 RECEIVE, INSPECT, AND STORE

A. Receive shipment of luminaires and verify that no damage during shipment and that the correct luminaires were received.

B. Store luminaires in a dry, clean, safe, secure area until ready for installation.

C. Do not install luminaires until the Project work area spaces are enclosed, dry, and free from potential damage due to ongoing major construction work.

3.03 EXAMINATION/COORDINATION

A. Examine conditions for compliance with lighting luminaire (luminaire) and ambient-temperature requirements for each luminaire.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, soffits, ceilings, floors, roofs, and parapets for suitable mounting conditions where luminaire will be installed.

D. Coordinate layout and installation of luminaires and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

3.04 INSTALLATION OF LUMINAIRE ASSEMBLIES AND SUPPORTS

A. Luminaire types are indicated by a capital letter next to the luminaire. Small letters indicate switching patterns and numbers indicate circuit connection. Any luminaires not typed shall be assumed to be the same as adjacent luminaires or luminaires in like areas in the building.

B. Install Luminaires at locations and heights as indicated. Set units plumb, square, and level with ceilings and walls and secure in accordance with luminaire manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", NEMA standards, with recognized industry practices to ensure that lighting luminaires fulfill requirements, and with Shop Drawings. Support luminaires in accordance with requirements of Section 26 05 00, "Common Work Results for Electrical" and Section 26 05 29 “Hangers and Supports for Electrical Systems.”

1. Provide luminaires and/or luminaire outlet boxes with hangers to properly support luminaire weight. Submit design of hangers, method of fastening, other than indicated or specified herein, for review by Owner.

C. Support for Luminaires in or on Grid-Type Suspended Ceilings. Use grid as a support element.

1. Install a minimum of two ceiling support system rods or wires for each luminaire. Locate not more than 6 inches (150 mm) from luminaire corners.
2. Support Clips. Fasten to luminaires and to ceiling grid members at or near each luminaire corner with clips that are UL listed for the application.
3. Luminaires of Sizes Less Than Ceiling Grid. Install as indicated on reflected ceiling plans or center in acoustical panel, and support luminaires independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
4. Install flush mounted luminaires to eliminate light leakage between luminaire frame and finished surface.

D. Support for Flush Luminaires in Plaster / Gypsum – Type Suspended Ceilings. Use ceiling as a support element.
   1. Provide plaster frames for recessed luminaires installed in other than suspended grid type acoustical ceiling systems. Brace frames temporarily to prevent distortion during handling.
   2. Install flush mounted luminaires to eliminate light leakage between luminaire frame and finished surface.

E. Suspended Luminaire Support
   1. Fasten luminaires securely to structural supports and ensure that pendant luminaires are plumb and level. Do not support luminaires from the ceiling system. Provide individually mounted suspended luminaires longer than 2 feet with two points of support. Mount continuous rows of luminaires with an additional hanger support greater than number of luminaires in the row.
   2. Pendants and Rods. Where longer than 48 inches (1200 mm), brace to limit swinging.
   3. Air craft cable. Provide where shown on drawings. Do not support luminaires from the ceiling system. Provide additional air craft cable support where shown. Attach to luminaire per manufacturer's recommendations.

F. Surface Flush mounted Luminaires.
   1. Support surface mounted luminaires greater than 2 feet in length at a point in addition to the outlet box luminaire stud. At surface mounted luminaires mounted over flush mounted junction box, provide opening through luminaire to junction box for wiring access.

G. Install THHN 90°C wire minimum for wiring entering the ballast chamber such as pendant wiring, whips, flexible cords, or through ballast chambers in continuous row luminaires. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors."
   1. Connectors. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torqueing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B, and the National Electrical Code.

H. Provide Guards for luminaires where indicated.

I. Maintain and protect luminaires from damage once installed and until Owner occupies the building

3.05 ACCEPTANCE TESTING

A. Demonstration. Upon completion of installation of luminaires, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements

B. Clean and Inspect each installed luminaire removing dust, dirt, marks, damage or evidence of corrosion and note for replacement. Touch up all scratched painted surfaces with paint ordered from the manufacturer.

C. Emergency/Egress Lighting Tests. Verify normal power operation of each luminaire after luminaires have been installed and circuits have been energized with normal power source. Interrupt electrical energy to demonstrate proper operation of emergency lighting installation. Include the following information in tests of emergency lighting equipment:
   1. Duration of supply.
   2. Low battery voltage shutdown.
   3. Normal transfer to emergency / battery source and retransfer to normal.
   4. Low supply voltage transfer.

D. Illumination Observations. Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.
   1. Verify operation of photoelectric controls.

E. Replace or Repair Malfunctioning luminaires and components that are not operational or are damaged, marked, or corroded and then retest. Repeat procedure until all units operate properly.

F. At Date of Substantial Completion, replace lamps in lighting luminaires which are observed to be noticeably dimmed after Contractor's use and testing, as judged by Owner.

G. Prepare a Written Report of Tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.06 FINAL CLEANING AND CLOSE OUT

A. Clean Luminaires of dirt and construction debris after completion of installation.

B. Clean fingerprints and smudges from lenses. Use methods and materials recommended by manufacturer.

C. Replace Defective and burned out lamps for the warranty period following the Date of Substantial Completion

D. Lighting Rebates: Copy of completed lighting rebate forms, including all back-up information and receipts.

E. Lighting Rebates: Lighting rebate forms to be completed by Owner. Provide all back-up information and receipts as required.

3.07 GUARANTEE (WARRANTY)

Provide warranty to repair or replace any luminaire, lamp, or accessory that fails in materials or workmanship within five years from date of acceptance as issued by the Architect/Engineer's certificate of completion.

A. Special Warranty for Emergency Lighting Batteries. Provide Manufacturer's warranty of battery-powered emergency lighting unit to repair or replace components of rechargeable batteries that fail in materials or workmanship.
   1. Warranty Period for Emergency Lighting Unit Batteries. 10 years from date of Substantial Completion. Full warranty shall apply for three years, and prorated warranty for the remaining seven years.

B. Warranty for Solid State Lighting fixtures: Manufacturers standard form in which manufacturer of Solid State Lighting unit agrees to repair or replace components that fail in materials or workmanship within specified warranty period.
   1. Warranty to include but may not be limited to:
      a. Luminaire finish.
      b. Drivers.
      c. LED Light Engine.
      d. Replacement when more that 10% of LED sources in any light bar or sub assembly is defective or non-starting.
      e. Replacement parts to be easily field serviceable molded connectors, soldering not allowed.
      f. Non-maintained luminance levels on all light sources (LED package/array/module).
      g. Color shift.
   2. Warranty Period for Solid State Lighting fixtures: Five years from date of Substantial Completion.
   3. Provide written copy of manufacturer's warranty with lighting submittals.

END OF SECTION

SECTION 26 56 00
EXTERIOR LIGHTING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings, the provisions of the Contract including the General and Supplementary Conditions, and the General Requirements apply to the Work of this Section.

B. The following sections have been specifically referenced in this specification: Section 26 05 00 “Common Work Results for Electrical.”

1.02 SUMMARY

A. Section Includes:
   1. Exterior luminaires with lamps and ballasts.
   2. Luminaire-mounted photoelectric relays.
   3. Exterior Solid State Lighting Fixtures, LED Light Engines and Drivers.
   4. Poles and accessories.

1.03 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

A. Dead Load. Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4-M.

B. Live Load. Single load of 500 lbf, distributed as stated in AASHTO LTS-4-M.

C. Ice Load. Load of 3 lbf/sq. ft., applied as stated in AASHTO LTS-4-M Ice Load Map.

D. Wind Load. Pressure of wind on pole and luminaire and banners and banner arms, calculated and applied as stated in AASHTO LTS-4-M.

1.04 ACTION SUBMITTALS

A. Product Data. For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, and finishes.

B. Include Data for O&M Manuals.

C. Shop Drawings. Anchor-bolt templates keyed to specific poles and certified by manufacturer.

D. Lighting Rebate
   1. Lighting Rebates. Copy of completed lighting rebate forms, including all backup information and receipts.
   2. Lighting Rebates. Lighting rebate forms shall be completed by the Owner. Provide all backup information and receipts as required.

1.05 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with IEEE C2, "National Electrical Safety Code."

C. Comply with NFPA 70.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Products. Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings.

2.02 GENERAL REQUIREMENTS FOR LUMINAIRES

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
   1. LER Tests Incandescent Fixtures. Where LER is specified, test according to NEMA LE 5A.
   2. LER Tests HID Fixtures. Where LER is specified, test according to NEMA LE 5B.

B. Lateral Light Distribution Patterns. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts. Free of burrs and sharp corners and edges.

D. Sheet Metal Components. Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings. Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access. Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses, designed to disconnect ballast when door opens.

G. Exposed Hardware Material. Stainless steel.

H. Plastic Parts. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields. Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Reflecting Surfaces shall have minimum reflectance as follows unless otherwise indicated:
   1. White Surfaces: 85 percent.
   2. Specular Surfaces: 83 percent.
   3. Diffusing Specular Surfaces: 75 percent.

K. Lenses and Refractors Gaskets. Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. Luminaire Finish. Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

M. Factory-Applied Labels. Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
   1. Label shall include the following lamp and ballast characteristics:
      a. "USES ONLY" and include specific lamp type.
      b. Lamp tube configuration (twin, quad, triple), base type, and nominal wattage for compact fluorescent luminaires.
      c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
      d. Start type (preheat, rapid start, instant start) compact fluorescent luminaires.
      e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
      f. CCT and CRI for all luminaires.

2.03 BALLASTS FOR HID LAMPS

A. Comply with ANSI C82.4 and UL 1029 and capable of open-circuit operation without reduction of average lamp life. Include the following features unless otherwise indicated:
   1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
   2. Minimum Starting Temperature: Minus 22 deg F.
   3. Normal Ambient Operating Temperature: 104 deg F.
   4. Ballast Fuses: One in each ungrounded power supply conductor. Voltage and current ratings as recommended by ballast manufacturer.

B. High-Pressure Sodium Ballasts. Electromagnetic type with solid-state igniter/starter and capable of open-circuit operation without reduction of average lamp life. Igniter/starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg C.

2.04 HID LAMPS

A. Metal-Halide Lamps. ANSI C78.43, with minimum CRI 65, and CCT color temperature 4000 K.

B. Pulse-Start, Metal-Halide Lamps. Minimum CRI 65, and CCT color temperature 4000 K.

C. Ceramic, Pulse-Start, Metal-Halide Lamps. Minimum CRI 80, and CCT color temperature 4000 K.

2.05 DRIVERS FOR LED LIGHT ENGINES

A. General Requirements for Solid State Lighting Power Supplies:
   1. Efficiency per LM-79:
      a. Drivers capable of 50 watts or greater: 85 percent or higher
      b. Drivers capable of less than 50 watts: 80 percent or higher
   2. Power Output: UL Class I or II output.
   3. Rated Driver Life: Shall match Light Engine Rated Life; 50,000 hours minimum.
   4. Rated Ambient Operating Temperature: Minus 22 Deg F (Minus 30 Deg C) and 104 Deg F (40 Deg C).
   5. Operating Frequency: 60 Hz
   6. Power Factor: 0.90 or higher.
   7. Total Harmonic Distortion Rating: Less than 20 percent.
   8. Sound Rating: Class A
   9. Hazardous Substances: RoHS compliant.
   10. Operations: Shall be compatible with standard 0-IOV dimming control circuit and/or standard forward/reverse phase dimming as indicated on drawings.
   11. Transient Voltage Protection: IEEE *C62,4* I. I and IEEE *C62,4* 1.2, Category A or better.
   12. Radio Frequency Interference: Comply with FCC 47 CFR part 15 Class A (commercial).

2.06 LED LIGHT ENGINE (PACKAGE/ARRAY/MODULE)

A. Light Engine shall be rated for operation in ambient temperatures of Minus 22 Deg F (Minus 30 Deg C) and 104 Deg F (40 Deg C).

B. Lumen Output: As indicated on the fixture schedule.

C. LED Binning: Within a 3-step MacAdam ellipse.

D. Rated Light Engine Life: Greater than 70 percent of initial lumens at 50,000 hours, per LM-79 and LM-80 testing.

E. Correlated Color Temperature (CCT): As indicated on the drawings is equivalent to the values indicated below with the following allowances:
   1. 3000K = 3045K +/- 175K
   2. 3500K = 3465K +/- 245K
   3. 4000K = 3985K +/- 275K
   4. 4500K = 4503K +/- 243K
   5. 5000K = 5028K +/- 283K
   6. 5700K = 5665K +/- 355K
   7. 6500K = 6530K +/- 510K

F. Color Rendering Index (CRr): As indicated for the specified CCT:
   1. CCT of3000K to 3500K: Greater than or equal to 80.
   2. CCT of 4000K to 6500K: Greater than or equal to 70.

2.07 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

A. Structural Characteristics. Comply with AASHTO LTS-4-M.
   1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.
   2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

B. Luminaire Attachment Provisions. Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

C. Mountings, Fasteners, and Appurtenances. Corrosion-resistant items compatible with support components.
   1. Materials: Shall not cause galvanic action at contact points.

2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
3. Anchor-Bolt Template: Plywood or steel.

D. Handhole. Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches, with cover secured by stainless-steel captive screws.

E. Concrete Pole Foundations. Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Section 03 30 00 "Cast-in-Place Concrete."

F. Power-Installed Screw Foundations. Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole base flange and strength required to support pole, luminaire, and accessories.

G. Breakaway Supports. Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4-M.

2.08 STEEL POLES

A. Poles. Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig (317 MPa); 1-piece construction up to 40 feet (12 m) in height with access handhole in pole wall.
1. Shape. See drawing for round, square, and/or tapered.
2. Mounting Provisions. Butt flange for bolted mounting on foundation or breakaway support.

B. Steel Mast Arms. Single-arm type, continuously welded to pole attachment plate. Material and finish same as pole.

C. Brackets for Luminaires. Detachable, cantilever, without underbrace.
1. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.
2. Cross Section. Tapered oval, with straight tubular end section to accommodate luminaire.
3. Match pole material and finish.

