Edison Impact Hub

1824 East McKinley St
Phoenix, AZ 85006

Project Manual

Multistudio Project No. 0520-0020

New Construction Bid Set

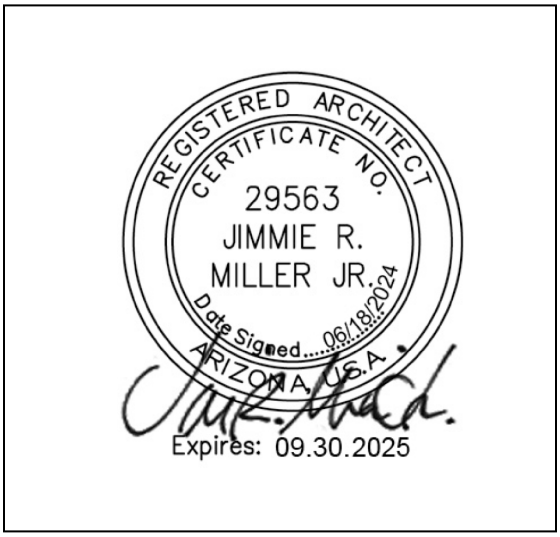
June 2024

SECTION 00 00 07

SEALS PAGES

Discipline: ARCHITECTURAL
Company Name: Multistudio, Inc.
Address: 521 S 3rd St #100
Phoenix, Arizona, 85004
Telephone: (602) 234-1140
Fax: (602) 234-1156
Contact: Jim Miller
Email: Jim.Miller@multi.studio

SEAL



Project Manual Responsibility:

DIVISION 01 - GENERAL REQUIREMENTS

01 10 00	Summary of Work
01 25 00	Substitution Procedures
01 26 00	Contract Modifications and Procedures
01 31 00	Project Management and Coordination
01 32 00	Construction Progress Documentation
01 32 33	Photograph Documentation
01 33 00	Submittal Procedures
01 40 00	Quality Requirements
01 50 00	Temporary Facilities and Controls
01 60 00	Product Requirements
01 73 00	Execution
01 77 00	Closeout Procedures
01 78 23	Operations and Maintenance Data
01 78 39	Project Record Documents.
01 79 00	Demonstration and Training

DIVISION 02 – EXISTING CONDITIONS

02 41 19	Selective Demolition

DIVISION 03 – CONCRETE

03 30 00 Cast-in-Place Concrete

DIVISION 04 – MASONRY

04 20 00 Unit Masonry

DIVISION 05 – METALS

05 12 00 Structural Steel
05 50 00 Metal Fabrications
05 52 13 Pipe and Tube Railings

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES
06 10 53 Miscellaneous Rough Carpentry
06 16 00 Sheathing
06 40 23 Interior Architectural Woodwork
06 64 00 Plastic Paneling

DIVISION 07 - THERMAL AND MOISTURE PROTECTION
07 18 00 Traffic Coatings
07 21 00 Thermal Insulation
07 27 13 Modified Bituminous Sheet Air Barriers
07 32 13 Clay Roof Tiles
07 57 00 Coated Foam Roofing
07 62 00 Sheet Metal Flashing and Trim
07 84 13 Penetration Firestopping
07 92 00 Joint Sealants

DIVISION 08 - OPENINGS
08 11 13 Hollow Metal Doors and Frames
08 14 16 Flush Wood Doors
08 31 13 Access Doors and Frames
08 41 13 Aluminum-Framed Entrances and Storefronts
08 51 23.13 Hot Rolled Steel Windows
08 71 00 Door Hardware
08 80 00 Glazing
08 83 00 Mirrors
08 87 00 Glazing Surface Films

DIVISION 09 - FINISHES
09 22 16 Non-Structural Metal Framing
09 24 00 Cement Plastering
09 29 00 Gypsum Board
09 30 13 Ceramic Tiling
09 51 13 Acoustical Panel Ceilings
09 65 13 Cork Flooring
09 65 13 Resilient Base and Accessories
09 67 23 Resinous Flooring

09 68 13 Tile Carpeting
09 77 23 Fabric-Wrapped Panels
09 84 38 Sound-Absorbing Ceiling Units
09 91 13 Exterior Painting
09 91 23 Interior Painting
09 96 00 High Performance Coatings

DIVISION 10 – SPECIALTIES
10 14 23 Panel Signage
10 21 13.17 Phenolic-Core Toilet Compartments
10 28 00 Toilet, Bath and Laundry Accessories
10 44 13 Fire Protection Cabinets
10 44 16 Fire Extinguishers
10 75 16 Ground-Set Flagpoles

DIVISION 12 - FURNISHINGS
12 24 13 Roller Window Shades

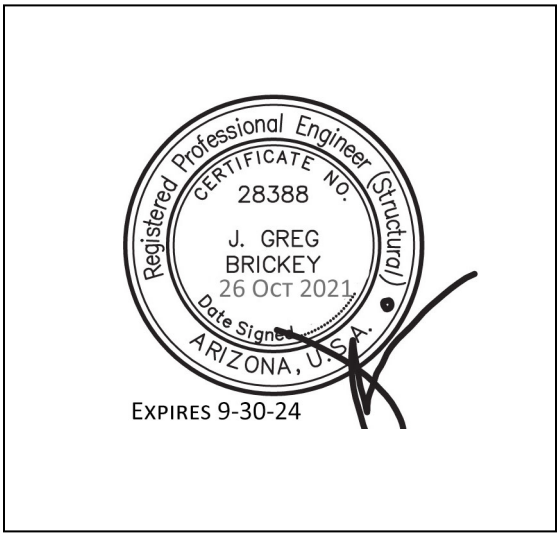
DIVISION 31 – EARTHWORK
31 31 16 Termite Control

SECTION 00 00 07

SEALS PAGES

Discipline: STRUCTURAL
Company Name: BDA Design
Address: 7047 E. Greenway Pkwy #250
Scottsdale, Arizona, 85254
Telephone: (480) 398-7729
Fax:
Contact: Greg Brickey
Email: greg@bdadesign.com

SEAL



Project Manual Responsibility:

DIVISION 04 – MASONRY
04 20 00 Unit Masonry

DIVISION 05 - METALS
05 12 00 Structural Steel

SECTION 00 00 07

SEALS PAGES

Discipline: CIVIL
Company Name: Wilson & Company
Address: 410 N. 44th Street Suite 460
Phoenix, Arizona, 85008
Telephone: (602) 283-2701
Fax:
Contact: Ed Latimer
Email: ed.latimer@wilsonco.com

SEAL

EXPIRES 09/30/24

Project Manual Responsibility:

DIVISION 22 – PLUMBING

22 11 13 Facility Water Distribution Piping

DIVISION 31 – EARTHWORK

31 10 00 Site Clearing
31 20 00 Earth Moving
31 31 16 Termite Control

DIVISION 32 – EXTERIOR IMPROVEMENTS

32 12 16 Asphalt Paving
32 13 13 Concrete Paving
32 17 23 Pavement Markings

DIVISION 33 – UTILITIES

33 30 00 Sanitary Sewer Piping

SECTION 00 00 07

SEALS PAGES

Discipline: MECHANICAL, PLUMBING
Company Name: Applied Engineering
Address: 2800 S. Rural Road #101
Tempe, Arizona, 85282
Telephone: (480) 928-3070
Fax:
Contact: Greg Piraino
Email: gregp@appliedengineering.ws

SEAL

Project Manual Responsibility:

DIVISION 22 – PLUMBING

22 05 00	Plumbing General Requirements
22 05 23	Valves
22 05 49	Installation Coordination
22 10 00	Piping
22 13 16	Sanitary Waste and Vent Systems
22 33 00	Water Heaters
22 40 00	Plumbing Fixtures

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING

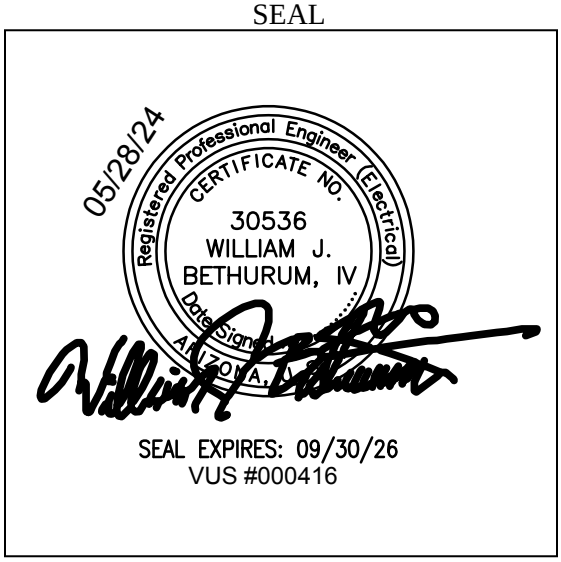
23 05 00	HVAC General Requirements
23 05 29	Hangers and Supports
23 05 93	HVAC Systems Testing, Adjusting and Balancing
23 08 39	Air Handling and Air Distribution Specialties
23 30 00	HVAC Air Distribution and Ductwork
23 33 13	Fire Dampers and Combination Fire and Smoke Dampers
23 80 00	HVAC Equipment

SECTION 00 00 07

SEALS PAGES

Discipline: ELECTRICAL
Company Name: Applied Engineering
Address: 2800 S. Rural Road #101
Tempe, Arizona, 85282
Telephone: (480) 928-3070
Fax:
Contact: Greg Piraino
Email: gregp@appliedengineering.ws

SEAL



Project Manual Responsibility:

DIVISION 26 – ELECTRICAL

26 05 10	General Provisions
26 05 19	Low Voltage Electrical Power Conductors and Cables
26 05 26	Grounding and Bonding for Electrical Systems
26 05 29	Hangers and Supports for Electrical Systems
26 05 33	Raceways and Boxes for Electrical Systems
26 05 36	Cable Trays for Electrical Systems
26 05 44	Sleeves and Sleeve Seals for Electrical Raceways and Cabling
26 05 48	Vibration Controls for Electrical Systems
26 05 53	Identification for Electrical Systems
26 05 73.16	Overcurrent Protective Device Coordination Study
26 05 73.19	Overcurrent Protective Device Arc Flash Study
26 09 36	Lighting Controls
26 24 13	Switchboards
26 24 16	Panelboards
26 27 26	Wiring Devices
26 28 13	Fuses
26 28 16	Enclosed Switches and Circuit Breakers
26 51 00	Lighting

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

28 31 00 Fire Detection and Alarm

SECTION 00 00 07

SEALS PAGES

Discipline: LANDSCAPE
Company Name: Floor Associates
Address: 1425 N. 1st Street #1607
Phoenix, Arizona, 85004
Telephone: (602) 462-1425
Fax:
Contact: Kris Floor
Email: kris@floorassociates.com

SEAL

Project Manual Responsibility:

DIVISION 32 – EXTERIOR IMPROVEMENTS

32 01 90 Operations and Maintenance of Planting
32 84 00 Planting Irrigation
32 92 00 Turf
32 93 00 Planting
32 95 16 Stone Topdress

DOCUMENT 00 01 10

TABLE OF CONTENTS

DIVISION 06 – WOOD, PLASTICS AND COMPOSITES

06 10 53	Miscellaneous Rough Carpentry
06 16 00	Sheathing
06 40 23	Interior Architectural Woodwork
06 64 00	Plastic Paneling

DIVISION 07 – Thermal and Moisture Protection

07 18 00	Traffic Coatings
07 21 00	Thermal Insulation
07 27 13	Modified Bituminous Sheet Air Barriers
07 32 13	Clay Roof Tiles
07 57 00	Coated Foam Roofing
07 62 00	Sheet Metal Flashing and Trim
07 84 13	Penetration Firestopping
07 92 00	Joint Sealants

DIVISION 08 – OPENINGS

08 11 13	Hollow Metal Doors and Frames
08 14 16	Flush Wood Doors
08 31 13	Access Doors and Frames
08 41 13	Aluminum-Framed Entrances and Storefronts
08 51 23.13	Hot Rolled Steel Windows
08 71 00	Door Hardware
08 80 00	Glazing
08 83 00	Mirrors
08 87 00	Glazing Surface Films