D. Pole-Top Tenons. Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

E. Grounding and Bonding Lugs. Welded 1/2-inch threaded lug, complying with requirements in Section 26 05 26 “Grounding and Bonding for Electrical Systems,” listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

F. Factory-Painted Finish. Comply with NAAMM’s “Metal Finishes Manual for Architectural and Metal Products” for recommendations for applying and designating finishes. Verify with drawings for finish.
1. Surface Preparation. Clean surfaces to comply with SSPC-SP 1, “Solvent Cleaning,” to remove dirt, oil, grease and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No.1, “White Metal Blast Cleaning,” or SSPC-SP 8, “Pickling.”
2. Interior Surfaces of Pole. One coat of bituminous paint, or otherwise treat for equal corrosion protection.
3. Exterior Surfaces. Manufacturer standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
a. Color. See drawing, as selected by Owner.

2.09 ALUMINUM POLES

A. Poles: Seamless, extruded structural tube complying with ASTM B 429/B 429M, Alloy 6063-T6 with access handhole in pole wall.

B. Poles: ASTM B 209, 5052-H34 marine sheet alloy with access handhole in pole wall.
1. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
a. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

b. Brackets for Luminaires: Detachable, with pole and adapter fittings of cast aluminum. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.
    1) Tapered oval cross section, with straight tubular end section to accommodate luminaire.
    2) Finish: See luminaire schedule.
c. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.

2.10 POLE ACCESSORIES

A. Duplex Receptacle. 120 V, 20 A in a weatherproof assembly complying with Section 26 27 26 "Wiring Devices" for ground-fault circuit-interrupter type.

B. Base Covers. Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

C. DESIGNER NOTE: OPTIONAL Transformer Base: Formed steel transformer base. 18 inches tall. Slotted holes at bottom and top for anchor bolts. Removable door for access to inside transformer base.

D. DESIGNER NOTE: OPTIONAL 3/4” Threaded conduit boss welded to side of pole for security camera mount. 3/4" pvc conduit routed inside pole for security camera LV cable. Height of camera shown on drawings.

E. DESIGNER NOTE: OPTIONAL Curved cover PVC plastic junction box by Carlon E1212C24 or equal, with divider for low voltage components. Curved cover to match curve of concrete forms. Install on north facing side of the concrete foundation. Route separate line voltage and low voltage PVC conduits to the light pole.

2.11 LIGHTING REBATE

A. Closeout Lighting rebates. The Contractor shall submit documentation as required (itemized invoices, fixture cutsheets, proof of demolished fixtures, etc.) to satisfy program requirements.

PART 3 EXECUTION

3.01 LUMINAIRE INSTALLATION

A. Install Lamps in each luminaire.

B. Fasten Luminaire to indicated structural supports.
    1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Adjust Luminaires that require field adjustment or aiming.

3.02 POLE INSTALLATION

A. Alignment. Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Concrete Pole Foundations. Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 03 30 00 "Cast-in-Place Concrete."

C. Foundation-Mounted Poles. Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
    1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
    2. SPEC WRITER NOTES: OPTIONAL Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
    3. Install base covers unless otherwise indicated.
    4. Use a short piece of 1/2-inch-diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

3.03 GROUNDING

A. Ground Metal Poles and support structures according to NEC.
    1. Install grounding electrode for each pole unless otherwise indicated.

2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

3.04 GUARANTEE (WARRANTY)

Provide warranty to repair or replace any luminaire, lamp, or accessory that fails in materials or workmanship within five years from date of acceptance as issued by the Architect/Engineer's certificate of completion.

A. Warranty Period for Emergency Fluorescent Ballast Batteries. 5 years from date of Substantial Completion.

B. Special Warranty for Ballasts. Provide Manufacturer's warranty to repair or replace any ballast that fails in materials or workmanship.
   1. Warranty Period for Electromagnetic Ballasts 3 years.

C. Special Warranty for Solid State Lighting fixtures: Manufacturers standard form in which manufacturer of Solid State Lighting unit agrees to repair or replace components that fail in materials or workmanship within specified warranty period.
   1. Warranty to include but may not be limited to:
      a. Luminaire finish.
      b. Drivers.
      c. LED Light Engine.
      d. Replacement when more that 10% of LED sources in any light bar or sub assembly is defective or non-starting.
      e. Replacement parts to be easily field serviceable molded connectors, soldering not allowed.
      f. Non-maintained luminance levels on all light sources (LED package/array/module).
      g. Color shift.
   2. Warranty Period for Solid State Lighting fixtures: Five years from date of Substantial Completion.
   3. Provide written copy of manufacturer's warranty with lighting submittals.

END OF SECTION

SECTION 27 05 28
PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings and the provisions of the Contract including the General and Supplementary Conditions, and the General Requirements apply to the Work of this Section.

B. The following sections have been specifically referenced in this specification:
   1. Section 26 05 00 Common Work Results for Electrical Systems.
   2. Section 26 05 29 Hangers and Supports for Electrical Systems.
   3. Section 26 05 33 Raceways and Boxes for Electrical Systems.

1.02 SCOPE

A. This Section covers the basic requirements for providing labor, materials, equipment, and services necessary for the selection and installation of pathways for telecommunications systems as shown on the drawings and specified herein. In general, this consists of:
   1. Metal conduits and fittings.
   2. Nonmetallic conduits and fittings.
   3. Optical-fiber-cable pathways and fittings.
   4. Metal wireways and auxiliary gutters.
   5. Surface pathways.
   6. Hooks.
   7. Boxes, enclosures, and cabinets.

1.03 DEFINITIONS/ABBREVIATIONS

A. No additional definitions/abbreviations provided.

1.04 SUBMITTALS

A. Bid: Provide the following with the bid documents.
   1. No additional submittals required; see Specification Section 26 05 00.

B. Manufacture: Provide the following prior to release for manufacture and/or purchase.
   1. Data sheets shall be submitted for approval for the following:
      a. Surface pathways.
      b. Wireways and fittings.
      c. Hooks.
      d. Floor boxes.
      e. Hinged-cover enclosures.
      f. Cabinets.
   2. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.
   3. Coordination Drawings: Pathway routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
      a. Structural members in paths of pathway groups with common supports.
      b. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
   4. No samples requested.
   5. See also Specification Section 26 05 00.

C. Construction: Provide the following during construction.
   1. No additional submittals required; see also Specification Section 26 05 00.

D. Closeout: Provide the following to complete the project.
   1. No additional submittals required; see Specification Section 26 05 00.

1.05 QUALITY ASSURANCE

A. Manufacturer: The equipment manufacturer shall be regularly engaged in the manufacture of raceways, fittings, boxes, and accessories of the types, capabilities, and capacities required, and whose products have been in satisfactory use in similar service for not less than ten years.

B. Installer Qualifications. No additional qualifications specified.

C. Codes/Standards. The products provided by this section shall comply with the following applicable references (latest edition):
   1. ANSI C80.1 – “Rigid Steel Conduit, Zinc Coated”
   2. ANSI C80.3 – “Electrical Metallic Tubing, Zinc Coated”
   3. ANSI C80.5 – “Aluminum Rigid Conduit”
   4. BICSI 568 – “Standard for Installing Commercial Building Telecommunications Cabling”
   5. NECA 1 – “Standard for Good Workmanship in Electrical Construction”
   6. NECA 101 – “Standard for Installing Steel Conduits (Rigid, IMC, EMT)”
   7. NECA 102 – “Standard for Installing Aluminum Rigid Metal Conduit”
   8. ANSI/NEMA FB-1 – “Fittings and Supports for Conduit and Cable Assemblies”
   9. NEMA 250 – “Enclosures for Electrical Equipment (1000V Maximum)”
   10. NEMA OS 1 – “Sheet Steel Outlet Boxes, Device Boxes, Covers and Box Supports”
   11. NEMA TC2 – “Electrical Plastic Tubing and Conduit “
   12. NEMA TC3 – “PVC Fittings for Use with Rigid PVC Conduit and Tubing”
   13. NEMA TC 14 – “Reinforced Thermosetting Resin Conduit (RTRC) and Fittings”
   14. NFPA 70 – “National Electrical Code”
   15. TIA-569-E – “Telecommunications Pathways and Spaces”
   16. UL, Building Materials Directory
   17. UL 5 – “Surface Metal Raceways and Fittings”
   18. UL 467 – “Grounding and Bonding Equipment”
   19. UL 651 – “Schedule 40 and 80 Rigid PVC Conduit”
   20. UL 1773 – “Standard for Termination Boxes”
   21. UL 2024 – “Standard for Cable Routing Assemblies and Communications Raceways”

D. Equipment. Communication system pathways and accessories shall be “Listed” or “Labeled” as defined in NFPA 70, Article 100, by a National Recognized Testing Laboratory acceptable to authorities having jurisdiction, and marked for the intended location and use.

PART 2 PRODUCTS

2.01 GENERAL INFORMATION

A. All raceway, fittings, boxes, accessories, and material shall be new unless otherwise required or specified in the plan set and associated notes. The type of equipment and/or material shall be approved for its planned use and environment and is so defined by NEMA/NFPA 70 standards and NRTL certifications.

2.02 ACCEPTABLE MANUFACTURERS

A. See individual paragraphs for specific manufacturers.

2.03 METAL CONDUITS AND FITTINGS

A. General Requirements for Metal Conduits and Fittings:
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Comply with TIA-569-E.

B. GRC: Comply with ANSI C80.1 and UL 6.

C. ARC: Comply with ANSI C80.5 and UL 6A.

D. EMT: Comply with ANSI C80.3 and UL 797.

E. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
   1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
   2. Fittings for EMT:
      a. Material: Steel.
      b. Type: Compression type.

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.

F. Joint Compound for GRC or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.04 NONMETALLIC CONDUITS AND FITTINGS

A. General Requirements for Nonmetallic Conduits and Fittings:
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Comply with TIA-569-E.

B. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

C. Continuous HDPE: Comply with UL 651A.

D. RTRC: Comply with UL 2515A and NEMA TC 14.

E. Fittings: Comply with NEMA TC 3; match to conduit or tubing type and material.

F. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.05 OPTIC FIBER CABLE PATHWAYS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. MaxCell 3-3 innerduct used inside PVC conduit
   2. Alpha Wire Company.
   3. Carlon Electrical Products.
   4. Dura-Line
   5. Endot Industries Inc.
   6. IPEX.

B. Description: Comply with UL 2024; flexible-type pathway, approved for plenum installation unless otherwise indicated.
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Comply with TIA-569-E.

2.06 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Cooper B-Line
   2. Thomas and Betts
   3. Hoffman
   4. Mono Systems
   5. Square D

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.
   1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Comply with TIA-569-E.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.07 SURFACE PATHWAYS

A. General Requirements for Surface Pathways:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-E.

B. Surface Metal Pathways: 3” wide or 4” wide aluminum with snap-on metal covers complying with UL 5. Manufacturer's standard finish. Metal surface raceway will be used where surface mounted conduit is not allowed.

C. Surface Nonmetallic Pathways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL-94 V-0 requirements for self-extinguishing characteristics. Use of nonmetallic raceway will only be allowed for special circumstances with the engineer’s approval.

2.08 HOOKS

A. Description: Prefabricated sheet metal cable supports for telecommunications cable.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Caddy, nVent
2. Mono Systems
3. Wiremold, Legrand

C. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

D. Comply with TIA-569-E.

E. Galvanized steel.

F. J shape.

G. Hook shall include smooth tapered edges, with a taper radius of at least 4 times the diameter of the cables being installed.

2.09 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following unless noted otherwise:
1. Chatsworth
2. Carlon
3. Cooper Technology
4. Leviton
5. Ericson Electrical Equipment
6. Optical Cable Corporation (OCC)
7. Hoffman
8. O-Z Gedney
9. Hubbell

B. General Requirements for Boxes, Enclosures, and Cabinets:
1. Comply with TIA-569-E.
2. Boxes, enclosures and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet-Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A. Boxes shall be minimum 4 inches square by 2-1/8 inches deep.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

H. Gangable boxes are prohibited.

I. Nonmetallic Outlet and Device Boxes prohibited.

J. Metal Floor Boxes:
   1. Material: sheet metal.
   2. Type: Semi-adjustable with vertically-angled device faceplates inside box, 180-degree cover hinge and knockouts. Minimum 4-gang with wiring separators between line voltage and low voltage power.
   3. Shape: Rectangular.
   4. Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

K. Nonmetallic Floor Boxes: Nonadjustable, rectangular.
   1. Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

L. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, type as identified on drawings or Type 1 indoors or Type 4X outdoor with continuous-hinge cover with flush latch unless otherwise indicated. Provide lockable hasp.
   1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
   2. Nonmetallic Enclosures: Plastic or fiberglass.
   3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

M. Cabinets:
   1. NEMA 250 type as identified on drawings or Type 1 indoors or Type 3R outdoor, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
   2. Hinged door in front cover with flush latch and concealed hinge.
   3. Key latch to match panelboards.
   4. Metal barriers to separate wiring of different systems and voltage.
   5. Accessory feet where required for freestanding equipment.
   6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 EXECUTION

3.01 GENERAL INFORMATION

A. Provide all labor and ground rods, conductors, copper, and associated materials required for the installation of a complete and operating ground system in accordance with applicable local, state, national codes, and the manufacturers' recommendations, except where the plan set drawings, associated notes, schedules, and/or specifications are stricter.

3.02 PATHWAY APPLICATION

A. Outdoors: Apply pathway products as specified below unless otherwise indicated:
   1. Exposed Conduit: GRC.
   2. Concealed Conduit, Aboveground: EMT.
   3. Underground Conduit: RNC direct buried.
   4. Boxes and Enclosures, Aboveground: NEMA 250, Type 4.
   5. Back boxes for card readers to be recessed flush with the surface of the masonry wall. Conduit to be run concealed in the masonry wall up to a height of 10’-0” above the finished floor.
   6. Cabling for Card readers installed at aluminum framed doors to be concealed in the window mullion.

B. Indoors: Apply pathway products as specified below unless otherwise indicated:
   1. Exposed, Not Subject to Physical Damage: Cable tray.
   2. Exposed, Not Subject to Severe Physical Damage: EMT.
   3. Exposed and Subject to Severe Physical Damage: GRC.
   4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
   5. Damp or Wet Locations: GRC.
   6. Pathways for Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical-fiber-cable pathway, Plenum-type, communications-cable pathway - EMT.

7. Pathways for Communications-Cable Risers in Vertical Shafts: Riser-type, optical-fiber-cable pathway.
8. Boxes and Enclosures: NEMA 250 Type 1, except use NEMA 250 Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Pathway Size: 1-1/4-inch trade size. Minimum size for optical-fiber cables is 1-1/2 inch.

D. Pathway Fittings: Compatible with pathways and suitable for use and location.
1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface pathways only where indicated on Drawings.

G. Install J hooks for branch runs of cabling from cable tray above accessible ceilings.

H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.03 INSTALLATION

A. Comply with NECA 1, NECA 101, BICSI 568, and TIA-569-E for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.

B. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.

C. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.

D. Arrange stub-ups so curved portions of bends are not visible above finished slab.

E. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all optical-fiber cables.

F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

G. Pathways Embedded in Slabs:
1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot intervals.
2. Arrange pathways to cross building expansion joints at right angles with expansion fittings.
3. Arrange pathways to keep a minimum of 2 inches of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.

H. Stub-ups to Above Recessed Ceilings:
1. Use EMT, IMC, or RMC for pathways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

I. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.

J. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.

K. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

L. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

M. Install pull string in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.

N. Surface Pathways:
   1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.
   2. Install surface pathway with a minimum 2-inch radius control at bend points.
   3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

O. Pathways for Optical-Fiber and Communications Cable: Install pathways as follows:
   1. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements.

P. Install devices to seal pathway interiors at accessible locations. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound.

Q. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
   2. Where an underground service pathway enters a building or structure.
   3. Where otherwise required by NFPA 70.

R. Expansion-Joint Fittings:
   1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
   2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
   3. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
   4. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

S. Hooks:
   1. Size to allow a minimum of 25 percent future capacity without exceeding design capacity limits.
   2. Shall be supported by dedicated support wires. Do not use ceiling grid support wire or support rods.
   3. Hook spacing shall allow no more than 6 inches of slack. The lowest point of the cables shall be no less than 6 inches adjacent to ceilings, mechanical ductwork and fittings, luminaires, power conduits, power and telecommunications outlets, and other electrical and communications equipment.
   4. Space hooks no more than 5 feet o.c.
   5. Provide a hook at each change in direction.

T. Mount boxes at heights indicated on Drawings in accordance with ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

U. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

V. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

W. Provide two-gang cover plates on all wall outlet boxes.

X. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

Y. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

Z. Set metal floor boxes level and flush with finished floor surface.

AA. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

BB. Proposed installation procedures shall be submitted to Engineer for approval.

3.04 PENETRATIONS.

A. Where raceways pass through fire partitions, fire walls, or smoke partitions, install a fire stop that provides an effective barrier against the spread of fire, smoke, and gasses with rock wool fiber or silicone foam sealant only. Each such penetration shall be separated from all others by 2-inch clear (not center-to-center) minimum. Completely fill and seal clearances between raceways and openings with the fire-stop material. Penetrations shall meet the requirements of UL 1479.

3.05 INSTALLATION OF SLEEVES

A. Coordinate sleeve locations.
   1. Where raceways pass through floors, floors shall be core drilled and appropriately sized sleeves shall be installed. Sleeves shall terminate not less than 3 inches above floor slabs and not less than 3 inches below the ceiling of the floor below. Completely seal clearances between the raceway and sleeve, and make watertight. Low-voltage sleeves shall be brushed.
   2. Schedule 40 pipe sleeves shall have at least three (3) concrete anchors.
   3. Set all sleeves true to line, grade and position and plumb or level after concrete is poured. Correct any deviation from proper position.
   4. Provide galvanized steel tube sleeve 1-1/2 inches larger than O.D. of conduit. Sleeve shall have wall thickness of 0.061 inches.
   5. Engineer shall approve below grade conduit seal method. Where conduits pass through exterior concrete walls below grade, provide “Link-Seal” or caulk both sides with oakum and lead wool or otherwise adequately waterproof the openings around the conduit.
   6. Caulk spaces between pipe and floor sleeves inside the building with a waterproof caulking material. Spaces between pipe and exterior partition sleeves shall be caulked with fiber glass insulation.
   7. Seal space outside of sleeves with grout for penetrations of concrete and masonry
   8. Roof-Penetration Sleeves. Seal penetration of individual raceways with flexible boot-type flashing units applied in coordination with roofing work.
   9. Aboveground, Exterior-Wall Penetrations. Seal penetrations using pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
   10. Underground, Exterior-Wall Penetrations. Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.06 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with firestopping requirements in Section 26 05 33 “Raceways and Boxes for Electrical Systems”.

3.07 PROTECTION/CLEANING

A. Upon completion of installation of raceways, inspect interiors of raceways; clear all blockages and remove burrs, dirt, and construction debris.

B. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion. Remove all construction debris.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.08 GUARANTEE (WARRANTY).

A. No additional material and/or labor warranty beyond that specified in Section 26 05 00 “Common Work Results for Electrical.”

END OF SECTION

SECTION 27 05 36
CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings, the provisions of the Contract including the General and Supplementary Conditions, and the General Requirements apply to the Work of this Section.

B. The following sections have been specifically referenced in this specification.
   1. Section 26 05 00 Common Work Results for Electrical.
   2. Section 26 05 53 Identification for Electrical systems.
   3. Section 26 05 90 Hangers and Supports for Electrical Systems.
   4. Section 26 05 26 Grounding and Bonding for Electrical systems.

1.02 SCOPE

A. This Section covers the basic requirements for providing labor, materials, equipment, and services necessary for the selection and installation of cable trays as shown on the drawings and specified herein. In general, this consists of:
   1. Ladder cable trays.
   2. Wire-basket cable trays.

1.03 DEFINITIONS/ABBREVIATIONS

A. No additional definitions/abbreviations provided.

1.04 SUBMITTALS

A. Bid: Provide the following with the bid documents.
   1. No additional submittals required; see Specification Section 26 05 00.

B. Manufacture: Provide the following prior to release for manufacture and/or purchase.
   1. Shop Drawings/Data Sheets shall be submitted for approval for the following equipment (confirm list with Engineer):
      a. Data sheets for each type of product.
      b. Shop drawings for each type of cable tray.
   2. Coordination Drawings. Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved.
      a. Structural members in paths of conduit groups with common supports.
      b. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
   3. No samples required.
   4. See also Specification Section 26 05 00.

C. Construction: Provide the following during construction.
   1. Field quality-control reports.
   2. See Specification Section 26 05 00.

D. Closeout: Provide the following to complete the project.
   1. No additional submittals required; see Specification Section 26 05 00.

1.05 QUALITY ASSURANCE

A. Manufacturer: The equipment manufacturer shall be regularly engaged in the manufacture of cable trays, fittings, and accessories of the types, capabilities, and capacities required, and whose products have been in satisfactory use in similar service for not less than ten years.

B. Installer Qualifications: No additional qualifications specified.

C. Codes/Standards. The products provided by this section shall comply with the following applicable references (latest edition):
   1. NEMA VE 1 – “Metal Cable Tray Systems”
   2. NEMA VE 2 – “Cable Tray Installation Guidelines”
   3. NFPA 70 – “National Electrical Code”

D. Equipment. Cable trays and accessories shall be “Listed” or “Labeled” as defined in NFPA 70, Article 100, by a National Recognized Testing Laboratory acceptable to authorities having jurisdiction, and marked for the intended location and use.

PART 2 PRODUCTS

2.01 GENERAL INFORMATION

A. Sizes and Configurations: See the Drawings for specific requirements for types, materials, sizes, and configurations.

B. Structural Performance: See articles on individual cable tray types for specific values for uniform load distribution, concentrated load, and load and safety factor parameters.

2.02 ACCEPTABLE MANUFACTURERS

A. None specified.

2.03 LADDER CABLE TRAYS

A. Description:
   1. Configuration: Two I-beam side rails with transverse rungs welded to side rails.
   2. Rung Spacing: 9 inches o.c.
   3. Radius-Fitting Rung Spacing: 9 inches at center of tray's width.
   4. Minimum Cable-Bearing Surface for Rungs: 7/8-inch width with radius edges.
   5. No portion of the rungs shall protrude below the bottom plane of side rails.
   6. Structural Performance of Each Rung: Capable of supporting a maximum cable load, with a safety factor of 1.5, plus a 200-lb concentrated load, when tested according to NEMA VE 1.
   7. Minimum Usable Load Depth: 4 inches.
   8. Straight Section Lengths: 10 feet except where shorter lengths are required to facilitate tray assembly.
   9. Width: 12 inches unless otherwise indicated on Drawings.
   10. Fitting Minimum Radius: 24 inches.
   11. Class Designation: Comply with NEMA VE 1, Class 12B.
   12. Splicing Assemblies: Bolted type using serrated flange locknuts.
   13. Hardware and Fasteners: Steel, zinc plated according to ASTM B 633.
   14. Splice Plate Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.

2.04 WIRE-BASKET CABLE TRAYS

A. Description:
   1. Configuration: Wires are formed into a standard 2-by-4-inch wire mesh pattern with intersecting wires welded together. Mesh sections must have at least one bottom longitudinal wire along entire length of section.
   2. Materials: High-strength-steel longitudinal wires with no bends.
   3. Safety Provisions: Wire ends along wire-basket sides (flanges) rounded during manufacturing to maintain integrity of cables and installer safety.
   4. Sizes:
      a. Straight sections shall be furnished in standard 118-inch lengths.
      b. Wire-Basket Depth: 4-inch usable loading depth by 18 inches wide or as noted on the drawings.
   5. Connector Assemblies: Bolt welded to plate shaped to fit around adjoining tray wires and mating plate. Mechanically joins adjacent tray wires to splice sections together or to create horizontal fittings.
   6. Connector Assembly Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.
   7. Hardware and Fasteners: Steel, zinc plated according to ASTM B 633.

2.05 MATERIALS AND FINISHES

A. Steel:
   1. Straight Section and Fitting Side Rails and Rungs: Steel complies with the minimum mechanical properties of ASTM A 1008/A 1008M, Grade 33, Type 2.

2. Steel Tray Splice Plates: ASTM A 1011/A 1011M, HSLAS, Grade 50, Class 1.
3. Fasteners: Steel complies with the minimum mechanical properties of ASTM A 510/A 510M, Grade 1008.
4. Finish: Black oxide finish for support accessories and miscellaneous hardware according to ASTM D 769.

2.06 CABLE TRAY ACCESSORIES

A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.

B. Barrier Strips: Same materials and finishes as for cable tray.

C. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

2.07 WARNING SIGNS

A. Lettering: 1-1/2-inch- high, black letters on yellow background with legend "Warning! Not To Be Used as Walkway, Ladder, or Support for Ladders or Personnel."

B. Comply with requirements for fasteners in Section 26 05 53 "Identification for Electrical Systems."

2.08 SOURCE QUALITY CONTROL

A. Testing: Test and inspect cable trays according to NEMA VE 1.

PART 3 EXECUTION

3.01 GENERAL INFORMATION

A. Provide all labor and trays, splices, supports, grounding, and associated materials required for the installation of a complete and operating cable tray system in accordance with applicable local, state, national codes, and the manufacturers' recommendations, except where the plan set drawings, associated notes, schedules, and/or specifications are stricter.

3.02 CABLE TRAY INSTALLATION

A. Install cable trays according to NEMA VE 2.

B. Install cable trays as a complete system, including fasteners, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, covers, and bonding.

C. Fasten cable tray supports to building structure.

D. Design fasteners and supports to carry cable tray, the cables, and a concentrated load of 200 lb. Comply with requirements in Section 26 05 90 "Hangers and Supports for Electrical Systems."

E. Support wire-basket cable trays with trapeze hangers or wall brackets.

F. Support trapeze hangers for wire-basket trays with 3/8-inch- diameter rods.

G. Make connections to equipment with flanged fittings fastened to cable trays and to equipment. Support cable trays independent of fittings. Do not carry weight of cable trays on equipment enclosure.

H. Install expansion connectors where cable trays cross building expansion joints and in cable tray runs that exceed dimensions recommended in NEMA VE 2. Space connectors and set gaps according to applicable standard.

I. Seal penetrations through fire and smoke barriers.

J. Install capped metal sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.

K. Install barriers to separate cables of different systems, such as power, communications, and data processing; or of different insulation levels, such as 600, 5000, and 15 000 V.

L. Install permanent covers, if used, after installing cable. Install cover clamps according to NEMA VE 2.

M. Install warning signs in visible locations on or near cable trays after cable tray installation.

3.03 CABLE TRAY GROUNDING

A. Ground cable trays according to NFPA 70 unless additional grounding is specified. Comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems."

B. Cable trays with communications cable shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.

C. Cable trays with control conductors shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.

D. Bond cable trays to power source for cables contained within with bonding conductors sized according to NFPA 70, Article 250.122, "Size of Equipment Grounding Conductors."

3.04 CABLE INSTALLATION

A. Install cables only when each cable tray run has been completed and inspected.

B. Fasten cables on horizontal runs with cable clamps or cable ties according to NEMA VE 2. Tighten clamps only enough to secure the cable, without indenting the cable jacket.

C. Fasten cables on vertical runs to cable trays every 18 inches.

D. Fasten and support cables that pass from one cable tray to another or drop from cable trays to equipment enclosures. Fasten cables to the cable tray at the point of exit and support cables independent of the enclosure. The cable length between cable trays or between cable tray and enclosure shall be no more than 72 inches.

E. In existing construction, remove inactive or dead cables from cable trays.

3.05 CONNECTIONS

A. Connect raceways to cable trays according to requirements in NEMA VE 2.

3.06 ACCEPTANCE TESTING

A. Perform the following tests and inspections:
   1. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements.
   2. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable trays, vibrations, and thermal expansion and contraction conditions, which may cause or have caused damage.
   3. Verify that the number, size, and voltage of cables in cable trays do not exceed that permitted by NFPA 70. Verify that communications or data-processing circuits are separated from power circuits by barriers or are installed in separate cable trays.
   4. Verify that there are no intruding items such as pipes, hangers, or other equipment in the cable tray.
   5. Remove dust deposits, industrial process materials, trash of any description, and any blockage of tray ventilation.
   6. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.
   7. Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
   8. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable trays. Test entire cable tray system for continuity. Maximum allowable resistance is 1 ohm.

B. Prepare test and inspection reports.

3.07 GUARANTEE (WARRANTY)

A. No additional material and/or labor warranty beyond that specified in Section 26 05 00 “Common Work Results for Electrical.”

END OF SECTION

SECTION 27 11 16
COMMUNICATIONS RACKS, FRAMES, AND ENCLOSURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings, the provisions of the Contract including the General and Supplementary Conditions, and the General Requirements apply to the Work of this Section.

B. The following sections have been specifically referenced in this specification:
   1. Section 26 05 00 Common Work Results for Electrical.
   2. Section 26 05 26 Grounding and Bonding for Electrical Systems.
   3. Section 26 05 53 Identification for Electrical Systems.