DIVISION 09 – FINISHES

09 22 16	Non-Structural Metal Framing
09 24 00	Cement Plastering
09 29 00	Gypsum Board
09 30 13	Ceramic Tiling
09 51 13	Acoustical Panel Ceilings
09 65 13	Cork Flooring
09 65 13	Resilient Base and Accessories
09 67 23	Resinous Flooring
09 68 13	Tile Carpeting
09 77 23	Fabric-Wrapped Panels
09 84 38	Sound-Absorbing Ceiling Units
09 91 13	Exterior Painting
09 91 23	Interior Painting
09 96 00	High Performance Coatings

DIVISION 10 – SPECIALTIES

10 14 23	Panel Signage
10 21 13.17	Phenolic-Core Toilet Compartments
10 28 00	Toilet, Bath and Laundry Accessories
10 44 13	Fire Protection Cabinets
10 44 16	Fire Extinguishers
10 75 16	Ground-Set Flagpoles

DIVISION 12 – FURNISHINGS

12 24 13	Roller Window Shades

FACILITIES SERVICES GROUP

DIVISION 22 – PLUMBING

22 05 00	Plumbing General Requirements
22 05 22	Valves
22 05 49	Installation Coordination
22 10 00	Piping
22 11 13	Facility Water Distribution Piping
22 13 16	Sanitary Waste and Vent Systems
22 33 00	Water Heaters
22 40 00	Plumbing Fixtures

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING

23 05 00	HVAC General Requirements
23 05 29	Hangers and Supports
23 05 93	HVAC Systems Testing, Adjusting and Balancing
23 08 39	Air Handling and Air Distribution Specialties
23 30 00	HVAC Air Distribution and Ductwork
23 33 13	Fire Dampers and Combination Fire and Smoke Dampers
23 80 00	HVAC Equipment

DIVISION 26 – ELECTRICAL

26 05 10	General Provisions
26 05 19	Low Voltage Electrical Power Conductors and Cables
26 05 26	Grounding and Bonding for Electrical Systems
26 05 29	Hangers and Supports for Electrical Systems
26 05 33	Raceways and Boxes for Electrical Systems
26 05 36	Cable Trays for Electrical Systems
26 05 44	Sleeves and Sleeve Seals for Electrical Raceways and Cabling
26 05 48	Vibration Controls for Electrical Systems
26 05 53	Identification for Electrical Systems
26 05 73.16	Overcurrent Protective Device Coordination Study
26 05 73.19	Overcurrent Protective Device Arc Flash Study

END OF DOCUMENT 00 01 10

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1. SUMMARY

A. Section Includes:
   1. Project information.
   2. Work covered by Contract Documents.
   3. Phased construction.
   4. Work under Owner's separate contracts.
   5. Owner-furnished/Contractor-installed (OFCI) products.
   6. Contractor's use of site and premises.
   7. Work restrictions.
   8. Specification and Drawing conventions.

B. Related Requirements: Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner

1.2. DEFINITIONS

A. Work Package: A group of specifications, drawings, and schedules prepared by the design tto describe a portion of the Project Work for pricing, permitting, and construction.

B. Furnish: To Purchase and deliver

C. Install: To Place into final position and connect

D. “As Shown”, “as detailed”, “as indicated” or words of similar import mean as indicated on the drawings

E. “As Selected”, “as approved”, or words of similar import mean as selected by, as approved by, or as accepted by the design professional.

F. “Approved Equal”, “or equal” shall mean as approved and accepted by the design professional and Owner.

G. Shall: means mandatory

H. “As required” means as required by the contract documents.

I. “As necessary” means essential to the completion of the work.

J. “Concealed” Means not visible in the finished work

K. “Days” means calendar days unless specifically indicated otherwise.

1.3. PROJECT INFORMATION

A. Project Identification: EDISON IMPACT HUB
   1. Project Location: 1824 East McKinley Street, Phoenix, AZ., 85006

B. Owner: City of Phoenix, 200 West Washington Street, Phoenix. AZ 85003
   1. Owner's Representative: Brad Puffer, City of Phoenix Housing Department, Project Manager.
      Email: brad.puffer@phoenix.gov
      Office: 602 – 256 – 3338
      Cell: 602 – 430 - 2341

C. Architect: Multistudio, 521 South 3rd Street, Phoenix, AZ., 85004
   1. Architect's Representative: Jim Miller, Primary Architect.
      Email: Jim.Miller@multi.studio
      Office: 602 – 650 – 7601
      Cell: 602 – 692 - 6809

D. Architect's Consultants: Architect has retained the following design professionals, who have prepared designated portions of the Contract Documents:
   1. Structural Engineering:
      BDA Design, 7047 East Greenway Parkway, Suite 250, Scottsdale, AZ. 85254
      Office: 480 – 398 - 7729
   2. Civil Engineering:
      Wilson & Company, 410 North 44th Street, Suite 460, Phoenix, AZ 85008
      Office: 602 – 283 - 2701
   3, Historic Preservation:
      Ryden Architects, 2241 East Mountain View Road, Phoenix, AZ. 85028
      Office: 602 – 253 - 5381
   4. Mechanical, Electrical, Plumbing Engineering:
      Applied Engineering Inc., 2800 South Rural Road, Suite 101, Tempe, AZ 85282
      Office: 480 – 968 - 3070
   5. Landscape Architecture
      Floor Associates, 1425 North 1st Street, Suite 200, Phoenix, AZ 85004
      Office: 602 – 462 - 1425

E. Web-Based Project Software: Project software will be used for purposes of managing communication and documents during the construction stage.
   1 See Section 013100 "Project Management and Coordination." for requirements for using web-based Project software.

1.4. WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:
   1. The Project is a Historical Preservation project consisting of Partial Structural Demolition of additions of the Non-Original Building and selective demolition in the Original Building renovation/adaptive reuse of the existing Historic Structure. Include is also site improvements along with other Work indicated in the Contract Documents.

B. Type of Contract:: Project will be constructed under a single prime contract.

1.5. WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

1.6. CONTRACTOR'S USE OF SITE AND PREMISES

A. Unrestricted Use of Site: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

B. Limits on Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
   1. Driveways, Walkways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.
      a. Schedule deliveries to minimize use of driveways and entrances by construction operations.

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

D. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.7. WORK RESTRICTIONS

A. Comply with restrictions on construction operations.
   1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.

B. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances within the existing building and on Project site is not permitted.

1.8. SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:
   1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.2 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

B. 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.
   1. 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.

1.3 ACTION SUBMITTALS

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: Use form acceptable to Architect.
   2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
      a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
      a. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
      b. Detailed comparison of significant qualities of proposed substitutions 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.
      c. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
      d. Samples, where applicable or requested.

e. Certificates and qualification data, where applicable or requested.
f. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
g. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
h. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
i. Detailed comparison of Contractor's construction schedule using proposed substitutions 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.
j. Cost information, including a proposal of change, if any, in the Contract Sum.
k. 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.
l. 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 (7) days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within **15** days of receipt of request, or **s**even days of receipt of additional information or documentation, whichever is later.
   a. Architect's Supplemental Instructions for minor changes in the Work.
   b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.4 QUALITY ASSURANCE

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

1.5 PROCEDURES

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

1.6 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on 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.
    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: Architect will consider requests for substitution if received within 60 days after the Notice to Proceed Requests received after that time may be considered or rejected at discretion of Architect.
    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 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

Substitution Request – During Bidding Period

2010.07.01

Project

Project Name: Edison Impact Hub *Date:*

Project No.: 0520-0020

Contract Documents References

Product for which substitution is requested is shown on the following documents:

Drawings		***Specifications***	
Product Name:		*Section Title:*	
Affected Drawing Sheet No(s):		*Section No.:*	
		Page:	

Attached Documentation

The following documentation is attached for the product identified above and is in accordance with the requirements of Section 012500 – Substitution Procedures for the above referenced project:

Attached:

☐ Coordination Info.	☐ Product Comparison	☐ Product Data	☐ Drawings
☐ Samples	☐ Certificates	☐ Similar Installations	☐ Test Reports
☐ Research Reports	☐ Schedule Comparison	☐ Cost Information	☐

Basis for Substitution

Reason specified product cannot be provided:

Product Comparison (include industry standard number, as applicable)

	Specified Product	***Proposed Substitution***
Description:		
Manufacturer:		
Manufacturer website:		
Manufacturer telephone:		
Model No.:		
Trade Name:		
Product Name:		
Type / Options:		
Dimensions (W"xL"xH"):		
Material Thickness:		
Composition / Material:		
Date Available:		
Country of Manufacture:		
Substrate Requirements:		
Available Warranty (years / coverage)		
Ratings (STC, NRC, etc.):		
Exposure class:		
Chemical resistance (list):		
Other specified performance criteria (list):		

List additional information on continuation page at the end of this document

Cost / Benefit Analysis

Describe in detail any alteration to any other part of the Work, including work of other trades, required that would result from the acceptance of this requested substitution:

Specified Product Total Value (from table above):	Plus (+) $ 0.00
Proposed Substitution Total Value (from table above):	Minus (-) $ 0.00
Cost / (savings) of alteration to the Work described above:	Plus (+) $
Cost / (savings) of contractor overhead and profit:	Plus (+) $
Estimated cost of Architect's review, documentation and administration:	Plus (+) $
Total cost / (savings) to Owner:	Equals (=) $ 0.00

Benefits to Owner (other than financial)

The undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, are available.
- Proposed substitution will have no adverse effect on other trades, and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Submitting contractor will pay for all changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- This Substitution Request complies with requirements as outlined in Contract Documents including those outlined in sections 007300 and 012500.

Submitting Contractor: _____ *Telephone:* _____
Street Address: _____ *Fax:* _____
City, State, Zip _____ *E-mail:* _____
Submitted By: _____

Signature: _____ *Date:* _____

Construction Manager's Review

I certify that I have checked the above documentation for the proposed Request for Substitution and warrant it to be substantially complete and accurate.

Signature: _____ *Date:* _____
Comments: _____

Architect's or Consultant's Review

- ☐ Substitution Approved – Include approval in addendum
- ☐ Substitution Approved As Noted – Include approval as noted in addendum
- ☐ Substitution Rejected – no action
- ☐ Substitution Request Received Too Late – no action

Signature: _____ *Date:* _____

Comments: _____

_____

_____

This page left blank intentionally.

CONTINUATION SHEET

Product Comparison (include industry standard number, as applicable)

	Specified Product	*Proposed Substitution*
Other specified performance criteria (list):		

The undersigned further certifies that these items listed on this “CONTINUATION SHEET” represent Performance Criteria of the proposed substitution product:

Submitting Contractor: ______________________ *Telephone:* ______________

Submitted By: ______________________

Signature: ______________________ *Date:* ______________

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.2 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architects Supplemental Instructions"
   1. Work Change Proposal Requests issued by **Architect** are not instructions either to stop work in progress or to execute the proposed change.

1.3 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
   1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
   2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
      a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
      b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      c. Include costs of labor and supervision directly attributable to the change.
      d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to **Architect**,
   1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.

2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

1.4 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Change Proposal Request, **Architect** will issue a Change Order for signatures of Owner and Contractor on AIA Document G701 and AIA Document G701CMa.

1.5 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714 and AIA Document G714CMa Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
   1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
   1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
   1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
   2. Submit the schedule of values to Architect at earliest possible date, but no later than seven (7) days before the date scheduled for submittal of initial Applications for Payment.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
   1. Identification: Include the following Project identification of the Schedule of Values:
      a. Project Name and location
      b. Name of Architect
      c. Architect’s Project Number
      d. Contractor’s name and address
      e. Date of Submittal
   2. Arrange schedule of values consistent with format of AIA Document G703.
   3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
   4. Round amounts to nearest whole dollar, total shall equal the Contract Sum.
   5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
      a. Differentiate between items stored on-site and items stored off-site. And A
   6. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of the general overhead and profit for each item.
      a. Temporary facilities and other major cost items that are not direct cost of actual work in place may be shown as a separate line item in the Schedule of Values.
   7. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.

8. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.3 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
   1. Submit draft copy of Application for Payment **seven** (7) days prior to due date for review by Architect.