1.02 SCOPE

A. This Section covers communication systems equipment, including racks, frames and enclosures as shown on the drawings and specified herein. In general, this consists of:
   1. 19-inch equipment racks.
   2. 19-inch freestanding and wall-mounted equipment cabinets.
   3. Backboards.
   4. Power strips.
   5. Grounding.
   6. Labeling.

1.03 DEFINITIONS/ABBREVIATIONS

A. Access Provider: An operator that provides a circuit path or facility between the service provider and user. An access provider can also be a service provider.

B. Service Provider: The operator of a telecommunications transmission service delivered through access provider facilities.

1.04 SUBMITTALS

A. Bid: Provide the following with the bid documents.
   1. No additional submittals required; see Specification Section 26 05 00.

B. Manufacture: Provide the following prior to release for manufacture and/or purchase.
   1. Data sheets shall be submitted for approval for the following equipment:
      a. Equipment racks.
      b. Equipment cabinets.
      c. Power Strips.
   2. Shop Drawings: For communications racks, frames, and enclosures. Include plans, elevations, sections, details, and attachments to other work.
      a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
      b. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
      c. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall-mounting brackets.
   3. No samples requested.
   4. See also Specification Section 26 05 00.

C. Construction: Provide the following during construction.
   1. No additional submittals required; see Specification Section 26 05 00.

D. Closeout: Provide the following to complete the project.
   1. No additional submittals required; see Specification Section 26 05 00.

1.05 QUALITY ASSURANCE

A. Manufacturer. The equipment manufacturer shall be regularly engaged in the manufacture of communications racks, cabinets and equipment, and accessories of the types, capabilities, and

capacities required, and whose products have been in satisfactory use in similar service for not less than ten years.

B. Installer Qualifications. Equipment installer must have personnel certified by BICSI on staff.
   1. Layout Responsibility: Preparation of Shop Drawings shall be under direct supervision of an RCDD.
   2. Installation Supervision: Installation shall be under the direct supervision of a Level 2, Copper or Fiber Installer, who shall be present at all times when Work of this Section is performed at Project site.
   3. Field Inspector: Currently registered by BICSI as RCDD to perform on-site inspection.

C. Codes/Standards. The products provided by this section shall comply with the following applicable references (latest edition):
   1. EIA/ECIA 310-E – “Cabinets, Racks, Panels, and Associated Equipment”
   2. BICSI 607 – “Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings”
   3. NECA 1 – “Standard for Good Workmanship in Electrical Construction”
   4. NFPA 70 – “National Electrical Code”
   5. TIA-606-C – “Administration Standard for Telecommunications Infrastructure”
   6. TIA-607-D – “Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises”
   7. UL 467 – “Grounding and Bonding Equipment”
   8. UL 969 – “Standard for Marking and Labeling Systems”
   9. UL 1363 – “Standard for Relocatable Power Taps”
   10. UL 1449 – “Standard for Surge Protective Devices”

D. Equipment. Communications racks, enclosures, equipment, and accessories shall be “Listed” or “Labeled” as defined in NFPA 70, Article 100, by a National Recognized Testing Laboratory acceptable to authorities having jurisdiction, and marked for the intended location and use.

PART 2 PRODUCTS

2.01 GENERAL INFORMATION

A. All equipment and material shall be new unless otherwise required or specified in the plan set and associated notes. The type of equipment and/or material shall be approved for its planned use and environment and is so defined by NEMA/NFPA 70 standards and NRTL certifications.

B. Equipment shall be compliant with requirements of the Payment Card Industry Data Security Standard.

2.02 ACCEPTABLE MANUFACTURERS

A. Chatsworth.

B. Eaton.

C. Panduit.

2.03 19-INCH EQUIPMENT RACKS

A. Description: Two-post floor-mounted racks with threaded rails designed for mounting telecommunications equipment. Width is compatible with EIA/ECIA 310-E, 19-inch equipment mounting with an opening of 17.72-inches between rails.

B. Frames: Modular units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.

C. Finish: Manufacturer’s standard, baked-polyester powder coat.

D. Color: Black.

E. Overall Height: 84 inches

F. Overall Depth: 20 inches.

G. Upright Depth: 3 inches.

H. Load Rating: 1500 lbs.

I. Number of Rack Units per Rack: 45. Number every 5 rack units on interior of rack.

J. Threaded #12-24 equipment mounting holes.

K. Vertical and horizontal cable management channels, top and bottom cable troughs, integrated grounding, and a power strip.

L. Base shall have a minimum of four mounting holes for permanent attachment to floor.

M. Top shall have provisions for attaching to cable tray or ceiling.

N. Self-leveling.

O. Cable Management:
   1. Metal, with integral wire retaining fingers.
   2. Baked-polyester powder coat finish.
   3. Vertical cable management panels shall have front and rear channels, with covers.
   4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

2.04 19-INCH EQUIPMENT CABINETS

A. Description: Manufacturer-assembled four-post frame enclosed by side and top panels and front and rear doors, designed for mounting telecommunications equipment. Width is compatible with EIA/ECIA 310-E, 19-inch equipment mounting with an opening of 17.72 inches between rails.

B. General Cabinet Requirements:
   1. Modular units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
   2. Finish: Manufacturer's standard, baked-polyester powder coat.
   3. Color: Black.

C. Modular Freestanding Cabinets:
   1. Overall Height: 84 inches.
   2. Overall Depth: 42 inches.
   3. Overall Width: 32 inches.
   4. Load Rating: 3000 lbs.
   5. Number of Rack Units: 45. Number every five rack units, on interior of rack.
   6. Threaded #12-24 equipment mounting holes.
   7. Removable and lockable side and top panels.
   8. Hinged and lockable front and rear doors. Front door shall be single perforated metal. Rear doors shall be double perforated metal.
   9. Adjustable feet for leveling.
   10. Screened ventilation openings in roof and rear door.
   11. Cable access provisions in roof and base.
   12. Integrated grounding.
   13. Roof-mounted, 550-cfm fan with filter.
   14. Power strip.
   15. All cabinets shall be keyed alike.

D. Modular Wall Cabinets:
   1. Height: 25 inches.
   2. Depth: 23 inches.
   3. Width: 23 inches.
   4. Load Rating: 130 lbs.
   5. Number of Rack Units: 12.
   6. Threaded #12-24 equipment mounting holes.
   7. Lockable solid front door.
   8. Louvered side panels.
   9. Cable access provisions on top and bottom.
   10. Integrated grounding.
   11. Roof-mounted, 250-cfm fan with filter.
   12. Power strip.
   13. All cabinets keyed alike.

E. Cable Management:
   1. Metal, with integral wire retaining fingers.
   2. Baked-polyester powder coat finish.
   3. Vertical cable management panels shall have front and rear channels, with covers.
   4. Provide horizontal crossover cable manager at top of each relay rack, with a minimum height of two rack units each.

2.05 BACKBOARDS

A. Plywood, fire-retardant treated, ¾ by 48 by 96 inches.

B. Pre-painted with light-colored fire-retardant paint.

2.06 POWER STRIPS

A. Comply with UL 1363.

B. Rack mounting, with detachable flanges.

C. Height: 1RU.

D. Housing: Metal.

E. Six 20-A, 120-VAC, NEMA WD 6, Configuration 5-20R receptacles.

F. Rear-facing receptacles.

G. LED indicator lights for power and protection status.

H. LED indicator lights for reverse polarity and open outlet ground.

I. Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and cannot be reset.

J. Cord connected with 10-foot line cord.

K. Rocker-type on-off switch, illuminated when in on position.

L. Surge Protection: UL 1449, Type 3.
   1. Maximum Surge Current, Line to Neutral: 72 kA.
   2. Protection modes shall be line to neutral, line to ground, and neutral to ground.
   3. UL 1449 Voltage Protection Rating for line to neutral and line to ground shall be 600V and 500V for neutral to ground.

2.07 GROUNDING

A. Comply with requirements in Section 26 05 26 “Grounding and Bonding for Electrical Systems” for grounding conductors and connectors.

B. Rack and Cabinet ground bars: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with TIA-607-D. Predrilling shall be with holes for use with lugs specified in this Section.
   1. Cabinet-Mounted ground bar: Terminal block, with stainless-steel or copper-plated hardware for attachment to cabinet.
   2. Rack-mounted Horizontal ground bar: Designed for mounting in 19-inch equipment racks. Include a copper splice bar for transitioning to an adjoining rack, and stainless-steel or copper-plated hardware for attachment to rack.
   3. Rack-mounted Vertical ground bar: 72 inches long, with stainless-steel or copper-plated hardware for attachment to rack.

2.08 LABELING

A. Comply with TIA-606-C and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers. Comply with requirements in Section 26 05 53 “Identification for Electrical Systems” for labeling requirements.

PART 3 EXECUTION

3.01 GENERAL INFORMATION

A. Provide all labor and racks, cabinets, enclosures, and associated materials required for the installation of a complete and operating system in accordance with applicable local, state,

national codes, and the manufacturers' recommendations, except where the plan set drawings, associated notes, schedules, and/or specifications are stricter

3.02 INSTALLATION

A. Comply with NECA 1.

B. Comply with BICSI's "Telecommunications Distribution Methods Manual" for layout of communications equipment spaces.

C. Comply with BICSI's "Information Technology Systems Installation Methods Manual" for installation of equipment in communications equipment spaces.

D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

E. Coordinate layout and installation of communications equipment in racks and room. Coordinate service entrance configuration with service provider.
   1. Meet jointly with system providers, equipment suppliers, and Owner to exchange information and agree on details of equipment configurations and installation interfaces.
   2. Record agreements reached in meetings and distribute them to other participants.
   3. Adjust configurations and locations of distribution frames, cross-connects, and patch panels in equipment spaces to accommodate and optimize configuration and space requirements of telecommunications equipment.
   4. Adjust configurations and locations of equipment of cabling systems of other communications, electronic safety and security, and related systems that share space in equipment room.

F. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

G. Backboards:
   1. Install from 6 inches to 8 feet, 6 inches above finished floor. If plywood is fire rated, ensure that fire-rating stamp is visible after installation.
   2. Paint all sides of backboard with two coats of paint**,** leaving fire rating stamp visible.
   3. Comply with requirements for backboard installation in BICSI's "Information Technology Systems Installation Methods Manual" and TIA-569-E.

3.03 GROUNDING

A. Comply with NECA/BICSI 607.

B. Install grounding according to BICSI ITSIMM, "Bonding, Grounding (Earthing) and Electrical Protection" Ch.

C. Locate ground bar to minimize length of bonding conductors. Fasten to wall, allowing at least 2 inches of clearance behind ground bar. Connect ground bar with a minimum No. 4 AWG grounding electrode conductor from ground bar to suitable electrical building ground. Connect rack ground bar to near telecommunications ground bar or the telecommunications main ground bar.

3.04 IDENTIFICATION

A. Coordinate system components, wiring, and cabling complying with TIA-606-C. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."

B. Paint and label colors for equipment identification shall comply with TIA-606-C for Class 2 level of administration.

3.05 FINAL CLEANING AND RESTORATIONS

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion. Remove all construction debris.
   1. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.06 GUARANTEE (WARRANTY)

A. No additional material and/or labor warranty beyond that specified in Section 26 05 00 “Common Work Results for Electrical.”

END OF SECTION

SECTION 27 13 00

COMMUNICATIONS BACKBONE CABLING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings, the provisions of the Contract including the General and Supplementary Conditions, and the General Requirements apply to the Work of this Section.

B. The following sections have been specifically referenced in this specification:
   1. Section 26 05 00 Common Work Results for Electrical.
   2. Section 26 05 26 Grounding and Bonding for Electrical Systems.
   3. Section 26 05 53 Identification for Electrical Systems.
   4. Section 27 05 28 Pathways for Communications Systems.

1.02 SCOPE

A. This Section covers basic requirements for providing labor, materials, equipment and services necessary for the selection and installation of an inside plan communications backbone cabling system as shown on the drawings and specified herein. In general, this consists of:
   1. Copper Backbone Cabling.
   2. Twisted pair cable hardware.
   3. Optical Fiber Backbone Cabling.
   4. Innerduct.
   5. Optical fiber cable connecting hardware.
   6. Grounding.
   7. Cabling identification products.

1.03 DEFINITIONS/ABBREVIATIONS

A. No additional definitions/abbreviations provided.

1.04 SUBMITTALS

A. Bid: Provide the following with the bid documents.
   1. No additional submittals required; see Specification Section 26 05 00.

B. Manufacture: Provide the following prior to release for manufacture and/or purchase.
   1. Data sheets for each type of product to be used.
   2. Shop Drawings: Reviewed and stamped by RCDD.
      a. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
      b. Cabling administration Drawings and printouts.
   3. Source quality-control reports.
   4. Cable testing plan.
   5. No samples requested.
   6. See also Specification Section 26 05 00.

C. Construction: Provide the following during construction.
   1. Test reports.
   2. See also Specification Section 26 05 00.

D. Closeout: Provide the following to complete the project.
   1. No additional submittals required; see Specification Section 26 05 00.

1.05 QUALITY ASSURANCE

A. Manufacturer. The equipment manufacturer shall be regularly engaged in the manufacture of copper structured cabling, fiber optic cabling, and accessories of the types, capabilities, and capacities required, and whose products have been in satisfactory use in similar service for not less than ten years.

B. Installer Qualifications. Cabling Installer must have personnel certified by BICSI on staff.
   1. Layout Responsibility: Preparation of Shop Drawings, and field testing program development by an RCDD.

2. Installation Supervision: Installation shall be under the direction supervision of a Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.

C. Codes/Standards. The products provided by this section shall comply with the following applicable references (latest edition):
1. ASTM E84 – “Standard Test Method for Surface Burning Characteristics of Building Materials”
2. ICEA S-103-701 – “Riser Cables Technical Requirements”
3. ICEA S-83-596 – “Indoor Optical Fiber Cable”
4. ICEA S-104-696 – Indoor-Outdoor Optical Fiber Cable”
5. NECA 1 – “Standard for Good Workmanship in Electrical Construction”
6. NECA -301 – “Fiber Optic Installation Standard”
7. NECA/BICSI 568 – “Standard for Installing Commercial Building Telecommunications Cabling”
8. NECA/BICSI 607 – “Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings”
9. NFPA 70 – “National Electrical Code”
10. NFPA 262 – “Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces”
11. TIA-455-78 – “Measurement Methods and Test Procedures – Attenuation”
12. TIA-492AAAB – “Detail Specification for 50-µm Core Diameter/125-µm Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers”
13. TIA-492AAAC – “Detail Specification for 850-nm Laser-Optimized, 50-µm Core Diameter/125-µm Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers
14. TIA-492AAAD – “Detail Specification for 850-nm Laser-Optimized, 50-µm Core Diameter/125-µm Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers Suitable for Manufacturing OM4 Cabled Optical Fiber”
15. TIA-492CAAA – “Detail Specification for Class Iva Dispersion-Unshifted Single-Mode Optical Fibers”
16. TIA-492CAAB – “Detail Specification for Class Iva Dispersion-Unshifted Single-Mode Optical Fibers with Low Water Peak”
17. TIA-526-14-B – “Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant”
18. TIA-568.0-D – “Generic Telecommunications Cabling for Customer Premises”
19. TIA-568.1-D – “Commercial Building Telecommunications Cabling”
20. TIA-568-C.2 – “Balanced Twisted-Pair Telecommunications Cabling and Components”
21. TIA-568.D-3 – “Optical Fiber Cabling Components”
22. TIA-569-E – “Telecommunications Pathways and Spaces”
23. TIA-598-D – “Optical Fiber Cable Color Coding”
24. TIA-604 – “Fiber Optic Connector Intermateability Standard”
25. TIA-606-C – “Administration Standard for Telecommunications Infrastructure”
26. TIA-607-D – “Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises”
27. UL 969 – “Standard for Marking and Labeling Systems”
28. UL 1666 – “Standard for Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts”
29. UL 1685 – “Standard for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables”

D. Equipment. Telecommunications backbone cabling and accessories shall be “Listed” or “Labeled” as defined in NFPA 70, Article 100, by a National Recognized Testing Laboratory acceptable to authorities having jurisdiction, and marked for the intended location and use.

PART 2 PRODUCTS

2.01 GENERAL INFORMATION

A. All communications equipment and material shall be new unless otherwise required or specified in the plan set and associated notes. The type of equipment and/or material shall be approved for its planned use and environment and is so defined by NEMA/NFPA 70 standards and NRTL certifications.

B. Backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, patch panels, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connections.

C. Backbone cabling cross-connections may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

D. Backbone cabling system shall comply with the transmission standards in TIA-568.1-D, when tested according to test procedures of this standard.

E. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 50 or less.

F. Telecommunications Pathways and Spaces: Comply with TIA-569-E.

G. Grounding: Comply with TIA-607-D.

2.02 ACCEPTABLE MANUFACTURERS

A. Belden.

B. Berk-Tek.

C. Corning.

D. Draka.

E. Essex.

F. General Cable.

G. OCC (Optical Cable Corporation).

H. TE.

I. Or approved equal.

2.03 COPPER BACKBONE CABLING

A. Copper backbone cable shall be ARMM shielded, 24-AWG solid copper conductors, insulated with color-coded PVC, and shall meet or exceed EIA/TIA Category 3 performance requirements.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Berk-Tek.
   2. Essex.
   3. General Cable.
   4. TE.

C. The voice backbone cable shall be sized as detailed on the Contract Documents. Where not shown, provide pair counts according to the following formula: 1.5 times the strand requirements shown, rounded up to the next commonly manufactured pair count in increments of 50.

D. Conductors shall be identified by the insulation color of each conductor. The color code shall follow the industry standard composed of ten (10) distinctive colors to identify 25 pairs in accordance with ICEA publication S-103-701. Marking of each mate of the primary conductor in a pair with the color of that primary conductor is optional.

E. When cables of larger than 25 pairs are required, the core shall be assembled into 25-pair subunits, each color-coded in accordance with ICEA publication S-103-701. Cables with over 600 pairs shall have 25-pair binder groups combined into super units. These super units shall

be wrapped with a solid color thread that follows the primary color scheme of white, red, black, yellow, and violet. Binder color code integrity shall be maintained wherever cables are spliced.

2.04 TWISTED PAIR CABLE HARDWARE

A. General Requirements for Cable Connecting Hardware:
   1. Twisted pair cable hardware shall meet the performance requirements of Category 5e or better.
   2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
   3. Cables shall be terminated with connecting hardware of same category or higher.
   4. Source Limitations: Obtain twisted pair cable hardware from single source from same manufacturer as twisted pair cable.

B. Connecting Blocks: 110-style IDC. Provide blocks for the number of cables terminated on the block, plus 25 percent spare, integral with connector bodies, including plugs and jacks where indicated.

C. Patch Panel: Modular panels housing numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
   1. Universal T568A and T568B wiring labels.
   2. Labeling areas adjacent to conductors.
   3. Replaceable connectors.
   4. 24 ports, straight connectors.
   5. 16-gauge steel and mountable on 19-inch equipment racks.
   6. Number of Jacks per Field: One for each four-pair cable indicated, plus spares and blank positions adequate to suit specified expansion criteria.
   7. Performance shall exceed Category 5e transmission requirements for connecting hardware.

D. Plugs and Plug Assemblies:
   1. Male; eight position (8P8C); color coded modular telecommunications connector designed for termination of a single four-pair 100-ohm unshielded or shielded twisted pair cable.
   2. Comply with TIA-568-C.2.

E. Jacks and Jack Assemblies:
   1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair 100-ohm unshielded or shielded twisted pair cable.
   2. Designed to snap into a patch panel or faceplate.
   3. Comply with TIA-568-C.2.

F. Patch Cords: Factory-made, four-pair cables in 36-inch lengths, terminated with an eight-position modular plug at each end. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 5e performance. Patch cords shall have latch guards to protect against snagging.

G. Legend: Machine printed in the field, using adhesive-tape label.

2.05 OPTICAL FIBER BACKBONE CABLING

A. General requirements for Optical Fiber cable:
   1. Fiber optic cable shall be manufactured with Corning Glass.
   2. Cables shall be listed OFNP, complying with NFPA 262 for plenum applications. Cables shall be listed OFNR, complying with UL 1666 for riser applications.
   3. Individual fibers shall be color-coded for identification. The optical fiber color-coding shall be in accordance with ANSI/TIA/EIA-598-D. The coloring material shall be stable over the temperature range of the cable, shall not be susceptible to migration, and shall not affect the transmission characteristics of the optical fibers. Color-coded buffered fibers shall not adhere to one another.
   4. A ripcord shall be applied between the aramid yarns and the outer jacket to facilitate jacket removal.
   5. The outer jacket shall be extruded over the aramid yarns for physical and environmental protection. The jacket shall be continuous, free from pinholes, splits, blisters, or other imperfections. The jacket shall have a consistent, uniform thickness. The jacket shall be smooth, as is consistent with the best commercial practice.

6. Cables shall be marked with the manufacturer name, date of manufacture, fiber type, flame rating, listing symbol, and sequential length markings every two feet. The marking shall be in contrasting color to the cable jacket. The cable jacket color shall match the color of the core optical fiber cable.
7. The fiber backbone cable shall be sized as detailed on the Contract Documents. Where not shown, provide strand counts according to the following formula: 1.5 times the strand requirements shown, rounded up to the next commonly manufactured pair count in increments of 12.
8. The fibers shall be stranded around a dielectric central member.
9. For cables containing 12-24 fibers, the fibers shall be arranged in two layers.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Belden.
2. Corning.
3. Draka
4. General Cable
5. OCC (Optical Cable Corporation).

C. 50/125 Micrometer, Multimode, Optical Fiber (OM2)
1. Description: Multimode, 50/125-micrometer, 24 fiber, nonconductive, tight buffer, optical fiber cable.
2. Comply with ICEA S-83-596 for mechanical properties.
3. Comply with TIA-568.3-D for performance specifications.
4. Comply with TIA-492AAAB for detailed specifications.
5. Maximum Attenuation: 3.5 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
6. Minimum Overfilled Modal Bandwidth-length Product: 500 MHz-km at 850 nm; 500 MHz-km at 1300 nm.
7. Jacket color shall be orange.

D. 850 Nanometer Laser-Optimized, 50/125 Micrometer, Multimode Optical Fiber Cable (OM3)
1. Description: Multimode, 50/125-micrometer 24 fiber, nonconductive, tight buffer optical fiber cable.
2. Comply with ICEA S-83-596 for mechanical properties.
3. Comply with TIA-568.3-D for performance specifications.
4. Comply with TIA-492AAAC for detailed specifications.
5. Maximum Attenuation: 3.5 dB/km at 850 nm; 1.5 dB/km at 1300 nm
6. Minimum Overfilled Modal Bandwidth-length Product: 1500 MHz-km at 850 nm; 500 MHz-km at 1300 nm.
7. Minimum Effective Modal Bandwidth-length Product: 2000 MHz-km at 850 nm.
8. Jacket color shall be aqua.

E. 850 Nanometer Laser-Optimized, 50/125 Micrometer, Multimode Optical Fiber Cable (OM4)
1. Description: Multimode, 50/125-micrometer 48 fiber, nonconductive, tight buffer optical fiber cable.
2. Comply with ICEA S-83-596 for mechanical properties.
3. Comply with TIA-568.3-D for performance specifications.
4. Comply with TIA-492AAAD for detailed specifications.
5. Maximum Attenuation: 3.5 dB/km at 850 nm; 1.5 dB/km at 1300 nm
6. Minimum Overfilled Modal Bandwidth-length Product: 3500 MHz-km at 850 nm; 500 MHz-km at 1300 nm.
7. Minimum Effective Modal Bandwidth-length Product: 4700 MHz-km at 850 nm.
8. Jacket color shall be aqua.

F. 9/125 Micrometer Single-Mode, Indoor-Outdoor Optical Fiber Cable (OS1)
1. Description: Single mode, 9/125-micrometer, 48 fibers, stranded loose tube optical fiber cable.
2. Comply with TIA-492CAAA for detailed specifications.
3. Comply with TIA-568.3-D for performance specifications.
4. Comply with ICEA S-104-696 for mechanical properties.

5. Maximum Attenuation: 0.5 dB/km at 1310 nm; 0.5 dB/km at 1550 nm.
6. Jacket color shall be yellow.

G. 9/125 Micrometer, Single-Mode, Indoor-Outdoor Optical Fiber Cable (OS2)
1. Description: Single mode, 9/125-micrometer, 48 fibers, stranded loose tube optical fiber cable.
2. Comply with TIA-492CAAB for detailed specifications.
3. Comply with TIA-568.3-D for performance specifications.
4. Comply with ICEA S-104-696 for mechanical properties.
5. Maximum Attenuation: 0.5 dB/km at 1310 nm; 0.5 dB/km at 1550 nm.
6. Jacket color shall be yellow.

2.06 INNERDUCT

A. Intra-building innerduct shall be 1 inch size, orange, unsplit, corrugated, with pull tape.
1. Plenum-rated: Carlon Plenum-Gard CF4x1C-nnnn.
2. Riser-rated: Carlon Riser-Gard DF4x1C-nnnn.

2.07 OPTICAL FIBER CABLE HARDWARE

A. Comply with Optical Fiber Connector Intermateability Standard specifications of the TIA-604 series.

B. Comply with TIA-568.3-D.

C. Cross-Connects and Patch Panels:
1. Modular panels housing multiple-numbered, duplex cable connectors.
2. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.
3. Provide complete patch panel with blank connector panels for unused connector panel slots, strain relief, fiber connectors and fiber optic receptacle adapters.

D. Patch Cords: Factory-made, dual-fiber cables in 36-inch lengths.

E. Connector Type: Complete with fiber optic receptacle adapters where required for mounting.
1. Multimode Fiber: Type LC/APC complying with TIA-604-10-B connectors.
2. Single mode Fiber: Type SC/APC complying with TIA-604-3-B connectors.

F. Plugs and Plug Assemblies:
1. Male; color-coded modular telecommunications connector designed for termination of a single optical fiber cable.
2. Insertion loss of not more than 0.25 dB.

G. Jacks and Jack Assemblies:
1. Female; quick-connect, simplex and duplex; fixed telecommunications connector designed for termination of a single optical fiber cable.
2. Insertion loss of not more than 0.25 dB.
3. Designed to snap-in to a patch panel or faceplate.

2.08 GROUNDING

A. Comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.

B. Comply with TIA-607-D.

2.09 IDENTIFICATION PRODUCTS

A. Comply with TIA-606-C and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

B. Comply with requirements in Section 26 05 53 “Identification for Electrical Systems” for identification products.

PART 3 EXECUTION

3.01 GENERAL INFORMATION

A. Provide all labor and conductors, connectors, and associated materials required for the installation of a complete and operating communications backbone system in accordance with

applicable local, state, national codes, and the manufacturers' recommendations, except where the plan set drawings, associated notes, schedules, and/or specifications are stricter.

3.02 ENTRANCE FACILITIES

A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.03 WIRING METHODS

A. Provide riser rated cable (CMR, OFNR) for riser locations, and locations where cable is to be installed in conduit. For cable not installed in conduit, provide plenum rated cable (CMP, OFNP).

B. Provide cables of the same type in the same color. Multiple colors of the same cable type are not acceptable.

C. Comply with NECA 1, NECA 301, and NECA/BICSI 568.

D. Install cables in raceways and cable trays, except within consoles, cabinets, and except in accessible ceiling spaces, in attics, and in gypsum board partitions where unenclosed wiring method may be used. Conceal conductors and cables in accessible ceilings, walls, and floors where possible, except in unfinished spaces.

E. Comply with requirements for pathways specified in Section 27 05 28 “Pathways for Communications Systems.”

F. Install exposed cables parallel to and perpendicular to surfaces on exposed structural members and follow surface contours where possible.

G. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals. Install tie-wraps (Velcro or similar) in conformance with the cable manufacturer’s installation recommendations.
   1. Attaching cables to pipes, electrical conduit, mechanical items, existing cables or the ceiling support system is not acceptable. Cables shall not rest upon acoustic ceiling grids or panels.

H. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.

I. Bundle, lace and train cables at racks and within enclosures. Connect to terminal points with no excess and without exceeding manufacturer’s limitations on bending radii. Provide and use lacing bars and distribution spools. Install cables parallel with or at right angles to sides and back of enclosure.

J. Install cable in a continuous non-spliced manner, unless otherwise indicated.

K. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation, and replace it with new cable.

L. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.