C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. **Architect** will return incomplete applications without action.
   1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
   2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
   3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on site and items stored off-site.
   1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
   2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation, do not include overhead and profit on stored materials.
   3. Provide summary documentation for stored materials indicating the following:
      a. Materials previously stored and included in previous Applications for Payment.
      b. Work completed for this application utilizing previously stored materials
      c. Additional materials stored with this Application.
      d. Total materials remaining stored, including materials with this Application

F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
   1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
   2. When an application shows completion of an item, submit conditional final or full waivers.
   3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
   4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
   5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
   1. List of subcontractors.
   2. Schedule of values.
   3. Contractor's construction schedule (preliminary if not final).
   4. Products list (preliminary if not final).
   5. Sustainable design action plans, including preliminary project materials cost data.
   6. Schedule of unit prices.
   7. Submittal schedule (preliminary if not final).
   8. List of Contractor's staff assignments.
   9. List of Contractor's principal consultants.
   10. Copies of building permits.
   11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
   12. Initial progress report.
   13. Report of preconstruction conference.
   14. Certificates of insurance and insurance policies.
   15. Performance and payment bonds.
   16. Data needed to acquire Owner's insurance.

I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
   1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
   2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
   1. Evidence of completion of Project closeout requirements.

2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706.
5. AIA Document G706A.
6. AIA Document G707.
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. General coordination procedures.
   2. Coordination drawings.
   3. RFIs. (Request from Owner, Architect or Contractor seeking information from each other during construction.)
   4. Digital project management procedures.
   5. Project meetings.

B. Related Requirements:

   1. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.2 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
   1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
   2. Number and title of related Specification Section(s) covered by subcontract.
   3. Drawing number and detail references, as appropriate, covered by subcontract.

1.3 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.

B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of Contractor's construction schedule.
   2. Preparation of the schedule of values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.
   5. Progress meetings.
   6. Preinstallation conferences.
   7. Project closeout activities.
   8. Startup and adjustment of systems.

1.4 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
   1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
      a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
      b. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:
   1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
   2. Plenum Space: Indicate subframing for support of ceiling**[, raised access floor,]** and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
   3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
   4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
   5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.

6. Mechanical and Plumbing Work: Show the following:
   a. Sizes and bottom elevations of ductwork, piping and conduit runs, including insulation, bracing, flanges and support systems.
   b. Dimensions of major components, such as heat pumps, fan coils, dampers, valves, etc
   c. Fire rated enclosures and wall penetrations.
7. Electrical work: Show the following:
   a. Conduit runs of vertical and horizontal 1 ¼ inch and larger
   b. Light fixture, Exit light, emergency battery pack, smoke detectors and other fire alarm locations.
   c. Locations of Panel Boards, switch boards, switch gear, transformer, busway, and motor control center, junction boxes.
8. Fire Protection Systems: Show the following:
   a. Locations of Standpipes, mains piping, branch lines and sprinkler heads.
9. Review: Architect will review coordination drawings to confirm that, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.

C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. File Preparation Format:
   a. Same digital data software program, version, and operating system as original Drawings.
2. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format (PDF format).
3. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
   a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
   b. Digital Data Software Program: Drawings are available in Bluebeam
   c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.

1.5 REQUEST FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Owner name.
2. Owner's Project number.

3. Name of Architect
4. Architect's Project number.
5. Date.
6. Name of Contractor.
7. RFI number, numbered sequentially.
8. RFI subject.
9. Specification Section number and title and related paragraphs, as appropriate.
10. Drawing number and detail references, as appropriate.
11. Field dimensions and conditions, as appropriate.
12. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
13. Contractor's signature.
14. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

C. RFI Forms: AIA Document G716.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven (7) days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for approval of Contractor's means and methods.
    d. Requests for coordination information already indicated in the Contract Documents.
    e. Requests for adjustments in the Contract Time or the Contract Sum.
    f. Requests for interpretation of Architect's actions on submittals.
    g. Incomplete RFIs or inaccurately prepared RFIs.
2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within **five** (5) days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly and include the following:
1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect
4. RFI number including that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.

8. Identification of Response; Minor Change in the work or generated contract change through: Proposal Request, Construction Chang Directive

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within **three** (3) days if Contractor disagrees with response.

1.6 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

B. Preconstruction Conference: **Schedule and conduct** a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than **15** days after execution of the Agreement.

1. Attendees: Authorized representatives of Owner**,** Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:
   a. Responsibilities and personnel assignments.
   b. Tentative construction schedule.
   c. Phasing.
   d. Critical work sequencing and long lead items.
   e. Designation of key personnel and their duties.
   f. Lines of communications.
   g. Use of web-based Project software.
   h. Procedures for processing field decisions and Change Orders.
   i. Procedures for RFIs.
   j. Procedures for testing and inspecting.
   k. Procedures for processing Applications for Payment.
   l. Distribution of the Contract Documents.
   m. Submittal procedures.
   n. Preparation of Record Documents.
   o. Use of the premises **and existing building**.
   p. Work restrictions.
   q. Working hours.
   r. Owner's occupancy requirements.
   s. Responsibility for temporary facilities and controls.
   t. Procedures for moisture and mold control.
   u. Procedures for disruptions and shutdowns.
   v. Construction waste management and recycling.
   w. Parking availability.
   x. Office, work, and storage areas.
   y. Equipment deliveries and priorities.
   z. First aid.
   aa. Security.
   bb. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other sections and when required for coordination with other construction.
   1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect**,** of scheduled meeting dates.
   2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
      a. Contract Documents.
      b. Options.
      c. Related RFIs.
      d. Related Change Orders.
      e. Purchases.
      f. Deliveries.
      g. Submittals.
      h. Review of mockups.
      i. Possible conflicts.
      j. Compatibility requirements.
      k. Time schedules.
      l. Weather limitations.
      m. Manufacturer's written instructions.
      n. Warranty requirements.
      o. Compatibility of materials.
      p. Acceptability of substrates.
      q. Temporary facilities and controls.
      r. Space and access limitations.
      s. Regulations of authorities having jurisdiction.
      t. Testing and inspecting requirements.
      u. Installation procedures.
      v. Coordination with other work.
      w. Required performance results.
      x. Protection of adjacent work.
      y. Protection of construction and personnel.
   3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
   4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
   5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Conduct progress meetings at weekly
   1. Coordinate dates of meetings with preparation of payment requests.

2. Attendees: In addition to representatives of Owner**,** and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. genda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
        1) Review schedule for next period.
    b. Review present and future needs of each entity present, including the following:
        1) Interface requirements.
        2) Sequence of operations.
        3) Status of submittals.
        4) Deliveries.
        5) Off-site fabrication.
        6) Access.
        7) Site use.
        8) Temporary facilities and controls.
        9) Progress cleaning.
        10) Quality and work standards.
        11) Status of correction of deficient items.
        12) Field observations.
        13) Status of RFIs.
        14) Status of Proposal Requests.
        15) Pending changes.
        16) Status of Change Orders.
        17) Pending claims and disputes.
        18) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
    a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Contractor's Construction Schedule.
   2. Construction schedule updating reports.
   3. Daily construction reports.
   4. Site condition reports.

1.2 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.
   1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
   2. Predecessor Activity: An activity that precedes another activity in the network.
   3. Successor Activity: An activity that follows another activity in the network.
   4. Float: The amount of time an activity can consume before it affects the finish date and subsequent project completion.

B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

1.3 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:.
   1. PDF file.

B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
   1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.
   2. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
   3. Logic Report: List of preceding and succeeding activities for each activity, sorted in ascending order by activity number and then by early start date, or actual start date if known.
   4. Total Float Report: List of activities sorted in ascending order of total float.

C. Construction Schedule Updating Reports: Submit with Applications for Payment.

D. Daily Construction Reports: Submit at monthly intervals.

E. Site Condition Reports: Submit at time of discovery of differing conditions.

1.4 COORDINATION

A. Coordinate Contractor's Construction Schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.
   1. Secure time commitments for performing critical elements of the Work from entities involved.
   2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules. how in the schedule the sequence in which the contractor proposes to perform the work and dates on which the Contractor contemplates starting and completing all schedule activities. The scheduling of the entire project, including the design and construction sequences is required. The scheduling of construction is the responsibility of the contractor. Contractor management personnel shall activity participate in its development. Subcontractors and suppliers working on the project shall also contribute in the developing and maintaining sn accurate Project Schedule. Provide a schedule that is a forward planning as well as a project monitoring tool.

B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion and final completion.
   1. Contract completion date shall not be changed by submission of a schedule that shows early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
   1. Activity Duration: Define activities so no activity is longer than **20** days, unless specifically allowed by Architect.
   2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
   3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
   4. Startup and Testing Time: Include no fewer than **15** days for startup and testing.
   5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.

6. Punch List and Final Completion: Include not more than **30** days for completion of punch list items and final completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
   1. Phasing: Arrange list of activities on schedule by phase.
   2. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
   3. Work Restrictions: Show the effect of the following items on the schedule:
      a. Coordination with existing construction.
      b. Limitations of continued occupancies.
      c. Uninterruptible services.
      d. Partial occupancy before Substantial Completion.
      e. Use-of-premises restrictions.
      f. Provisions for future construction.
      g. Seasonal variations.
      h. Environmental control.

E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
   1. Unresolved issues.
   2. Unanswered Requests for Information.
   3. Rejected or unreturned submittals.
   4. Notations on returned submittals.
   5. Pending modifications affecting the Work and the Contract Time.

F. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before with Construction Progress Payment..
   1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
   2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
   3. As the Work progresses, indicate final completion percentage for each activity.

G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.

H. Distribution: Distribute copies of approved schedule to Architect**,** Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
   1. Post copies in Project meeting rooms and temporary field offices.
   2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

I. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall Project schedule.

J. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the schedule of values).

K. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

1.6 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Testing and inspection.
8. Accidents.
9. Meetings and significant decisions.
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.

16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial completions and occupancies.
19. Substantial Completions authorized.

B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013200

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Preconstruction photographs.
   2. Periodic construction photographs.

B. Related Requirements:

1.2 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files within seven days of taking photographs.
   1. Submit photos on CD-ROM Include copy of key plan indicating each photograph's location and direction.
   2. Identification: Provide the following information with each image description
      a. Name of Project.
      b. Name and contact information for photographer.
      c. Name of Architect
      d. Name of Contractor.
      e. Date photograph was taken.
      f. Description of location, vantage point, and direction.
      g. Unique sequential identifier keyed to accompanying key plan.

1.3 FORMATS AND MEDIA

A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels. Use flash in low light levels or backlit conditions.

B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

C. File Names: Name media files with date and Project area and sequential numbering suffix.

1.4 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs with maximum depth of field and in focus.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

B. Preconstruction Photographs: Before commencement of the Work, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points.
   1. Flag construction limits before taking construction photographs.
   2. Take 20 (Minimum) photographs to show existing conditions adjacent to property before starting the Work.
   3. Take 20 (Minimum) photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
   4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

C. Periodic Construction Photographs: Take photographs Monthly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

D. Final Completion Construction Photographs: Take photographs after date of Substantial Completion for submission as Project Record Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013233

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Submittal schedule requirements.
   2. Administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples and other submittals as required in the specifications.

1.2 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."

1.3 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1.4 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:
   1. Project name.
   2. Date.
   3. Name of Architect.
   4. Name of Construction Manager.
   5. Name of Contractor.
   6. Name of firm or entity that prepared submittal.
   7. Names of subcontractor, manufacturer, and supplier.
   8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
   9. Category and type of submittal.

10. Submittal purpose and description.
11. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
12. Drawing number and detail references, as appropriate.
13. Indication of full or partial submittal.
14. Location(s) where product is to be installed, as appropriate.
15. Other necessary identification.
16. Remarks.
17. Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

1.5 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. Email: Prepare submittals as PDF package, and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on **Architect's** receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow **15** days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. **Architect** will advise Contractor when a submittal being processed must be delayed for coordination.
2. Resubmittal Review: Allow **15** days for review of each resubmittal.