M. Pulling Cable: Comply with BICSI's "Information Transport Systems Installation Manual," Ch. 4, "Pulling Cable." Monitor cable pull tensions.
   1. Pull all cables simultaneously where more than one cable is being installed in the same raceway.
   2. Use pulling compound or lubricant where necessary. Use compounds that will not damage conductor or insulation (Polywater, or approved equal).
   3. Use pulling means, including fish tape, rope and basket-weave wire/cable grips that will not damage media or raceway. Repair or replace conduit bushings that become damaged during cable installation.

N. Cabling at backboards: Route cable as close as possible to the ceiling, floor, sides, or corners to ensure that adequate wall or backboard space is available for current and future equipment and for cable terminations. Use vertical ladder racking (securing cabling with hook-and-loop straps) and horizontal ladder racking, using the most direct route to the termination point. Route

via a path that will minimize obstruction to future installation of equipment, backboards or other cables.

O. In telecommunication rooms, lay cable neatly in tray in even bundles and loosely secure cabling to the tray at regular intervals with tie-wraps or hook-and-loop straps.
   1. Route cables to patch panels on racks by routing across tray above rack, then down vertical rack to patch panel.
   2. Wherever possible, terminate cables consecutively according to their far-end termination in intuitively occurring groups (jacks in an outlet, outlets in a room, etc.).

P. In the communications equipment room, provide a 10-foot- long service loop on each end of cable.

Q. Terminate all conductors and fiber strands; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.

R. Group connecting hardware for cables into separate logical fields.

3.04 INSTALLATION OF COPPER BACKBONE CABLES

A. Comply with TIA-568.0-D, TIA-568.1-D, and TIA-568-C.2.

B. Comply with BICSI's "Information Transport Systems Installation Manual," Ch. 6, "Cable Termination Practices."

C. Install 110-style IDC termination hardware unless otherwise indicated.

D. Do not untwist twisted pair cables more than 1/2 inch from the point of termination to maintain cable geometry.

E. Open-Cable Installation:
   1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
   2. Suspend twisted pair cabling, not in a wireway or pathway, a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
   3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

F. Installation of Cable Routed Exposed under Raised Floors:
   1. Install plenum-rated cable only.
   2. Install cabling after the flooring system has been installed in raised floor areas.
   3. Coil cable 6 feet long not less than 12 inches in diameter below each feed point.

G. Separation from EMI Sources:
   1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-E for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.
   2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
      a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
      b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
      c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
   3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
      a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
      b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
      c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
   4. Separation between communications cables in grounded metallic raceways, power lines, and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
      a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
      b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
      c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
   5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.

6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.05 INSTALLATION OF OPTICAL FIBER BACKBONE CABLES

A. Comply with TIA-568.1-D and TIA-568.3-D.

B. Comply with BICSI ITSIMM, Ch. 6, "Cable Termination Practices."

C. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

D. Open-Cable Installation:
   1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
   2. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

E. Installation of Cable Routed Exposed under Raised Floors:
   1. Install plenum-rated cable only.
   2. Install cabling after the flooring system has been installed in raised floor areas.
   3. Coil cable 6 feet long not less than 12 inches in diameter below each feed point.

F. Secure fiber optic cable with hook-and-loop straps (similar to Velcro).

G. Innerduct is required for routing inside plant fiber optic backbone cabling through all vertical riser pathways (conduits and sleeves) that exceed 4 feet in length. Innerduct is also required for routing inside plant fiber optic backbone cabling through cable trays where larger outside plant cable shares the cable tray.
   1. Install fiber optic cable in innerduct per manufacturer’s instructions.
   2. Innerduct shall terminate within 6 inches of top of each patch panel where fiber optic cable terminates.
   3. Secure innerduct with zip-ties at intervals not exceeding 24 inches. Do not use wire or tape.

3.06 PATCH PANEL INSTALLATION

A. Provide rack-mount patch panels and horizontal wire management according to locations, elevations and plan views as shown on the Contract Documents.

B. Copper patch panels: Size and install rack-mountable patch panels as shown on the Contract Documents. Use patch panels to terminate copper backbone cables.
   1. Termination:
      a. Terminate 2 pairs per jack, on pins 4 & 5 and on pins 3 & 6.
      b. The 25th pair of each binder group shall be preserved at the end of the patch panel for future use (replace damaged pair or support a 2-pair application).
      c. Maintain pair twist ratio for exposed wires at patch panel termination.
   2. Horizontal Wire Management: Provide horizontal wire management as shown on the Contract Documents.

C. Fiber patch panels: Size and install rack-mountable patch panels as shown on the Contract Documents. Mount intra-building fiber patch panel below outside plant fiber patch panel. Use fiber patch panels to terminate backbone and horizontal fiber optic cables.
   1. Terminate all fiber optic cabling using LC/APC or SC/APC-Duplex connectors.
   2. Where multiple cables terminate in a patch panel, terminate single mode fiber on the left side of patch panel, and multimode fiber on the right side.

3.07 FIRESTOPPING

A. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

B. Comply with TIA-569-E, Annex A, "Firestopping."

C. Comply with "Firestopping Systems" Article in BICSI's "Telecommunications Distribution Methods Manual."

3.08 GROUNDING

A. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."

B. Comply with TIA-607-D and NECA/BICSI-607.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall, allowing at least a 2-inch clearance behind the grounding bus bar. Connect grounding bus bar to suitable electrical building ground, using a minimum No. 4 AWG grounding electrode conductor.

D. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6 AWG equipment grounding conductor.

3.09 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606-C. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
   1. Administration Class: 2.
   2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

B. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

C. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

D. Cable and Wire Identification:
   1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
   2. Each wire connected to building-mounted devices is not required to be numbered at the device if wire color is consistent with associated wire connected and numbered within panel or cabinet.
   3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
   4. Label each terminal strip, and screw terminal in each cabinet, rack, or panel.
      a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group, extended from a panel or cabinet to a building-mounted device, with the name and number of a particular device.
      b. Label each unit and field within distribution racks and frames.
   5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and -connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

E. Labels shall be preprinted or computer-printed type, with a printing area and font color that contrast with cable jacket color but still comply with TIA-606-C requirements for the following:
   1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.10 ACCEPTANCE TESTING

A. Perform tests and inspections.

B. Tests and Inspections:
   1. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568.1-D.
   2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
   3. Test cables on the reel upon delivery to the job site, again prior to installation, and again after installation.
   4. Intrabuilding Backbone Copper Tests:

a. Test all cable pairs for length, shorts, opens, grounds, continuity, polarity reversals, termination order, transposition (wire map), attenuation, and the presence of AC voltage. All pairs shall demonstrate compliance to TIA/EIA-568.1-D Category 3 standards.
b. Test entire channel, from entrance protection to patch panel.
c. Use a TIA/EIA Level III testing instrument, re-calibrated within the manufacturer's recommended calibration period, with the most current software revision based upon the most current TIA/EIA testing guidelines, capable of storing and printing test records for each cable within the system.

5. Optical Fiber Cable Tests:
   a. Test all strands using a bi-directional end-to-end optical transmission loss test instrument (such as an OTDR) trace performed per ANSI/TIA/EIA 455-78, or a bi-directional end-to-end power meter test performed per and ANSI/TIA/EIA 568-C.2. Test the polarity of each pair of strands. Record length and attenuation.
      1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in one direction according to TIA-526-14-B, Method B, One Reference Jumper.
      2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than those calculated according to equation in TIA-568.1-D.
6. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.

D. End-to-end cabling will be considered defective if it does not pass tests and inspections.

E. Remove and replace cabling at no additional cost to the Owner where test results indicate that they do not comply with specified requirements. Cable repairs are not acceptable.

F. If a cable which occupies the same innerduct or conduit as a damaged cable is damaged by the extraction and installation process, replace the cable at no additional expense to the Owner.

G. Damaged and defective cables which are replaced shall be subject to the testing procedures of this specification.

H. Prepare test and inspection reports.

3.11 GUARANTEE (WARRANTY)

A. No additional material and/or labor warranty beyond that specified in Section 26 05 00 "Common Work Results for Electrical."

END OF SECTION

SECTION 27 15 13
COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings, the provisions of the Contract including the General and Supplementary Conditions, and the General Requirements apply to the Work of this Section.

B. The following sections have been specifically referenced in this specification:
   1. Section 26 05 00 Common Work Results for Electrical.
   2. Section 26 05 26 Grounding and Bonding for Electrical Systems.
   3. Section 26 05 53 Identification for Electrical Systems.
   4. Section 26 27 26 Wiring Devices.
   5. Section 27 05 28 Pathways for Communications Systems.

1.02 SCOPE.

A. This Section covers the basic telecommunications requirements for providing labor, materials, equipment, and services necessary for the selection and installation of communications copper horizontal cabling as part of an inside plant telecommunication system as shown on the drawings and specified herein. In general, this consists of:
   1. Category 6 twisted pair cable.
   2. Category 6A twisted pair cable.
   3. Twisted pair cable hardware, including plugs and jacks.
   4. Grounding provisions for twisted pair cable.

1.03 DEFINITIONS/ABBREVIATIONS

A. No additional definitions/abbreviations provided.

1.04 SUBMITTALS

A. Bid: Provide the following with the bid documents.
   1. No additional submittals required; see Specification Section 26 05 00.

B. Manufacture: Provide the following prior to release for manufacture and/or purchase.
   1. Data sheets shall be submitted for approval for each type of product.
   2. Shop drawings reviewed and stamped by RCDD shall be submitted for approval as follows.
      a. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
      b. Cabling administration Drawings and printouts.
      c. Wiring diagrams and installation details of telecommunications equipment, to show location and layout of telecommunications equipment.
   3. Cable testing plan.
   4. No samples requested.
   5. See also Specification Section 26 05 00.

C. Construction: Provide the following during construction.
   1. Test reports.
   2. See also Specification Section 26 05 00.

D. Closeout: Provide the following to complete the project.
   1. Upon completion of project, provide as-built drawings showing jack numbers and locations.
   2. See Specification Section 26 05 00.

1.05 QUALITY ASSURANCE

A. Manufacturer. The equipment manufacturer shall be regularly engaged in the manufacture of copper structured cabling and accessories of the types, capabilities, and capacities required, and whose products have been in satisfactory use in similar service for not less than ten years.

B. Installer Qualifications. Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings, and field testing program development by an RCDD.
2. Installation Supervision: Installation shall be under the direction supervision of a Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.

C. Codes/Standards. The products provided by this section shall comply with the following applicable references (latest edition):
1. ASTM E84 – “Standard Test Method for Surface Burning Characteristics of Building Materials”
2. NECA 1 – “Standard for Good Workmanship in Electrical Construction”
3. NECA/BICSI 568 – “Standard for Installing Commercial Building Telecommunications Cabling”
4. NECA/BICSI-607 – “Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings”
5. NEMA WC 66/ICEA S-116-732 – “Standard for Category 6 and 6A, 100 Ohm, Individually Unshielded Twisted Pairs, Indoor Cables (With or Without an Overall Shield) for Use in LAN Communication Wiring Systems”
6. NFPA 70 – “ National Electrical Code”
7. TIA-568.1- D – “Commercial Building Telecommunications Cabling”
8. TIA-568-C.2 – “Balanced Twisted-Pair Telecommunications Cabling and Components”
9. TIA-569-E – “Telecommunications Pathways and Spaces”
10. TIA-606-C – “Administration Standard for Telecommunications Infrastructure”
11. TIA-607-D – “Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises”

D. Equipment. Telecommunications horizontal cabling and accessories shall be “Listed” or “Labeled” as defined in NFPA 70, Article 100, by a National Recognized Testing Laboratory acceptable to authorities having jurisdiction, and marked for the intended location and use.

PART 2 PRODUCTS

2.01 GENERAL INFORMATION

A. All communications equipment and material shall be new unless otherwise required or specified in the plan set and associated notes. The type of equipment and/or material shall be approved for its planned use and environment and is so defined by NEMA/NFPA 70 standards and NRTL certifications.

B. Horizontal cabling system shall provide the means of transporting signals between the telecommunications outlet/connector and the patch panel located in the communications equipment room. Cabling system consists of horizontal cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.
1. TIA-568.1-D requires that a minimum of two equipment outlets be installed for each work area.
2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications equipment outlet.
3. Bridged taps and splices shall not be installed in the horizontal cabling.

C. A work area is approximately 100 sq. ft., and includes the components that extend from the equipment outlets to the station equipment.

D. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

E. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

F. Telecommunications Pathways and Spaces: Comply with TIA-569-E.

G. Grounding: Comply with TIA-607-D.

2.02 ACCEPTABLE MANUFACTURERS

A. Belden.

B. Berk-Tek.

C. Commscope.

D. Essex.

E. General Cable.

2.03 CATEGORY 6 TWISTED PAIR CABLE

A. Four-pair balanced twisted pair cable with internal separator, certified to meet transmission characteristics of Category 6 cable at frequencies up to 250MHz.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
   1. Berk-Tek LANmark-1000 UTP cable
   2. Commscope Systimax GigaSPEED XL cable
   3. Essex DataGain Category 6+ cable
   4. General Cable GenSpeed 6 Cat 6 cable

C. Comply with NEMA WC 66/ICEA S-116-732 and TIA-568-C.2 for Category 6 cables.

D. Conductors: 100-ohm, 23 AWG solid copper.

E. Shielding/Screening: Unshielded twisted pairs (UTP).

F. Cable Rating: Plenum (CMP).

G. Jacket: Blue thermoplastic.

2.04 CATEGORY 6A TWISTED PAIR CABLE

A. Four-pair balanced twisted pair cable, with internal spline, certified to meet transmission characteristics of Category 6A cable at frequencies up to 500 MHz.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
   1. Belden 10GXS Cat 6A cable
   2. Berk-Tek LANmark-XTP UTP cable
   3. Essex 10Gain XP cable
   4. General Cable GenSpeed MTP Cat 6A cable

C. Comply with TIA-568-C.2 for Category 6A cables.

D. Conductors: 100-ohm, 23 AWG solid copper.

E. Shielding/Screening: Unshielded twisted pairs (UTP).

F. Cable Rating: Plenum (CMP).

G. Jacket: Green thermoplastic.

2.05 TWISTED PAIR CABLE HARDWARE

A. Description: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. AMP NETCONNECT; a Tyco Electronics brand; a TE Connectivity Ltd. Company.
   2. Belden CDT Networking Division/NORDX.
   3. Panduit Corp.

C. General Requirements for Cable Connecting Hardware:
   1. Twisted pair cable hardware shall meet the performance requirements of Category 6 or Category 6A.
   2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.

3. Cables shall be terminated with connecting hardware of same category or higher.
4. Source Limitations: Obtain twisted pair cable hardware from the same manufacturer as the twisted pair cable, from single source.

D. Connecting Blocks: 110-style IDC for Category 6 or Category 6A. Provide blocks for the number of cables terminated on the block, plus 25 percent spare, integral with connector bodies, including plugs and jacks where indicated.

E. Patch Panel: Modular panels with pre-manufactured cable management for supporting station cable behind the patch panel, housing numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
1. Universal T568A and T568B wiring labels.
2. Labeling areas adjacent to conductors.
3. Replaceable connectors.
4. 24 ports (1U) or 48 ports (2U).
5. 16-gauge steel and mountable on 19-inch equipment racks.
6. Number of Jacks per Field: One for each four-pair cable indicated, plus spares and blank positions adequate to suit specified expansion criteria.

F. Patch Cords: Factory-made, four-pair cables in 48-inch lengths, terminated with an eight-position modular plug at each end. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 or Category 6A performance. Patch cords shall have latch guards to protect against snagging.

G. Plugs and Plug Assemblies:
1. Male; eight position (8P8C), non-keyed; color coded modular telecommunications connector designed for termination of a single four-pair 100-ohm unshielded or shielded twisted pair cable.
2. Comply with TIA-568-C.2.

H. Jacks and Jack Assemblies:
1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair 100-ohm unshielded or shielded twisted pair cable.
2. Designed to snap in to a patch panel or faceplate
3. Comply with TIA-568-C.2.

I. Faceplate:
1. Two, Four or Six port (accommodating quantity of cables at each outlet as indicated on drawings), vertical single gang faceplates designed to mount to single gang wall boxes.
2. Plastic Faceplate: High-impact plastic. Coordinate color with Section 26 27 26 “Wiring Devices.”
3. Metal Faceplate: Stainless steel, complying with requirements in Section 26 27 26 “Wiring Devices.”
4. For use with snap-in jacks accommodating any combination of twisted pair, optical fiber and coaxial work area cords.
   a. Flush mounting jacks, positioning the cord at a 45-degree angle.
   Provide blank inserts/fillers for covering unused connector openings.

J. Legend: Machine printed in the field, using adhesive-tape label.

2.06 GROUNDING

A. Comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.

B. Comply with TIA-607-D.

PART 3 EXECUTION

3.01 GENERAL INFORMATION

A. Provide all labor and conductors, connectors, patch panels, and associated materials required for the installation of a complete and operating communications horizontal cabling system in accordance with applicable local, state, national codes, and the manufacturers'

recommendations, except where the plan set drawings, associated notes, schedules, and/or specifications are stricter

3.02 WIRING METHODS

A. Install cables in raceways and cable trays, except within consoles, cabinets, desks and counters, and except in accessible ceiling spaces, in attics, and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.

B. Comply with requirements for pathways specified in Section 27 05 28 “Pathways for Communications Systems.”

C. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

D. Bundle, lace and train cables at racks and within enclosures. Connect to terminal points with no excess and without exceeding manufacturer’s limitations on bending radii. Provide and use lacing bars and distribution spools. Install cables parallel with or at right angles to sides and back of enclosure.

3.03 INSTALLATION OF TWISTED-PAIR HORIZONTAL CABLES

A. Comply with NECA 1 and NECA/BICSI 568. Comply with TIA-568.0-D, TIA-568.1-D, and TIA-568-C.2.

B. Comply with BICSI's Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.

C. Provide cables of the same type in the same color. Multiple colors of the same cable type are not acceptable.

D. Install exposed cables parallel to and perpendicular to surfaces on exposed structural members and follow surface contours where possible.

E. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals. Install tie-wraps (Velcro or similar) in conformance with the cable manufacturer’s installation recommendations.
   1. Attaching cables to pipes, electrical conduit, mechanical items, existing cables or the ceiling support system is not acceptable. Cables shall not rest upon acoustic ceiling grids or panels.

F. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.

G. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI's "Information Transport Systems Installation Manual," Ch. 6, "Cable Termination Practices." Use lacing bars and distribution spools.

H. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation, and replace it with new cable.

I. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.

J. Pulling Cable: Comply with BICSI's "Information Transport Systems Installation Manual," Ch. 4, "Pulling Cable." Monitor cable pull tensions.
   1. Pulling tension shall not exceed 25 pounds per cable.
   2. Pull all cables simultaneously where more than one cable is being installed in the same raceway.
   3. Use pulling compound or lubricant where necessary. Use compounds that will not damage conductor or insulation (Polywater, or approved equal).
   4. Use pulling means, including fish tape, rope and basket-weave wire/cable grips that will not damage media or raceway. Repair or replace conduit bushings that become damaged during cable installation.

K. Cabling in trays: Do not bundle cables together. During installation, temporarily install hook-and-loop straps (similar to Velcro) to hold cables in place near outside edges of cable tray around corners. After terminating the cables, remove the straps.

L. Cabling at backboards: Route cable as close as possible to the ceiling, floor, sides, or corners to ~~insure -~~ ensure that adequate wall or backboard space is available for current and future equipment and for cable terminations. Use vertical ladder racking (securing cabling with hook-and-loop straps) and horizontal ladder racking, using the most direct route to the termination point. Route via a path that will minimize obstruction to future installation of equipment, backboards or other cables.

M. In telecommunication rooms, lay cable neatly in tray in even bundles and loosely secure cabling to the tray at regular intervals with tie-wraps or hook-and-loop straps.
   1. Route cables to patch panels on racks by routing across tray above rack, then down vertical rack to patch panel.
   2. Wherever possible, terminate cables consecutively according to their far-end termination in intuitively occurring groups (jacks in an outlet, outlets in a room, etc.).

N. Do not untwist twisted pair cables more than 1/2 inch from the point of termination to maintain cable geometry.

O. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and patch panels.

P. Provide one cable per each connector at each outlet.

Q. Provide service loops of 18 inches for each outlet, stored in the cable tray near the conduit serving the outlet. Provide minimum of 10 feet of service loop for each cable in telecommunications rooms.

R. Separation from EMI Sources:
   1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-E for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.

3.04 PATCH PANEL INSTALLATION

A. Provide rack-mount patch panels and horizontal wire management according to locations, elevations and plan views as shown on the Contract Documents.

B. Terminate copper horizontal cables on patch panels. Do not exceed ten 2U-sized patch panels per rack.

3.05 DATA OUTLET INSTALLATION

A. Mount connectors at 90-degrees (i.e. straight, not angled).

B. Standard telecommunications outlets shall be installed a minimum of 15” above finished floor, and at the same height as electrical outlets. Standard wall phone outlet height shall be installed 48” above finished floor. At wireless access points, height shall be ceiling height or as noted on the plans.

C. Telecommunications outlet boxes shall be used solely for low voltage wiring for telecommunications.

D. Telecommunications outlets shall not be placed back to back, and shall be separated by 12 inches horizontally, or be placed on opposite sides of a wall stud.

E. Punch down cable using only the selected structured cable system manufacturer approved tool, achieving a fully repeatable, self-centering, non-impact mechanical termination process.

F. Provide bend-limiting strain relief caps on both ends of cable.

G. Provide faceplates in the locations and gang counts shown on the Contract Documents. Flush-mount connectors in faceplates.

H. Faceplates shall completely conceal outlet boxes, reducer plates, etc. Do not use oversized faceplate to cover openings in the wall.

I. Faceplates shall provide a snug and secure fit for connectors – loose connectors are not acceptable. Do not over-tighten faceplates such that warping occurs.

3.06 FIRESTOPPING

A. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

B. Comply with TIA-569-E, Annex A, "Firestopping."

C. Comply with "Firestopping Systems" Article in -BICSI's "Telecommunications Distribution Methods Manual."

3.07 GROUNDING

A. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."

B. Comply with TIA-607-D and NECA/BICSI-607.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall, allowing at least a 2-inch clearance behind the grounding bus bar. Connect grounding bus bar to suitable electrical building ground, using a minimum No. 4 AWG grounding electrode conductor.

D. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6 AWG equipment grounding conductor.

3.08 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606-C. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
   a. Paint and label colors for equipment identification shall comply with TIA-606-C for Class 2 level of administration.

B. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

C. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-C. Furnish electronic record of all drawings, in software and format selected by Owner.

D. Cable and Wire Identification:
   1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
   2. Each wire connected to building-mounted devices is not required to be numbered at the device if wire color is consistent with associated wire connected and numbered within panel or cabinet.
   3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
   4. Label each terminal strip, and screw terminal in each cabinet, rack, or panel.
      a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group, extended from a panel or cabinet to a building-mounted device, with the name and number of a particular device.
      b. Label each unit and field within distribution racks and frames.
   5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label the front of each patch panel jack and outlet jack. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

E. Labels shall be preprinted or computer-printed type, with a printing area and font color that contrast with cable jacket color but still comply with TIA-606-C requirements for the following:
   1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.09 ACCEPTANCE TESTING

A. Perform tests and inspections.

B. Tests and Inspections:
   1. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568.1-D.
   2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
   3. Test each end-to-end link (the entire channel from the connector at the outlet to the connector or termination in the telecommunications room) utilizing sweep tests, for continuity, shorts, polarity, attenuation, installed length, transposition (wire map), mutual capacitance, characteristic impedance, resistance, ACR, Insertion Loss, Pair-to-Pair Near End Crosstalk (NEXT), Power Sum Near End Crosstalk (PSNEXT), Equal Level Far End Crosstalk (ELFEXT), Power Sum Equal Level Far End Crosstalk (PSELFEXT), Return Loss, and presence of AC voltage. Test each cable in both directions.
   4. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.
   5. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.
   6. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.

D. End-to-end cabling will be considered defective if it does not pass tests and inspections.

E. Remove and replace cabling at no additional cost to the Owner where test results indicate that they do not comply with specified requirements. Cable repairs are not acceptable.

F. If a cable which occupies the same conduit as a damaged cable is damaged by the extraction and installation process, replace the cable at no additional expense to the Owner.

G. Damaged and defective cables which are replaced shall be subject to the testing procedures of this specification.

H. Prepare test and inspection reports.

3.10 GUARANTEE (WARRANTY)

A. No additional material and/or labor warranty beyond that specified in Section 26 05 00 “Common Work Results for Electrical.”

END OF SECTION

SECTION 31 23 15
EARTHWORK AT BUILDING PAD

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES:

A. Excavating, filling and backfilling, trench excavation, and grading indicated or required for building footings, foundation walls, slabs-on-grade, and mechanical and electrical Work within 5 ft. of building line after site has been previously prepared under separate contract.

B. Soil Testing: Performed by independent Testing Agency selected and paid by Owner.

1.03 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Vapor barrier placement under concrete slab-on-grade.

1.04 REFERENCE STANDARDS

A. ASTM C33/C33M - Standard Specification for Concrete Aggregates.

B. Manual of Accident Prevention in Construction" (AGC101) by Associated General Contractors of America; 9th Edition.

1.05 DEFINITIONS

A. Satisfactory soil material: Clean subsoil, free from debris, roots, topsoil, frozen material, and rock larger than 1/2 CF. Test fill material; obtain Testing Agency approval for degree of compaction required by its intended use.

B. Unsuitable soil materials: Soil materials not capable of being compacted to density required, mass or trench rock material, debris, and organic material.

C. Mass rock: Material more than one CY in original volume and cannot be excavated with a single-toothed ripper drawn by equivalent of Caterpillar D8K crawler tractor having 56,000 lbs. minimum draw bar pull, or by equivalent Caterpillar 977 front end loader.

D. Trench rock: Material more than 1/2 CY in original volume that cannot be excavated by equivalent of Caterpillar 215 backhoe having bucket curling force of 18,300 lbs.

E. Muck: Wet organic material which will not support light crawler tractor; requires removal by power shovels or draglines.

1.06 SUBMITTALS

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

B. Quality Control Submittals; Contractor quality control submittals shall not be submitted to the Architect for review.
   1. Submit complete shoring and bracing plans, designs, and other means of retaining undisturbed earth for Owner's files.
   2. Intent is to demonstrate Contractor's understanding of regulations; no review will be made of this submittal.
   3. Excavating or trenching requiring depths over 3 ft. without this submittal is strictly prohibited.

1.07 QUALITY ASSURANCE

A. Regulatory Requirements: Strictly adhere to local governmental and published OSHA requirements.

1.08 PROJECT CONDITIONS

A. Verify existing grades and lay out grade stakes for building and appurtenances. If existing grades are at variance with drawings, notify Owner and receive instructions prior to proceeding.

B. Protection:

1. Protect benchmarks and monuments; if disturbed or destroyed, replace in original position.
2. Protect existing facilities and adjacent property. Prevent ponding or washing of water on site, on adjacent property or downstream. Erect straw bale barricades and retention pond as required.
3. Protect areas outside limits of construction from encroachment by construction personnel or equipment, regardless of property ownership. Access shall be by specific written permission or easement only.
4. Protect active utilities and remove or relocate as indicated on drawings. Remove or relocate active utilities encountered but not indicated on drawings.
5. Plug or cap inactive utilities encountered, not less than 5 ft. outside building lines.
6. Identify and protect utilities for Project duration.

C. Subsurface Soil Data: Subsurface investigation may have been performed. However, neither Owner, Developer, nor Architect assumes responsibility for completeness or accuracy of data contained and no claims for compensation or extension of time will be considered based on Contractor's assumptions.

PART 2 PRODUCTS

2.01 MATERIALS

A. Porous Fill: Crushed stone or gravel meeting ASTM C33/C33M, size 57.

B. Compacted Structural Fill: Gravel, crushed gravel, or crushed stone, in accord with ASTM C33/C33M, for coarse aggregate, meeting the following gradation and compacted to 95% Standard Proctor:
1. 3/4 in. Sieve: 50-to-100% passing.
2. No. 10 Sieve: 10-to-35% passing.
3. No. 100 Sieve: 1-to-10% passing.

PART 3 EXECUTION

3.01 PREPARATION

A. Excess, Unsuitable, and Insufficient Materials:
1. Remove excess and unsuitable materials from Project site unless otherwise approved by Soils Engineer.
2. Provide satisfactory fill material in areas where existing materials are insufficient or unsuitable for earthwork operations.

3.02 EXCAVATION

A. Excavate on basis of unclassified excavation. Include excavation under Contract Sum of soil materials required to establish grades indicated on drawings and excavation for utilities, structures, and appurtenances.