D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

1.6 SUBMITTAL REQUIREMENTS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
   1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
   2. Mark each copy of each submittal to show which products and options are applicable.
   3. Include the following information, as applicable:
      a. Manufacturer's catalog cuts.
      b. Manufacturer's product specifications.
      c. Standard color charts.
      d. Statement of compliance with specified referenced standards.
      e. Testing by recognized testing agency.
      f. Application of testing agency labels and seals.
      g. Notation of coordination requirements.
      h. Availability and delivery time information.
   4. For equipment, include the following in addition to the above, as applicable:
      a. Wiring diagrams that show factory-installed wiring.
      b. Printed performance curves.
      c. Operational range diagrams.
      d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
   5. Submit Product Data before Shop Drawings, and before or concurrent with Samples.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data unless submittal based on Architect's digital data drawing files is otherwise permitted.
   1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
      a. Identification of products.
      b. Schedules.
      c. Compliance with specified standards.
      d. Notation of coordination requirements.
      e. Notation of dimensions established by field measurement.
      f. Relationship and attachment to adjoining construction clearly indicated.
      g. Seal and signature of professional engineer if specified.

C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.
   1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.

2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
    a. Project name and submittal number.
    b. Generic description of Sample.
    c. Product name and name of manufacturer.
    d. Sample source.
    e. Number and title of applicable Specification Section.
    f. Specification paragraph number and generic name of each item.
3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics, and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
    a. Number of Samples: Submit Two (2) full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
    a. Number of Samples: Submit Two (2) sets of Samples. Architect will retain one (1) Sample sets; remainder will be returned.
        1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
        2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least **three** sets of paired units that show approximate limits of variations.

D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of

assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

G. Certificates:
   1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
   2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
   3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
   4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
   5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
   6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

H. Test and Research Reports:
   1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
   2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
   3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
   4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
   5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
   6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
      a. Name of evaluation organization.
      b. Date of evaluation.
      c. Time period when report is in effect.
      d. Product and manufacturers' names.
      e. Description of product.

f. Test procedures and results.
g. Limitations of use.

1.7 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
   1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
   1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.8 CONTRACTOR'S REVIEW

A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp 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.
   1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.9 ARCHITECT'S REVIEW

A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required**,** and return it.
   1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action as follows:
      a. APPROVED – Fabrication/Installation may be undertaken. Approval does not authorize changes to the contract sum or contract time.
      b. APPROVED AS CORRECTED – Same as Approved
      c. REVISE AND RESUBMIT – Fabrication and/or installation may not be undertaken. In resubmitting, limit corrections to items marked.
      d. REJECTED – Same as “Revise and Resubmit”

e. NO ACTION TAKEN – Submittal either not required for this item or provided for information only. Informational Submittals Reviewed but not returned, or rejected if it does not comply with requirements.

B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Architect will return without review submittals received from sources other than Contractor.

F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013300

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 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. Uniform Standard Specifications for Public Works Construction by the Maricopa Association of Governments (MAG), latest edition.

C. City of Scottsdale Supplements to MAG Specifications, latest edition, as noted above.

1.2 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Requirements:

1. Division 01 Section "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Division 01 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
3. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
4. Division 01 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Landscape Architect's and Owner’s Representative’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 Landscape Architect's and Owner’s Representative’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."

C. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Landscape Architect and Owner's Representative and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Landscape Architect and Owner's Representative final release or approval.
    g. Scheduled date of fabrication.
    h. Scheduled dates for purchasing.
    i. Scheduled dates for installation.
    j. Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Landscape Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will not be provided by Landscape Architect for Contractor's use in preparing submittals.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Landscape Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Landscape Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Landscape Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Landscape Architect before being returned to Contractor.

D. Paper Submittals: Electronic submittals are highly encouraged. Only if necessary, use paper submittals. If providing paper submittals, place a permanent label or title block on each submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 6 inches on label or beside title block to record Contractor's review and approval markings and action taken by Landscape Architect.
3. Include the following information for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name of Landscape Architect.
    d. Name of Owner.
    e. Name of Contractor.

f. Name of subcontractor.
g. Name of supplier.
h. Name of manufacturer.
i. Submittal number or other unique identifier, including revision identifier.

1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Re-submittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).

j. Number and title of appropriate Specification Section.
k. Drawing number and detail references, as appropriate.
l. Location(s) where product is to be installed, as appropriate.
m. Other necessary identification.

4. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Landscape Architect or Owner's Representative observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Landscape Architect and Owner's Representative.

5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Landscape Architect and Owner's Representative will return without review received from sources other than Contractor.

a. Transmittal Form for Paper Submittals: Provide locations on form for the following information:

1) Project name.
2) Date.
3) Destination (To:).
4) Source (From:).
5) Name and address of Landscape Architect.
6) Name of Owner's Representative.
7) Name of Contractor.
8) Name of firm or entity that prepared submittal.
9) Names of subcontractor, manufacturer, and supplier.
10) Category and type of submittal.
11) Submittal purpose and description.
12) Specification Section number and title.
13) Specification paragraph number or drawing designation and generic name for each of multiple items.
14) Drawing number and detail references, as appropriate.
15) Indication of full or partial submittal.
16) Transmittal number**,** numbered consecutively.
17) Submittal and transmittal distribution record.
18) Remarks.

19) Signature of transmitter.

E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Landscape Architect and Owner's Representative.
4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software acceptable to Owner**,** containing the following information:

a. Project name.
b. Date.
c. Name and address of Landscape Architect.
d. Name of Owner's Representative.
e. Name of Contractor.
f. Name of firm or entity that prepared submittal.
g. Names of subcontractor, manufacturer, and supplier.
h. Category and type of submittal.
i. Submittal purpose and description.
j. Specification Section number and title.
k. Specification paragraph number or drawing designation and generic name for each of multiple items.
l. Drawing number and detail references, as appropriate.
m. Location(s) where product is to be installed, as appropriate.
n. Related physical samples submitted directly.
o. Indication of full or partial submittal.
p. Transmittal number, numbered consecutively.
q. Submittal and transmittal distribution record.
r. Other necessary identification.
s. Remarks.

5. Metadata: Include the following information as keywords in the electronic submittal file metadata:

a. Project name.
b. Number and title of appropriate Specification Section.
c. Manufacturer name.
d. Product name.

F. Options: Identify options requiring selection by Landscape Architect.

G. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Landscape Architect and Owner’s Representative on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

H. Re-submittals: Make re-submittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Landscape Architect's action stamp.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Landscape Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: To the greatest extent possible and as appropriate, all submittals should be PDF’s.

B. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Submit electronic submittals via email as PDF electronic files.

    a. Landscape Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

2. Action Submittals: Submit PDF of each submittal unless otherwise indicated. Landscape Architect will electronically annotate.
3. Informational Submittals: Submit PDF of each submittal unless otherwise indicated. Landscape Architect will electronically annotate as appropriate.
4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.

C. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

a. Manufacturer's catalog cuts.
b. Manufacturer's product specifications.
c. Standard color charts.
d. Statement of compliance with specified referenced standards.
e. Testing by recognized testing agency.
f. Application of testing agency labels and seals.
g. Notation of coordination requirements.
h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

a. Wiring diagrams showing factory-installed wiring.
b. Printed performance curves.
c. Operational range diagrams.
d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:

a. PDF electronic file.

D. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Identification of products.
b. Schedules.
c. Compliance with specified standards.
d. Notation of coordination requirements.
e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 24 by 36 inches.
3. Submit Shop Drawings in the following format:

    a. PDF electronic file.

E. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:

    a. Generic description of Sample.
    b. Product name and name of manufacturer.
    c. Sample source.
    d. Number and title of applicable Specification Section.
    e. Specification paragraph number and generic name of each item.

3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

    a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Landscape Architect will return submittal with options selected.

F. Coordination Drawing Submittals: Comply with requirements specified in Division 01 Section "Project Management and Coordination."

G. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

H. Application for Payment and Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."

I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."

J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."

K. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

T. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

U. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file or three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Landscape Architect.

B. Project Closeout and Maintenance Material Submittals: See requirements in Division 01 Section "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, 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.

3.2 LANDSCAPE ARCHITECT'S ACTION

A. Action Submittals: Landscape Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Landscape Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

B. Informational Submittals: Landscape Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Landscape Architect will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Landscape Architect.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for re-submittal without review.

E. Submittals not required by the Contract Documents may be returned by the Landscape Architect without action.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
   2. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.2 DEFINITIONS

A. Experienced: When used with an entity or individual, "experienced" unless otherwise further described means having successfully completed a minimum of [**five**] <**Insert number**> previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.
   1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).

D. Mockups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.
   1. Mockups are used for one or more of the following:
      a. Verify selections made under Sample submittals.
      b. Demonstrate aesthetic effects.
      c. Demonstrate the qualities of products and workmanship.
      d. Demonstrate successful installation of interfaces between components and systems.
      e. Perform preconstruction testing to determine system performance.

2. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
3. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.

E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.

F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

G. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source; for example, plant, mill, factory, or shop.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."

I. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

J. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect[**or Construction Manager**].

1.3 DELEGATED DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated Design Services Statement: Submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.4 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified is the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 ACTION SUBMITTALS

A. Mockup Shop Drawings:
   1. Include plans, sections, elevations, and details, indicating materials and size of mockup construction.
   2. Indicate manufacturer and model number of individual components.
   3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.6 INFORMATIONAL SUBMITTALS

A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
   1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
   2. Main wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.

B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

C. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, 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.

1.7 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, telephone number, and email address of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspection.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Statement on condition of substrates and their acceptability for installation of product.
2. Statement that products at Project site comply with requirements.
3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
5. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Statement that equipment complies with requirements.
2. Results of operational and other tests and a statement of whether observed performance complies with requirements.
3. Other required items indicated in individual Specification Sections.

1.8 QUALITY ASSURANCE

A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities be performed by entities who are recognized experts in those operations. Specialists will satisfy qualification requirements indicated and engage in the activities indicated.
   1. Requirements of authorities having jurisdiction supersede requirements for specialists.

G. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented according to **ASTM E329** and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
   1. Contractor responsibilities include the following:
      a. Provide test specimens representative of proposed products and construction.
      b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
      c. When testing is complete, remove test specimens and test assemblies,**and** mockups; do not reuse products on Project.
   2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

K. Mockups: 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 of size indicated.
   2. Build mockups in location indicated or, if not indicated, as directed by Architect.
   3. Notify Architect **seven** (7) days in advance of dates and times when mockups will be constructed.
   4. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed to perform same tasks during the construction at Project.
   5. Demonstrate the proposed range of aesthetic effects and workmanship.
   6. Obtain Architect's approval of mockups before starting corresponding work, fabrication, or construction.
      a. Allow **seven** (7) days for initial review and each re-review of each mockup.
   7. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
   8. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   10. Demolish and remove mockups when directed unless otherwise indicated.

1.9 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
   1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
   2. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
   1. Engage a qualified testing agency to perform quality-control services.
      a. Contractor will not employ same entity engaged by Owner, unless agreed to in writing by Owner.
   2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
   3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
   4. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
   5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

D. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
   1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
   2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
   3. Conduct and interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from requirements.
   4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
   5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
   6. Do not perform duties of Contractor.

E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."

F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
   1. Access to the Work.
   2. Incidental labor and facilities necessary to facilitate tests and inspections.
   3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
   4. Facilities for storage and field curing of test samples.
   5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
   6. Security and protection for samples and for testing and inspection equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
   1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.10 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner and as follows:
   1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
   2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
   3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
   4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
   5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
   6. Retesting and reinspecting corrected Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
   1. Date test or inspection was conducted.
   2. Description of the Work tested or inspected.
   3. Date test or inspection results were transmitted to Architect.
   4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's and authorities' having jurisdiction reference during normal working hours.
   1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspection, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 01 42 00

REFERENCES

PART 1 - GENERAL

1.01 QUALITY ASSURANCE

A. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on date of Contract Documents.

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

D. Should specified reference standards conflict with Contract Documents, request clarification from Design Professional/Engineer before proceeding.

E. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.02 SCHEDULE OF REFERENCES

AA	Aluminum Association 900 19th St. N.W., Suite 300 Washington, DC 20006 www.aluminum.org	(202) 862-5100
AABC	Associated Air Balance Council 1518 K. Street, N.W. Washington, DC 20005 www.aabchq.com	(202) 737-0202
AACPA	Autoclaved Aerated Concrete Product Association 3701 C.R. 544 E Haines City, FL 33844 www.aacpa.org	(863) 419-2058
AAMA	American Architectural Manufacturers Association 1540 E. Dundee Rd., Suite 310 Palatine, IL 6067-8321 www.aamanet.org	(847) 303-5664
AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol Street, N.W., Suite 249 Washington, DC 20001 www.aashto.org	(202) 624-5800
ACI	American Concrete Institute P. O Box 9094 Farmington Hills, MI 48999-9094 www.aci-net.org	(248) 848-3700

ADC	Air Diffusion Council 230 North Michigan Avenue Chicago, IL 60601 www.flexibleduct.org	(312) 201-0101
AFPA	American Forest and Paper Association (Formerly: National Forest Products Association 1111 19th St., NW, Suite 800 Washington, DC 20036 www.afandpa.org	(202) 463-2700
AI	Asphalt Institute 2696 Research Park Dr P.O. Box 14052 Lexington, KY 40512-4052 www.asphaltinstitute.org	(606) 288-4960
AIA	American Institute of Architects 1735 New York Avenue, N.W. Washington, DC 20006-5292 www.aia.org	(202) 626-7300
AISC	American Institute of Steel Construction 1 E. Wacker Dr., Suite 3100 Chicago, IL 60601 www.aisc.org	(312) 670-2400
AISI	American Iron and Steel Institute 1101 17th Street, N.W., Suite 1300 Washington, DC 20036 www.steel.org	(202) 452-7133
AITC	American Institute of Timber Construction 7012 S. Revere Pky, Suite 140 Englewood, CO 80112 www.aitc-glulam.org	(303) 792-9559
AMCA	Air Movement and Control Association 30 West University Drive Arlington Heights, IL 60004 www.amca.org	(847) 394-0150
AMG	Arizona Masonry Guild 5225 N. Central Ave., Suite 400 Phoenix, AZ 85014 www.azmasonryguild.org	(602) 265-5999
ANSI	American National Standards Institute 11 West 42nd Street, 13th Fl New York, NY 10036 www.ansi.org	(212) 642-4900
APA	Engineered Wood Association (Formerly: American Plywood Association) P.O. Box 11700 Tacoma, WA 98411 www.apawood.org	(253) 656-6600
API	American Petroleum Institute 1220 L Street, N.W. Washington, DC 20005 www.api.org	(202) 682-8000

AQMD	Air Quality Management District 21865 E. Copley Drive Diamond Bar, CA 91765 www.aqmd.gov	(909) 396-2000
ARI	Air-Conditioning and Refrigeration Institute 4301 N. Fairfax Dr., Suite 425 Arlington, VA 22203 www.ari.org	(703) 524-8800
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers 1791 Tullie Circle, N.E. Atlanta, GA 30329 www.ashrae.org	(800) 527-4723 (404) 636-8400
ASME	American Society of Mechanical Engineers 345 East 47th Street New York, NY 10017 www.asme.org	(800) 843-2763 (973) 882-1167
ASTM	American Society for Testing and Materials 100 Barr Harbor Dr West Conshohocken, PA 19428 www.astm.org	(610) 832-9585
AWI	Architectural Woodwork Institute 1952 Isaac Newton Square West Reston, VA 20190 www.awinet.org	(703) 733-0600
AWPA	American Wood Preservers Association PO Box 5690 Granbury, TX 76049 www.awpa.com	(817) 326-6300
AWS	American Welding Society 8669 NW 36 St., #130 Miami, FL 33166-6672 www.amweld.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235 www.awwa.org	(303) 794-7711
BHMA	Builders Hardware Manufacturer's Association 355 Lexington Ave., 17th Floor New York, NY 10017	(212) 661-4261
BIA	Brick Institute of America 11490 Commerce Park Drive Reston, VA 22091 www.bia.org	(703) 620-0010
CDA	Copper Development Association 260 Madison Ave. New York, NY 10016 www.copper.org	(212) 251-7200

CFPC	Certified Forest Products Council 14780 SW Osprey Drive, Suite 285 Beaverton, OR 97007 www.certifiedwood.org	(503) 590-6600
CISCA	Ceilings and Interior Systems Construction Association 1500 Lincoln Highway, Suite 202 St. Charles, IL 60174 www.cisca.org	(630) 584-1919
CLFMI	Chain Link Fence Manufacturers Institute 9891 Broken Land Pkwy, Ste 300 Columbia, MD 21046 www.chainlinkinfo.org	(301) 596-2584
CRI	The Carpet and Rug Institute Box 2048 Dalton, GA 30722-2048 www.carpet-rug.com	(706) 278-3176
CRSI	Concrete Reinforcing Steel Institute 933 Plum Grove Road Schaumburg, IL 60173 www.crsi.org	(847) 517-1200
CSSB	Cedar Shingle and Shake Bureau (Formerly: Red Cedar Shingle and Handsplit Shake Bureau) 515 116th Avenue Bellevue, WA 98004	(425) 453-1323
DCAT	Development Center for Appropriate Technology P.O. Box 41144 Tucson, AZ 85717 www.dcat.net	(520) 624-6628
DHI	Door and Hardware Institute 14170 Newbrook Drive Chantilly, VA 20151 www.dhi.org	(703) 222-2010
DOE	U.S. Department of Energy 1000 Independence Ave., SW Washington, DC 20585 http://www.energy.gov	(800) 342-5363
EEBA	Energy and Environmental Building Association 10740 Lyndale Avenue South, 10W, Bloomington, MN 55420-5615 http://www.eeba.org/	(952) 881-1098
EBN	Environmental Building News 122 Birge St., Suite 30 Brattelboro, VT 05301 www.BuildingGreen.com	(802) 257-7300
EJMA	Expansion Joint Manufacturers Association 25 North Broadway Tarrytown, NY 10591 www.ejma.org	(914) 332-0040

EPA	U.S. Environmental Protection Agency 401 M St. WS, 6202J Washington, DC 20460 www.epa.gov	(202) 775-6650
FSC	Forest Stewardship Council - U.S. 1155 30th Street NW, Suite 300 Washington, DC 20007 www.fscus.org	(877) 372-5646
FM	FM Global (Formerly: Factory Mutual System) 1151 Boston-Providence Turnpike P.O. Box 688 Norwood, MA 02062 www.factorymutual.com	(781) 762-4300
GA	Gypsum Association 125 S Franklin St Chicago, IL 60606 www.usg.com	(312) 606-4000
GANA	Glass Association of North America (Formerly: Flat Glass Marketing Association) 3310 SW Harrison St Topeka, KS 66611 www.glasswebsite.com/gana	(785) 266-7013
ICC	International Code Council Headquarters 5203 Leesburg Pike, Suite 600 Falls Church, VA 22041 Los Angeles District Office 5360 S. Workman Mill Road Whittier, CA 90601 http://www.iccsafe.org/	(703) 931-4533 (800) 284-4406
IEEE	Institute of Electrical and Electronics Engineers 3 Park Ave 17th Floor New York, NY 10016 www.ieee.org	(212) 419-7900
ISRI	Institute of Scrap Recycling Industries 1325 G St. NW, Suite 1000 Washington, DC 20005-3104 www.isri.org	(202) 737-1770
MAG	Maricopa Association of Governments 302 N. 1st Street, suite 300 Phoenix, AZ 85003 www.mag.maricopa.gov	(602) 254-6300
MBMA	Metal Building Manufacturer's Association 1300 Sumner Ave. Cleveland, OH 44115	(216) 241-7333
MIL	Military Specification Naval Publications and Forms Center 5801 Tabor Avenue Philadelphia, PA 19120	

ML/SFA	Metal Lath/Steel Framing Association (A Division fo the NAAMM) 8 South Michigan Ave., Suite 1000 Chicago, IL 60603	(312) 456-5590
NAAMM	National Association of Architectural Metal Manufacturers 8 South Michigan Ave, Suite 1000 Chicago, IL 60603 www.naamm.org	(312) 456-5590
NCMA	National Concrete Masonry Association 2302 Horse Pen Rd. Herndon, VA 22071 www.ncma.org	(703) 713-1900
NEBB	National Environmental Balancing Bureau 8575 Grovemont Circle Gaithersburg, MD 20877 www.nebb.org	(301) 977-3698
NEMA	National Electrical Manufacturers Association 1300 N 17th St, Ste 1847 Rosslyn, VA 22209 www.nema.org	(703) 841-3200
NFPA	National Fire Protection Association 1 Battery March Park Quincy, MA 02269 www.nfpa.org	(800) 344-3555 (617) 770-3000
NRCA	National Roofing Contractors Association 10255 W. Higgins Rd., Suite 600 Rosemont, IL 60018 www.roofonline.org	(847) 299-9070
NTMA	National Terrazzo and Mosaic Association 110 E Market St, Ste 200A Leesburg, VA 20176 www.ntma.com	(800) 323-9736 (703) 779-1022
PCA	Portland Cement Association 5420 Old Orchard Road Skokie, IL 60077 www.portcement.org	(847) 966-6200
PCI	Precast/Prestressed Concrete Institute 209 W. Jackson Blvd Chicago, IL 60606 www.pci.org	(312) 786-0300
PDCA	Painting and Decorating Contractors of America 3913 Old Lee Hwy., Suite 33B Fairfax, VA 22030 www.pdca.com	(703) 359-0826
PS	Product Standard U. S. Department of Commerce Washington, DC 20203	
RIS	Redwood Inspection Service 405 Enfrente Rd Novato, CA 94949	(415) 382-0662

RCSHSB	Red Cedar Shingle and Handsplit Shake Bureau	Refer to CSSB
RFCI	Resilient Floor Covering Institute 966 Hungerford Dr., Suite 12B Rockville, MD 20850 www.buildernet.com/rfci	(301) 340-8580
SDI	Steel Deck Institute P.O. Box 25 Fox River Grove, IL 60021-0025 www.sdi.org	(847) 462-1930
SDI	Steel Door Institute 30200 Detroit Rd. Cleveland, OH 44145 www.steeldoor.org	(440) 899-0010
SIGMA	Sealed Insulating Glass Manufacturers Association 401 N. Michigan Ave Chicago, IL 60611 www.sigmaonline.org	(312) 664-6610
SJI	Steel Joist Institute 3127 10th Ave Extension North Myrtle Beach, SC 29582 www.steeljoist.org	(843) 626-1995
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association 4201 Lafayette Center Drive Chantilly, VA 20151 www.smacna.org	(703) 803-2980
SSPC	The Society for Protective Coatings (Formerly: Steel Structures Painting Council) 4516 Henry St., 6th Flr Pittsburgh, PA 15222 www.sspc.org	(412) 281-2331
TCNA	Tile Council of North America, Inc. 100 Clemson Research Blvd Anderson, SC 29625 www.tileusa.com	(864) 646-8453
UL	Underwriters' Laboratories, Inc. 333 Pfingston Road Northbrook, IL 60062 www.ul.com	(800) 704-4050
USGBC	US Green Building Council 1825 I St. NW, Suite 400 Washington, DC 20006 www.usgbc.org	(202) 429-2081
WCLIB	West Coast Lumber Inspection Bureau Box 23145 Portland, OR 97281 www.wclib.org	(503) 639-0651

WDMA	Window and Door Manufacturing Association (Formerly: National Woodwork Manufacturers Association 1400 E. Touhy Avenue, Ste 470 Des Plaines, IL 60018 www.wdma.com	(800) 223-2301
WWPA	Western Wood Products Association 522 S.W. 5th Ave., Ste 500 Portland, OR 97204 www.wwpa.org	(503) 224-3930

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

1.2 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
   3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, 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.

B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.
   1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that

does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
   1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
   2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.

E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 013300 "Submittal Procedures."

F. Substitution: Refer to Section 012500 "Substitution Procedures" for definition and limitations on substitutions.

1.3 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

1.5 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
   1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
   2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
   1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
   2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
   3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
   4. Where products are accompanied by the term "as selected," Architect will make selection.
   5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Product Selection Procedures:
   1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
      a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."
   2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
      a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."
   3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
      a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."
   4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.

a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.

5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
   a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."
6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.
   a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
   b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.
7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
   a. For approval of products by unnamed manufacturers, comply with requirements in Section 012500 "Substitution Procedures" for substitutions for convenience.

C. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
   1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:

1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 013300 "Submittal Procedures."
   1. Form of Approval of Submittal: As specified in Section 013300 "Submittal Procedures."
   2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

C. Submittal Requirements, Two-Step Process: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

D. Submittal Requirements, Single-Step Process: When acceptable to Architect, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by the Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:
   1. Construction layout.
   2. Field engineering and surveying.
   3. Installation of the Work.
   4. Cutting and patching.
   5. Progress cleaning.
   6. Starting and adjusting.
   7. Protection of installed construction.
   8. Correction of the Work.

1.2 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.3 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
   1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
   2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
   3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in

reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.

C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where

indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to [**local utility**] [**Owner**] that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect in accordance with requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Architect promptly.

B. Engage a land surveyor experienced in laying out the Work, using the following accepted surveying practices:

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record 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. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of **two** permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

3.5 INSTALLATION

A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical work plumb and make horizontal work level.
   2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
   3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
   4. Maintain minimum headroom clearance of 96 inches (2440 mm) in occupied spaces and 90 inches (2300 mm) in unoccupied spaces, unless otherwise indicated on Drawings.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.

F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.

G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.
   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
   2. Allow for building movement, including thermal expansion and contraction.
   3. 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.

I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.

3.6 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
   1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of Work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

F. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
   4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
   5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
   6. Proceed with patching after construction operations requiring cutting are complete.

G. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.

   1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
   2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
   a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.
4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

H. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 PROGRESS CLEANING

A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
   1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
   2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
   3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
      a. Use containers intended for holding waste materials of type to be stored.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.
   1. Remove liquid spills promptly.
   2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in **Section 015000 "Temporary Facilities and Controls."** [

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.

C. Comply with manufacturer's written instructions for temperature and relative humidity.

3.10 CORRECTION OF THE WORK

A. Repair or remove and replace damaged, defective, or nonconforming Work. Restore damaged substrates and finishes.
   1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.

C. Restore permanent facilities used during construction to their specified condition.

D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:
   1. Substantial Completion procedures.
   2. Final completion procedures.
   3. Warranties.
   4. Final cleaning.

1.2 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest-control inspection.

1.3 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of **10** days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
   1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
   3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
   4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect Label with manufacturer's name and model number.
   5. Submit testing, adjusting, and balancing records.
   6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of **10** days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
   1. Advise Owner of pending insurance changeover requirements.
   2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
   3. Complete startup and testing of systems and equipment.
   4. Perform preventive maintenance on equipment used prior to Substantial Completion.
   5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
   6. Advise Owner of changeover in utility services.
   7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
   8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
   9. Complete final cleaning requirements.
   10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1.4 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:
   1. Submit a final Application for Payment in accordance with Section 012900 "Payment Procedures."
   2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
   3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
   4. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1.5 LIST OF INCOMPLETE ITEMS

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
   1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor, listed by room or space number.
   2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
   3. Include the following information at the top of each page:
      a. Project name.
      b. Date.
      c. Name of Architect
      d. Name of Contractor.
      e. Page number.
   4. Submit list of incomplete items in the following format:
      a. MS Excel Electronic File: Architect will return annotated file.
      b. PDF Electronic File: Architect will return annotated file.
      c. Web-Based Project Software Upload: Utilize software feature for creating and updating list of incomplete items (punch list).

1.6 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

C. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
   1. Submit on digital media acceptable to Architect

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
   1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
      a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
      b. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
      c. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
      d. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.
      e. Vacuum and mop concrete.
      f. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
      g. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
      h. Remove labels that are not permanent.
      i. Wipe surfaces of mechanical and electrical equipment**[, elevator equipment,]** and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
      j. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
      k. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
      l. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
         1) Clean HVAC system in compliance with NADCA ACR.
      m. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
      n. Clean strainers.
      o. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste-disposal requirements in Section 015000 "Temporary Facilities and Controls."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations required by Section 017300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory manuals.
   2. Emergency manuals.
   3. Systems and equipment operation manuals.
   4. Systems and equipment maintenance manuals.
   5. Product maintenance manuals.

1.2 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
   1. Architect will comment on whether content of operation and maintenance submittals is acceptable.
   2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operation and maintenance manuals in the following format:
   1. Submit on digital media acceptable to Architect Enable reviewer comments on draft submittals.

C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
   1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

D. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.3 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

1.4 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:
1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.5 EMERGENCY MANUALS

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Content: Organize manual into a separate section for each of the following:
   1. Type of emergency.
   2. Emergency instructions.
   3. Emergency procedures.

C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
   1. Fire.
   2. Flood.
   3. Gas leak.
   4. Water leak.
   5. Power failure.
   6. Water outage.
   7. System, subsystem, or equipment failure.
   8. Chemical release or spill.

D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

E. Emergency Procedures: Include the following, as applicable:
   1. Instructions on stopping.
   2. Shutdown instructions for each type of emergency.
   3. Operating instructions for conditions outside normal operating limits.
   4. Required sequences for electric or electronic systems.
   5. Special operating instructions and procedures.

1.6 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.

B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
   1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
   2. Performance and design criteria if Contractor has delegated design responsibility.
   3. Operating standards.
   4. Operating procedures.
   5. Operating logs.
   6. Wiring diagrams.

7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

C. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

D. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

1.7 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds, as described below.

C. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
    a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

H. Include procedures to follow and required notifications for warranty claims.

I. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1.8 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for Project Record Documents, including the following:
   1. Record Drawings.
   2. Record specifications.
   3. Record Product Data.
   4. Miscellaneous record submittals

1.2 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit one set of marked-up record prints.
   2. Number of Copies: Submit copies of Record Drawings as follows:
      a. Initial Submittal:
         1) Submit one paper-copy set(s) of marked-up record prints.
         2) Submit PDF electronic files of scanned record prints and one set of file prints.
         3) Submit Record Digital Data Files and one set(s) of plots
         4) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
      b. Final Submittal:
         1) Submit three paper-copy set(s) of marked-up record prints.
         2) Submit PDF electronic files of scanned Record Prints and three set(s) of file prints.
         3) Print each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit annotated PDF electronic files and paper copies of Project's Specifications, including addenda and Contract modifications.

C. Record Product Data: Submit annotated PDF electronic files of each submittal.
   1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

1.3 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
   1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data,

whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
   a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
   b. Accurately record information in an acceptable drawing technique.
   c. Record data as soon as possible after obtaining it.
   d. Record and check the markup before enclosing concealed installations.
   e. Cross-reference record prints to corresponding photographic documentation.
2. Content: Types of items requiring marking include, but are not limited to, the following:
   a. Dimensional changes to Drawings.
   b. Revisions to details shown on Drawings.
   c. Depths of foundations.
   d. Locations and depths of underground utilities.
   e. Revisions to routing of piping and conduits.
   f. Revisions to electrical circuitry.
   g. Actual equipment locations.
   h. Duct size and routing.
   i. Locations of concealed internal utilities.
   j. Changes made by Change Order or Construction Change Directive.
   k. Changes made following Architect's written orders.
   l. Details not on the original Contract Drawings.
   m. Field records for variable and concealed conditions.
   n. Record information on the Work that is shown only schematically.
3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Annotated PDF electronic file with comment function enabled.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Architect for resolution.
4. Architect will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.

C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.

3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:
   a. Project name.
   b. Date.
   c. Designation "PROJECT RECORD DRAWINGS."
   d. Name of Architect
   e. Name of Contractor.

1.4 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation, where installation varies from that indicated in Specifications, addenda, and Contract modifications.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
   3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.

B. Format: Submit record specifications as annotated PDF electronic file

1.5 RECORD PRODUCT DATA

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.

B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
   3. Note related Change Orders**,** Record Specifications, and Record Drawings where applicable.

C. Format: Submit Record Product Data as annotated PDF electronic file
   1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

1.6 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible

condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Instruction in operation and maintenance of systems, subsystems, and equipment.
   2. Demonstration and training video recordings.

1.2 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
   1. At completion of training, submit complete training manual(s) for Owner's use prepared in same paper and PDF file format required for operation and maintenance manuals specified in Section 017823 "Operation and Maintenance Data."

1.3 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

1.4 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.5 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
   1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
      a. System, subsystem, and equipment descriptions.
      b. Performance and design criteria if Contractor is delegated design responsibility.
      c. Operating standards.
      d. Regulatory requirements.
      e. Equipment function.
      f. Operating characteristics.
      g. Limiting conditions.
      h. Performance curves.
   2. Documentation: Review the following items in detail:
      a. Emergency manuals.
      b. Systems and equipment operation manuals.
      c. Systems and equipment maintenance manuals.
      d. Product maintenance manuals.
      e. Project Record Documents.
      f. Identification systems.
      g. Warranties and bonds.
      h. Maintenance service agreements and similar continuing commitments.
   3. Emergencies: Include the following, as applicable:
      a. Instructions on meaning of warnings, trouble indications, and error messages.
      b. Instructions on stopping.
      c. Shutdown instructions for each type of emergency.
      d. Operating instructions for conditions outside of normal operating limits.
      e. Sequences for electric or electronic systems.
      f. Special operating instructions and procedures.
   4. Operations: Include the following, as applicable:
      a. Startup procedures.
      b. Equipment or system break-in procedures.
      c. Routine and normal operating instructions.
      d. Regulation and control procedures.
      e. Control sequences.
      f. Safety procedures.
      g. Instructions on stopping.
      h. Normal shutdown instructions.
      i. Operating procedures for emergencies.
      j. Operating procedures for system, subsystem, or equipment failure.
      k. Seasonal and weekend operating instructions.
      l. Required sequences for electric or electronic systems.
      m. Special operating instructions and procedures.
   5. Adjustments: Include the following:
      a. Alignments.
      b. Checking adjustments.
      c. Noise and vibration adjustments.
      d. Economy and efficiency adjustments.
   6. Troubleshooting: Include the following:
      a. Diagnostic instructions.

b. Test and inspection procedures.

7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning.
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.
8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

1.6 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

1.7 INSTRUCTION

A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

B. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
   1. Schedule training with Owner and Architect with at least seven (7) days' advance notice.

C. Cleanup: Collect used and leftover educational materials and remove from Project site and give to Owner instructional equipment. Restore systems and equipment to condition existing before initial training use.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 017900

Project No. 0520-0020

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Demolition and removal of selected portions of building or structure.
   2. Demolition and removal of selected site elements.
   3. Salvage of existing items to be reused or recycled.

1.2 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
   1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.3 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Engineering Survey: Submit engineering survey of condition of building.

B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

C. Schedule of selective demolition activities with starting and ending dates for each activity.
   1. Detailed sequence of selective demolition and removal of work, starting and ending dates for each activity.

D. Predemolition photographs or video.

E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician.

1.5 CLOSEOUT SUBMITTALS

A. Inventory of items that have been removed and salvaged.

1.6 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.7 FIELD CONDITIONS

A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
   1. Before selective demolition, Owner will remove the following items:
      a. All interior furnishings and equipment within the buildings.

B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
   1. Hazardous materials will be removed by Owner before start of the Work.
   2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

D. Storage or sale of removed items or materials on-site is not permitted.

E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
   1. Maintain fire-protection facilities in service during selective demolition operations.

F. Arrange selective demolition schedule so as not to interfere with Owner's operations.

1.8 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

C. Inventory and record the condition of items to be removed and salvaged.

D. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

3.2 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
   1. Arrange to shut off utilities with utility companies.
   2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
   3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
      a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
      b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
      c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
      d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
      e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
      f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.4 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
   2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
   3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
   4. Maintain fire watch during and for at least 2 hours after flame-cutting operations.
   5. Maintain adequate ventilation when using cutting torches.
   6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off site.
   7. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
   8. Dispose of demolished items and materials promptly.

B. Selective demolition procedures for specific materials:
   1. Concrete: Demolish in sections; cut concrete full depth at junctures with construction to remain and at regular intervals using power driven saw, and then remove concrete between saw cuts.
   2. Masonry: Demolish in small sections; cut masonry at junctures with construction to remain using power driven saw and then remove masonry between saw cuts,
   3. Concrete Slabs-on-Grade: Saw cut perimeter of area to be demolished and then break up and remove.

4. Resilient Floor Covering: Remove floor coverings and adhesive according to recommendations in RFCI's "recommended Work Practices for the Removal of Resilient Floor Coverings". Do not use methods requiring solvent based adhesive strippers.
5. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight. See Sections covering Roofing in division 7 of this project manual for new roofing requirements.
    a. Remove existing roof membrane, flashings, copings and roof accessories.
    b. Remove existing roofing system down to substrate.

C. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

D. Removed and Salvaged Items:
1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner
5. Protect items from damage during transport and storage.

E. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

F. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition\ and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 CLEANING

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:
   1. Section 03 35 43 “Polished Concrete Finishing” for floors

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, and other pozzolans materials subject to compliance with requirements.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at **Project site**.

1.4 ACTION SUBMITTALS

A. Product Data: For each of the following.
   1. Portland cement.
   2. Fly ash.
   3. Slag cement.
   4. Blended hydraulic cement.
   5. Aggregates.
   6. Admixtures:
      a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
   7. Vapor retarders.
   8. Liquid floor treatments.
   9. Curing materials.
   10. Joint fillers.
   11. Form materials and form release agents
   12. Steel Reinforcement and accessories

13. Fiber reinforcement
14. Waterstops
15. Bonding Agents
16. Vapor retarders
17. Repair materials

B. Design Mixtures: For each concrete mixture, include the following:
1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Slump limit.
6. Air content.
7. Nominal maximum aggregate size.
8. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
9. Intended placement method.
10. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings:
1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
a. Location of construction joints is subject to approval of the Architect.

D. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:
1. Concrete Class designation.
2. Location within Project.
3. Exposure Class designation.
4. Formed Surface Finish designation and final finish.
5. Final finish for floors.
6. Curing process.
7. Floor treatment if any.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each of the following, signed by manufacturers:
1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Vapor retarders.
5. Joint-filler strips.

B. Material Test Reports: For the following, from a qualified testing agency:
1. Portland cement.
2. Fly ash.
3. Slag cement.

4. Blended hydraulic cement.
5. Aggregates.
6. Admixtures:

C. Research Reports: For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.

D. Preconstruction Test Reports: For each mix design.

E. Field quality-control reports.

F. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

A. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
2. Installer Qualifications: A qualified installer who employs on the project personnel qualified as ACI certified Flatwork Technician and Finisher and a supervisor who is an ACI Certified Concrete Flatwork Technician.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.
1. Include the following information in each test report:
a. Admixture dosage rates.
b. Slump.
c. Air content.
d. Seven-day compressive strength.
e. 28-day compressive strength.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301 (ACI 301M).

1.9 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 306.1.

B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M).

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 (ACI 301M) unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Cementitious Materials:
   1. Portland Cement: ASTM C150/C150M, gray
   2. Fly Ash: ASTM C618, Class C or F.
   3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S or Class 3M coarse aggregate or better, graded. Provide aggregates from a single source.
   1. Alkali-Silica Reaction: Comply with one of the following:
      a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
      b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
      c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. (2.37 kg/cu. m) for moderately reactive aggregate or 3 lb./cu. yd. (1.78 kg/cu. m) for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301 (ACI 301M).
   2. Maximum Coarse-Aggregate Size: 1-1/2 inches (38 mm) nominal.
   3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Air-Entraining Admixture: ASTM C260/C260M.

D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride in steel-reinforced concrete.
   1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
   2. Retarding Admixture: ASTM C494/C494M, Type B.
   3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
   5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
   6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

E. Water and Water Used to Make Ice: ASTM C94/C94M, potable.

2.3 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

2.4 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

B. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.
   1. Color:
      a. Ambient Temperature Below 50 deg F (10 deg C): Black.
      b. Ambient Temperature between 50 deg F (10 deg C) and 85 deg F (29 deg C): Any color.
      c. Ambient Temperature Above 85 deg F (29 deg C): White.

C. Curing Paper: Eight-feet- (2438-mm-) wide paper, consisting of two layers of fibered kraft paper laminated with double coating of asphalt.

D. Water: Potable or complying with ASTM C1602/C1602M.

E. Clear, Waterborne, Membrane-Forming, Nondissipating Curing Compound: ASTM C309, Type 1, Class B, certified by curing compound manufacturer to not interfere with bonding of floor covering.

F. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

2.5 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.

B. Floor Slab Protective Covering: Eight-feet- (2438-mm-) wide cellulose fabric.

2.6 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301 (ACI 301M).
   1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
   1. Fly Ash or Other Pozzolans: 25 percent by mass.
   2. Slag Cement: 50 percent by mass.

3. Total of Fly Ash or Other Pozzolans, Slag Cement: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass.
4. Total of Fly Ash or Other Pozzolans: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.
1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.

2.7 CONCRETE MIXTURES

A. Class Normal-weight concrete used for footings, and exterior slab on grade.
1. Exposure Class: ACI 318 (ACI 318M)
2. Minimum Compressive Strength: As indicated at 28 days.
3. Maximum w/cm: 0.50.
4. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm)

B. Class B Normal-weight concrete used for interior slabs-on-ground.
1. Exposure Class: ACI 318 (ACI 318M)
2. Minimum Compressive Strength As indicated at 28 days.
3. Maximum w/cm: 0.50

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M and furnish batch ticket information.

PART 3 - EXECUTION

3.1 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.
1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.2 JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.
   1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
   2. Place joints perpendicular to main reinforcement.
      a. Continue reinforcement across construction joints unless otherwise indicated.
      b. Do not continue reinforcement through sides of strip placements of floors and slabs.
   3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
   4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
   5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
   6. Space vertical joints in walls as indicated on Drawings Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.

C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:
   1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
   2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
   1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
   2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints:
   1. Install dowel bars and support assemblies at joints where indicated on Drawings.
   2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

F. Dowel Plates: Install dowel plates at joints where indicated on Drawings.

3.3 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
   1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.

2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M), but not to exceed the amount indicated on the concrete delivery ticket.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
1. If a section cannot be placed continuously, provide construction joints as indicated.
2. Deposit concrete to avoid segregation.
3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301 (ACI 301M).
    a. Do not use vibrators to transport concrete inside forms.
    b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer.
    c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
    d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Do not place concrete floors and slabs in a checkerboard sequence.
2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Maintain reinforcement in position on chairs during concrete placement.
4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleed water appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

3.4 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:
   1. ACI 301 (ACI 301M) Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.
      a. Patch voids larger than 1-1/2 inches (38 mm) wide or 1/2 inch (13 mm) deep.
      b. Remove projections larger than 1 inch (25 mm).
      c. Tie holes do not require patching.
      d. Surface Tolerance: ACI 117 (ACI 117M) Class D.
      e. Apply to concrete surfaces not exposed to public view.
   2. ACI 301 (ACI 301M) Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.
      a. Patch voids larger than 3/4 inch (19 mm) wide or 1/2 inch (13 mm) deep.
      b. Remove projections larger than 1/4 inch (6 mm).
      c. Patch tie holes.
      d. Surface Tolerance: ACI 117 (ACI 117M) Class B.
      e. Locations: Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
   3. ACI 301 (ACI 301M) Surface Finish SF-3.0:
      a. Patch voids larger than 3/4 inch (19 mm) wide or 1/2 inch (13 mm) deep.
      b. Remove projections larger than 1/8 inch (3 mm).
      c. Patch tie holes.
      d. Surface Tolerance: ACI 117 (ACI 117M) Class A.
      e. Locations: Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

B. Related Unformed Surfaces:
   1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
   2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.5 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, re-straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish:
   1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.
   2. Use stiff brushes, brooms, or rakes to produce a profile depth of 1/4 inch (6 mm) in one direction.
   3. Apply scratch finish to surfaces to receive concrete floor toppings, to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish:
1. When bleed water sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
2. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 (ACI A117M) tolerances for conventional concrete.
3. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish:
1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
7. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch (6 mm).

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated on Drawings, where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.
1. Coordinate required final finish with Architect before application.
2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.
1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.

G. Slip-Resistive Finish: Before final floating, apply slip-resistive aggregate finish to concrete stair treads, platforms, ramps as indicated on Drawings
1. Apply in accordance with manufacturer's written instructions and as follows:
    a. Uniformly spread 25 lb/100 sq. ft. (12 kg/10 sq. m) of dampened slip-resistive aggregate over surface in one or two applications.
    b. Tamp aggregate flush with surface, but do not force below surface.
    c. After broadcasting and tamping, apply float finish.
    d. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate.

H. Abrasive Blast Finish: After comncrete has cured a minimum of 28 days, apply a light (SF2) exposing some of the fine aggregate, but not to exceed 116 inch (1.5 mm) cut finish to the surface of the the concrete where noted.
   1. Provide abrasive blast finish sample prior to executing for approval.

3.6 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:
   1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
   2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
   3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:
   1. Coordinate sizes and locations of concrete bases with actual equipment provided.
   2. Construct concrete bases 8 inches (200 mm) high unless otherwise indicated on Drawings, and extend base not less than 6 inches (150 mm) in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
   3. Minimum Compressive Strength: 5000 psi (34.5 MPa) at 28 days.
   4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
   5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
   6. Prior to pouring concrete, place and secure anchorage devices.
      a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
      b. Cast anchor-bolt insert into bases.
      c. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.7 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
   1. Comply with ACI 301 (ACI 301M) and ACI 306.1 for cold weather protection during curing.
   2. Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M) for hot-weather protection during curing.

B. Curing Formed Surfaces: Comply with ACI 308.1 (ACI 308.1M) as follows:
   1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.

2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
3. If forms remain during curing period, moist cure after loosening forms.
4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
    a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
    b. Continuous Sprinkling: Maintain concrete surface continuously wet.
    c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
    d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
    e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
        1) Recoat areas subject to heavy rainfall within three hours after initial application.
        2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 (ACI 308.1M) as follows:
1. Begin curing immediately after finishing concrete.
2. Interior Concrete Floors:
    a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
        1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
            a) Lap edges and ends of absorptive cover not less than 12-inches (300-mm).
            b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
        2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive.
            a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
            b) Cure for not less than seven days.
        3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
            a) Water.
            b) Continuous water-fog spray.
    b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:
        1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
        2) Lap edges and ends of absorptive cover not less than 12 inches (300 mm).

a) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

3) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive.
   a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
   b) Cure for not less than seven days.
4) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
   a) Water.
   b) Continuous water-fog spray.

c. Floors to Receive Chemical Stain:
   1) As soon as concrete has sufficient set to permit application without marring concrete surface, install curing paper over entire area of floor.
   2) Install curing paper square to building lines, without wrinkles, and in a single length without end joints.
   3) Butt sides of curing paper tight; do not overlap sides of curing paper.
   4) Leave curing paper in place for duration of curing period, but not less than 28 days.

d. Floors to Receive Curing Compound:
   1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
   2) Recoat areas subjected to heavy rainfall within three hours after initial application.
   3) Maintain continuity of coating, and repair damage during curing period.
   4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

e. Floors to Receive Curing and Sealing Compound:
   1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
   2) Recoat areas subjected to heavy rainfall within three hours after initial application.
   3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

3.8 TOLERANCES

A. Conform to ACI 117 (ACI 117M).

3.9 APPLICATION OF LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment in accordance with manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.
3. Rinse with water; remove excess material until surface is dry.
4. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller in accordance with manufacturer's written instructions.

3.10 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.

B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
    a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:
        1) Project name.
        2) Name of testing agency.
        3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
        4) Name of concrete manufacturer.
        5) Date and time of inspection, sampling, and field testing.
        6) Date and time of concrete placement.
        7) Location in Work of concrete represented by samples.
        8) Date and time sample was obtained.
        9) Truck and batch ticket numbers.
        10) Design compressive strength at 28 days.
        11) Concrete mixture designation, proportions, and materials.
        12) Field test results.
        13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
        14) Type of fracture and compressive break strengths at seven days and 28 days.

C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size,

design air content, design slump at time of batching, and amount of water that can be added at Project site.

D. Inspections:
1. Headed bolts and studs.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Verification of concrete strength before removal of shores and forms from beams and slabs.
6. Batch Plant Inspections: On a random basis, as determined by Architect.

E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
   a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C143/C143M:
   a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   b. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete; ASTM C173/C173M volumetric method, for structural lightweight concrete.
   a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C1064/C1064M:
   a. One test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C31/C31M:
   a. Cast and laboratory cure two sets of four 6-inch (150 mm) by 12-inch (300 mm) or 4-inch (100 mm) by 8-inch (200 mm) cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C39/C39M.
   a. Test one set of four laboratory-cured specimens at seven days and one set of two specimens at 28 days.
   b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa) if specified compressive strength is 5000 psi (34.5 MPa), or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi (34.5 MPa).