B. Assume responsibility for design and construction of excavation shoring and bracing capable of supporting excavations and construction loads. Selected materials and methods are Contractor's option and in accord with regulatory requirements.

C. Excavation of unsuitable soil material:
1. If unsuitable soil material, including mass or trench rock or muck, is encountered, clear away earth to expose material. Notify Soils Engineer and receive written instructions prior to proceeding.
2. Remove rock to a depth of 6 in. below slabs and pavement, 2 ft. outside building walls, 6 in. below and 8 in. each side of piping in utility trenches and 1 ft. below finished grade in areas to receive landscaping and grassing.
3. Perform blasting only after receiving written approval from Owner and notifying Owner's insurance company of intent. Engage experienced mechanics to perform blasting. Handling, store, and use explosives in accord with "Manual of Accident Prevention in Construction" (AGC101) by Associated General Contractors of America, Inc., 9th edition.
4. Remove unsuitable soil materials to extent directed by Soils Testing Agency.

D. Excavate to lines and levels required to obtain finish elevation indicated. Provide space for foundation work and inspection. Cut excavations clean with level bottoms. Where changes in levels occur, provide vertical steps in horizontal footings.

E. Cut footing trenches to exact size of footing and omit forms if soil conditions permit. Notify Soils Engineer, in writing, if earth of doubtful bearing is encountered or if indicated design bearing capacity is not encountered within 8 in. of indicated depth; await Soils Engineer's written instructions.

F. If excavations are by error carried deeper than indicated, fill additional depth with concrete class specified for foundations at no additional cost.

G. Protect excavations against cave-ins, ponding, and freezing. Provide bracing, shoring, and sheeting to contain excavations. Slope embankments over 5 ft. in height at 45 degree angle away from excavation, or shore. When freezing can be anticipated prior to concrete placement, protect excavations or delay carrying excavations to full depth until concrete can be placed.

H. Maintain excavations including utility trenches free of surface water. Provide pumps and wellpoints if required to drain excavations. Provide and maintain temporary drainage ditches.

I. Notify Soils Engineer immediately of subsurface water encountered; await written instructions.

J. Notify Testing Agency when footing excavations are complete. Testing Lab shall verify bearing capacity determined by Soils Engineer just prior to footings placement.

K. Trench excavation: Excavate trenches to a maximum width equal to pipe diameter plus 2 ft. for pipe 2 ft. 6 in. diameter and smaller; 2 ft. 6 in. for pipe exceeding 2 ft. 6 in. diameter. Do not over-excavate.

3.03 FILL AND BACKFILL

A. Provide satisfactory soil material to perform earthwork operations indicated; include filling and backfilling to bring grade to elevations indicated.

B. Surface preparation to receive fill:
   1. Remove vegetation, unsuitable soil materials, obstructions, and deleterious materials from ground surface prior to fill placement. Break up sloped surfaces steeper than one vertical to four horizontal for fill material to bond with existing surface.
   2. Proof roll areas to receive fill, foundations, pavements, and building slabs with fully loaded 20-ton dump truck or equivalent. Make two complete coverages of areas in each of two perpendicular passes. Undercut and replace areas exhibiting "pumping" during proof rolling with selected fill materials compacted in accord with requirements of this section.
   3. When existing ground surface has density less than specified for particular area classification, break up ground surface, pulverize, moisture condition to optimum moisture content, and compact to required depth and percentage of maximum density or undercut to firm soil and replace with properly compacted structural fill.

C. Placement and compaction:
   1. Place fill materials in layers not more than 1 ft. in loose depth.
   2. Placing rocks exceeding 3 in. diameter in top 1 ft. of fill is prohibited. Before compaction, moisten or aerate each layer to provide optimum moisture content. Compact each layer to specified percentage of maximum density for area classification.
   3. Placing backfill or fill material on muddy or frozen surfaces or surfaces containing frost or ice is prohibited.

D. Bed pipe in trenches on continuous soil foundation shaped to lowest one-fourth of pipe profile. Form depressions for hubs and similar joints only in sizes required for making joints.

E. Backfill against pipe in layers not more than 6 in. loose depth. Place backfill evenly along both sides of pipe to level of top of piping; compact each layer with power tampers. Placement of rock exceeding 3 in. diameter in first 1 ft. of fill directly over top of piping is prohibited.

F. Backfill excavations promptly, but not prior to completion of following:
   1. Inspecting, testing, and recording locations of underground utilities.
   2. Removal of shoring and bracing, and backfilling voids.
   3. Removal of debris and excavations.
   4. Permanent or temporary horizontal bracing for unsupported walls.

G. Place backfill against blow grade walls in uniform lifts to prevent wedging action. Placement of backfill until slabs-on-grade and framed floors lending lateral bracing to such construction is in place and until concrete has developed design compressive strength is prohibited.

3.04 COMPACTION

A. Perform compaction of soil materials using mechanical soil compaction equipment for type and size materials to be compacted. Hand compact materials in areas inaccessible to machinery and within 5 ft. of below-grade walls.

B. Percentage of maximum density requirements: Provide not less than percentages of maximum density required to obtain design bearing capacity.

C. Moisture control: Where subgrade or soil layer must be moisture conditioned before compaction, apply water to surface of subgrade or soil layer. Scarify and air dry soil material too wet to permit compaction to specified density.

D. Soil material removed because of excess wetness to permit compaction may be stockpiled or spread where directed by Owner and permitted to dry. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to satisfactory value, as determined by moisture-density relation tests. When accepted by Soils Engineer, soil material may be used in compacted backfill or fill.

3.05 GRADING

A. Grade areas to lines and elevations indicated, including adjacent transition areas. Smooth finished surface within specified tolerances, compact and bring to uniform levels of slopes between points where elevations are indicated, or between such points and existing grades.

B. Finish surfaces shall be free from irregular surface changes and as follows:
   1. Surfaces under walks and pavements: Shape surface area under walks to line. Grade and cross-section with finish surface not more than 0.10 ft. above or below required subgrade elevation.
   2. Surface under building slabs and foundations: Grade level, free of voids, compacted as specified, within 0.2 ft. of required elevation. Proof roll as specified above.
   3. Grassed areas: Shape areas to receive topsoil within 0.2 ft. above or below required subgrade elevation.

C. After grading compact subgrade surfaces to depth and percentage of maximum density for each area classification.

D. Grade areas adjacent to building lines to drain away from building to prevent ponding. Finish grades shall be within 0.2 ft. of indicated elevations.

E. Where compacted areas are disturbed by construction operations, scarify surface, reshape, and recompact to required density.

F. Protection of graded areas: Protect newly graded surfaces from traffic and erosion. Keep free of debris. Where graded or compacted surfaces are damaged by subsequent operations, return to indicated grade and state of compaction.

END OF SECTION

SECTION 31 23 23
FILL

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 SECTION INCLUDES

1.03 DEFINITIONS

A. Finish Grade Elevations: Indicated on Drawings.

B. Subgrade Elevations: Indicated on Drawings.

1.04 SUBMITTALS

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

B. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used, including manufactured fill.

1.05 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. Structural Fill- Fill Type "Structural Soil" as labeled on Landscape Drawings: Subsoil excavated on-site.

2.02 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for testing and analysis of soil material.

B. If tests indicate materials do not meet specified requirements, change material and retest.

PART 3 EXECUTION

3.01 EXAMINATION

A. Identify required lines, levels, contours, and datum locations.

B. Verify areas to be filled are not compromised with surface or ground water.

3.02 PREPARATION

A. Scarify and proof roll subgrade surface to a depth of 6 inches to identify soft spots.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 FILLING

A. Fill to contours and elevations indicated using unfrozen materials.

B. Employ a placement method that does not disturb or damage other work.

C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

D. Maintain optimum moisture content of fill materials to attain required compaction density.

E. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches compacted depth.

F. Slope grade away from building minimum 2 inches in 10 feet, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

G. Correct areas that are over-excavated.

1. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.

H. Compaction Density Unless Otherwise Specified or Indicated:

I. Reshape and re-compact fills subjected to vehicular traffic.

J. Maintain temporary means and methods, as required, to remove all water while fill is being placed as required, or until directed by the Architect. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

END OF SECTION

SECTION 31 31 16
TERMITE CONTROL

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 SECTION INCLUDES

A. Chemical soil treatment.

1.03 RELATED REQUIREMENTS

A. Section 03 05 16 - Underslab Vapor Barrier: Vapor barrier placement under concrete slab-on-grade.

1.04 REFERENCE STANDARDS

A. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act.

1.05 SUBMITTALS FOR INFORMATION

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

B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.
   1. Mark as "FOR INFORMATION ONLY."

C. Manufacturer's Certificate: Certify that toxicants meet or exceed specified requirements.

D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following as applicable:
   1. Date and time of application.
   2. Moisture content of soil before application.
   3. Brand name and manufacturer of termiticide.
   4. Quantity of undiluted termiticide used.
   5. Dilutions, methods, volumes, and rates of application used.
   6. Areas of application.
   7. Water source for application.

E. Record and document moisture content of soil before application, date and rate of application, areas of application, diary of toxicity meter readings and corresponding soil coverage, and quantity of undiluted termiticide used, water source for application, dilutions, methods, volumes, and rates of application used.

F. Maintenance Data: Indicate re-treatment schedule .

G. Warranty: Submit warranty and ensure that forms have been completed in Owner's name.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing this type of work and:
   1. Having minimum of three (3) years documented experience.
   2. Approved by manufacturer of treatment materials.
   3. Licensed in Louisiana.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year installer's warranty against damage to building caused by termites.
   1. Include coverage for repairs to building and to contents damaged due to building damage. Repair damage and, if required, re-treat.
   2. Inspect annually and report in writing to Owner. Provide inspection service for 3 years from Date of Substantial Completion or as established by the Owner under direct agreement with Maintenance & Inspection entity.

PART 2 PRODUCTS

2.01 CHEMICAL SOIL TREATMENT

A. Toxicant Chemical: EPA Title 7, United States Code, 136 through 136y approved; synthetically color dyed to permit visual identification of treated soil.

B. Diluent: Recommended by toxicant manufacturer.

C. Manufacturers:
   1. Any manufacturer with an EPA approved product.

D. Mixes: Mix toxicant to manufacturer's instructions.

E. Toxicant Chemical: EPA (1) approved; synthetically color dyed to permit visual identification of treated soil.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.

B. Verify final grading is complete.

3.02 APPLICATION - CHEMICAL TREATMENT

A. Comply with requirements of U.S. EPA and applicable state and local codes.

B. Apply toxicant in accordance with manufacturer's written instructions.

C. Apply toxicant at following locations:
   1. Under Slabs-on-Grade.
   2. Soil Within 10 feet of Building Perimeter For a Depth of 2 feet.

D. Under slabs, apply toxicant no less than 12 hours prior to installation of vapor barrier, unless specifically stated by manufacturer in writing.

E. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.

F. Re-treat disturbed treated soil with same toxicant as original treatment.

G. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

3.03 PROTECTION

A. Do not permit soil grading over treated work.

END OF SECTION

SECTION 32 11 13
UNDERSLAB CAPILLARY FILL

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 SECTION INCLUDES

A. Underslab areas within building limits.

1.03 RELATED REQUIREMENTS

A. Division 07 Section “Below Grade Vapor Retarder”.

B. Division 31 Section “Earthwork”.

C. Division 33 Section “Subdrainage.”

1.04 REFERENCE STANDARDS

A. ASTM C33/C33M - Standard Specification for Concrete Aggregates.

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. Underslab Capillary Fill: Narrowly graded mixtures of crushed stone, or crushed or uncrushed gravel; ASTM C33/C33M; coarse-aggregate grading Size 67.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earthwork."

3.03 UNDERSLAB CAPILLARY FILL INSTALLATION

A. Place impervious fill material on properly prepared subgrade. Place and compact impervious fill to dimensions indicated, but not less than 4 inches (100 mm) deep.

3.04 PROTECTION

A. Maintain capillary fill clear of dirt and other debris until concrete slab is poured.

END OF SECTION

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SECTION 33 41 13
FOUNDATION DRAINAGE

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 SECTION INCLUDES

A. Building Perimeter and Retaining Wall Drainage Systems.

B. Filter aggregate and fabric and bedding.

1.03 RELATED REQUIREMENTS

A. Section 31 23 16.13 - Trenching: Excavating and backfilling for site subdrainage systems.

B. Section 31 23 23 - Fill: Backfilling over filter aggregate, up to subgrade elevation.

C. Section 32 11 13 - Underslab Capillary Fill.

1.04 SUBMITTALS

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

B. Product Data: Provide data on pipes and fittings, filter fabrics, and aggregates and/or bedding.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Project Record Documents: Record location of pipe runs, connections, cleanouts and principal invert elevations.

1.05 REGULATORY REQUIREMENTS

A. Conform to applicable code for materials and installation of the work of this section.

PART 2 PRODUCTS

2.01 PERFORATED-WALL PIPES AND FITTINGS

A. Perforated PE Pipe and Fittings:
   1. NPS 6 (DN 150) and Smaller: ASTM F405 or AASHTO M 252, Type CP; corrugated, for coupled joints.
   2. NPS 8 (DN 200) and Larger: ASTM F667; AASHTO M 252, Type CP; or AASHTO M 294, Type CP; corrugated; for coupled joints.
   3. Couplings: Manufacturer's standard, band type.

2.02 GEOTEXTILE FILTER FABRICS

A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. (4480 to 13 440 L/min. per sq. m) when tested according to ASTM D4491.

B. Structure Type: Nonwoven, needle-punched continuous filament.
   1. Survivability: AASHTO M 288 Class 2.
   2. Styles: Flat and sock.

2.03 AGGREGATE AND BEDDING

A. Filter Aggregate and Bedding Material: Granular fill:.
   1. Granular Fill - Gravel : natural washed stone; free of shale, clay, friable material and debris.
   2. Graded in accordance with ASTM D2487 Group Symbol GW.

2.04 ACCESSORIES

A. Pipe Couplings: Solid plastic.

B. Filter Fabric: Water pervious type, black polyolefin.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on Drawings.

3.02 PREPARATION

A. Hand trim excavations to required elevations. Correct over-excavation as required.

B. Remove large stones or other hard matter that could damage drainage piping or impede consistent backfilling or compaction.

3.03 INSTALLATION

A. Install and join pipe and pipe fittings in accordance with pipe manufacturer's instructions.

B. Place drainage pipe on clean cut subsoil.

C. Lay pipe to slope gradients noted on Drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

3.04 PROTECTION

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation begins.

END OF SECTION