9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
10. Additional Tests:
    a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
    b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
        1) Acceptance criteria for concrete strength shall be in accordance with ACI 301 (ACI 301M), section 1.6.6.3.
11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 (ASTM E1155M) within 48 hours of completion of floor finishing and promptly report test results to Architect.

3.11 PROTECTION

A. Protect concrete surfaces as follows:
1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

END OF SECTION 033000

SECTION 04 20

00 UNIT

MASONRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Concrete masonry units.
2. Mortar and grout.
3. Steel reinforcing bars.
4. Masonry-joint reinforcement.
5. Ties and anchors.
6. Miscellaneous masonry accessories.

1.02 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:
1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.

1.04 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of product and for masonry units include data on material properties and material test reports substantiating compliance with requirements:

B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
2. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do notuse

1.06 FIELD CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.01 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

2.02. CONCRETE MASONRY UNITS

B. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
   1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
   2. Provide square-edged units for outside corners unless otherwise indicated.

C. CMUs: ASTM C90, Light Weight
   1. Unit Compressive Strength: Provide units with minimum average net area compressive strength of 2150 psi (14.8 MPa).
   2. Density Classification: Light weight unless otherwise indicated
   3. Size (Width): Manufactured to dimensions 3/8 inch (10 mm) less than nominal dimensions.

2.02 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
   1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Masonry Cement: ASTM C91/C91M

E. Preblended Dry Mortar Mix: Packaged blend made from portland cement and hydrated lime masonry cement, sand and admixturescomplying with ASTM C1714/C1714M.
1. Preblended Dry Portland Cement Mortar Mix.
2. Preblended Dry Masonry Cement Mortar Mix.

F. Aggregate for Mortar: ASTM C144.
1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
3. White Mortar Aggregates: Natural white sand or crushed white stone.

G. Aggregate for Grout: ASTM C404

H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

I. Water: Potable.

2.03 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60 (Grade 420).

B. Masonry-Joint Reinforcement, General: ASTM A951/A951M.
1. Interior Walls: Hot-dip galvanized carbon steel.
2. Exterior Walls: Hot-dip galvanized carbon steel.
3. Wire Size for Side Rods: 0.148-inch (3.77-mm) diameter.
4. Wire Size for Cross Rods: 0.148-inch (3.77-mm) diameter.
5. Spacing of Cross Rods, Tabs and Cross Ties: Not more than 16 inches (406 mm).
6. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.

C. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder type with single pair of side rods.

2.04 TIES AND ANCHORS

A. General: Ties and anchors shall extend at least 1-1/2 inches (38 mm) into veneer but with at least a 5/8- inch (16-mm) cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
1. Hot-Dip Galvanized Carbon Steel Wire: ASTM A1064/A1064M with ASTM A153/A153M, Class B-2 coating.

C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches (102 mm) wide.
1. Wire Fabricated from 3/16 inch (4.76 mm) diameter galvanized steel wire. Mill galvanized wire ties

may be used in interior walls unless noted otherwise indicated.

2.05. MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane, or PVC.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805 or PVC, complying with ASTM D2287, Type PVC- 65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

2.06. MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. Use portland cement-lime or masonry cement mortar unless otherwise indicated.
   3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view,
      regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish diy mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270.
   1. For masonry below grade or in contact with earth, use Type M.
   2. For reinforced masonry, use Type M.
   3. For mortar parge coats, use Type S or Type N.
   4. For exterior, above-grade, load-bearinrg and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
   5. For interior nonload-bearing partitions, Type O may be used instead of Type N.

D. Grout for Unit Masonry: Comply with ASTM C476.
   1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
   2. Proportion grout in accordance with ASTM C476, Table 1 but not less than 2000 psi (14 MPa)
   3. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C143/C143M.

PART 3 - EXECUTION

3.01. EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work
   2. Verify that foundations are within tolerances specified.
   3. Verify that reinforcing dowels are properly placed.
   4 Verify that substrates are free of substances that impair mortar bond.

A. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02. INSTALLATION, GENERAL

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. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

3.03. TOLERANCES

A. Dimensions and Locations of Elements:
   1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch (12mm) or minus 1/4 inch (6 mm).
   2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
   3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

B. Lines and Levels:
   1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.
   2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2- inch (12- mm) maximum.
   3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
   4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
   5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
   6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.

C Joints:
   1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).

2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3-mm)

3.04. LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half- size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in bond pattern indicated on Drawings; do not use units with less-than-nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

D. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.05. MORTAR BEDDING AND JOINTING

A. Lay CMUs as follows:
1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.

B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

C Cut Joints flush for masonry walls to receive plaster or other direct applied finishes (other than paint) unless otherwise indicated

3.06. MASONRY-JOINT REINFORCEMENT

A. General: Install enlire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
1. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

3.07. CONTROL AND EXPANSION JOINTS

A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in- plane wall or partition movement.

B. Form expansion joints in brick as follows:
   1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches (100 mm) in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
   2. Build flanges of factory-fabricated, expansion-joint units into masonry.
   3. Build in compressible joint fillers where indicated.
   4. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch (10 mm) for installation of sealant and backer rod specified in Section 07 92 00 “Joint sealants”.

3.09. REINFORCED UNIT MASONRY

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
   1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
   2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

C. Grouting: Do not place prout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
   1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
   2. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

3.11 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Special inspections according to Level C in TMS 402/ACI 530/ASCE 5.
   1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
   2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
   3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C67 for compressive strength.

E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C140 for compressive strength.

F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C780.

3.12 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect’s approval of sample cleaning before proceeding with cleaning of masonry.
   3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
   4. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.13 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

END OF
SECTION

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural steel.
2. Shrinkage-resistant grout.

1.2 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Structural-steel materials.
2. High-strength, bolt-nut-washer assemblies.
3. Shear stud connectors.
4. Anchor rods.
5. Threaded rods.
6. Shop primer.
7. Galvanized-steel primer.
8. Etching cleaner.
9. Galvanized repair paint.
10. Shrinkage-resistant grout.

B. Shop Drawings: Show fabrication of structural-steel components.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Mill test reports for structural-steel materials, including chemical and physical properties.

C. Source quality-control reports.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that is approved by the City of Phoenix and who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).

B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE.

C. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with applicable provisions of the following specifications and documents:
1. ANSI/AISC 303.
2. ANSI/AISC 360.
3. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

B. Connection Design Information:
1. Connection designs have been completed and connections indicated on the Drawings.

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A992/A992M or ASTM A572/A572M, Grade 50 (Grade 345).

B. Channels, Angles: ASTM A36/A36M or ASTM A572/A572M, Grade 50 (Grade 345).

C. Plate and Bar: ASTM A36/A36M

D. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade **B** structural tubing.

E. Steel Pipe: ASTM A53/A53M, Type E or Type S, Grade B.

F. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 1, heavy-hex steel structural bolts all with plain finish.

2.4 RODS

A. Unheaded Anchor Rods: ASTM F1554, Grade 36 or ASTM F1554, Grade 55, weldable.
   1. Configuration: Straight
   2. Finish: Plain

B. Threaded Rods: ASTM A36/A36M or ASTM A193/A193M, Grade B.

2.5 PRIMER

A. Steel Primer:

   1. Comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting." and Section 099600 "High-Performance Coatings."
   2. SSPC-Paint 23, latex primer.
   3. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

B. Galvanized-Steel Primer: MPI#134.
   1. Etching Cleaner: MPI#25, for galvanized steel.

2.6 SHRINKAGE-RESISTANT GROUT

A. Metallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.

B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.7 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.

2.8 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.9 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M.
   1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.

2.10 SHOP PRIMING

A. Shop prime steel surfaces, except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
   2. Surfaces to be field welded.
   3. Surfaces of high-strength bolted, slip-critical connections.
   4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
   5. Galvanized surfaces
   6. Surfaces enclosed in interior construction.

B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:

C. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.

B. Baseplates Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure.

C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

3.3 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.
1. Joint Type: Snug tightened

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:
1. Verify structural-steel materials and inspect steel frame joint details.
2. Verify weld materials and inspect welds.
3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Owner will engage qualified testing agency to perform tests and inspections.
1. Bolted Connections: Inspect bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.
a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

END OF SECTION 051200

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Steel and Stainless Steel railings.

1.2 ACTION SUBMITTALS

A. Product Data:
   1. Handrail brackets.
   2. Shop primer.
   3. Nonshrink, nonmetallic grout
   4. Metal finishes.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish.

D. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For delegated-design professional engineer.

B. Welding certificates.

C. Product Test Reports: For tests on railings performed by a qualified testing agency, in accordance with ASTM E894 and ASTM E935.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   2. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.5. COORDINATION

A. Coordinate selection of Shop Primers with top coats to be applied over them. Comply with paint and coating manufactures' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for railings and guard railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts and items with integral anchors that are to be embedded in concrete or masonry. Deliver such items t project site in time for installation.

C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporary by any means that do not satisfy structural performance requirements.

1.6. FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.

B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
1. Handrails and Top Rails of Guards:
   a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
   b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
   c. Uniform and concentrated loads need not be assumed to act concurrently.
2. Infill of Guards:
   a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
   b. Infill load and other loads need not be assumed to act concurrently.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch (38-mm) clearance from inside face of handrail to finished wall surface.

2.3 STEEL RAILINGS

A. Tubing: ASTM A500/A500M (cold formed) or ASTM A513/A513M, Type 5.

B. Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
   1. Provide galvanized finish for exterior installations and where indicated.

C. Plates, Shapes, and Bars: ASTM A36/A36M.

D. Cast Iron Fittings: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

E. Perforated-Metal Infill Panels:
   1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, or hot-rolled steel sheet, ASTM A1011/A1011M, commercial steel, Type B, 0.060 inch (1.52 mm) thick, with 1/4-inch (6.4-mm) holes 3/8 inch (9.5 mm) o.c. in staggered rows.
      a. Basis-of-Design Product: Provide product with perforations matching product indicated on Drawings

2.4 FASTENERS

A. Fastener Materials:
   1. Ungalvanized-Steel Railing Components: Plated steel fasteners complying with ASTM F1941 (ASTM F1941M), Class Fe/Zn 5 for zinc coating.
   2. Hot-Dip Galvanized Railing Components complying with ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.
   3. Stainless Steel Fasteners: Type 304

B. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308..
   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) or Group 2 (A4) stainless steel bolts, ASTM F593, and nuts, ASTM F594.

2.5 MISCELLANEOUS MATERIALS

A. Handrail Brackets: Cast iron or as detailed center of handrail 2-1/2 inches (63.5 mm) from face of railing or wall.

B. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.
   1. For railings, 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.

C. Galvanizing Repair Paint: High-zinc-dust-content paint, complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Shop Primers: Provide primers that comply with **Section 099113 "Exterior Painting" and Section 099600 "High-Performance Coatings."**

E. Universal Shop Primer: 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.

F. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

G. Intermediate Coats and Topcoats: Provide products that comply with **Section 099113 "Exterior Painting."** ; **Section 099600 "High-Performance Coatings."**

H. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

I. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
   1. Water-Resistant Product: [**At exterior locations**] [**and**] [**where indicated on Drawings**], provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

A. Cut, drill, and punch metals cleanly and accurately.
   1. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated.
   2. Remove sharp or rough areas on exposed surfaces.

B. Form work true to line and level with accurate angles and surfaces.

C. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove flux immediately.
   4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 welds; ornamental quality with no evidence of a welded joint

D. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

E. Form changes in direction as follows:
   1. By bending or by inserting prefabricated elbow fittings.

F. Bend 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 of components.

G. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.

H. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.

I. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
   1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

J. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.
   1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
   2. Coordinate anchorage devices with supporting structure.

K. For railing posts set in concrete, provide stainless steel sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with metal plate forming bottom closure.

L. For removable railing posts, fabricate slip-fit sockets from stainless steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height.
   1. Provide socket covers designed and fabricated to resist being dislodged.
   2. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

M. Perforated-Metal Infill Panels: As indicated on Drawings
   1. Edge panels with U-shaped channels made from metal sheet, of same metal as perforated metal and not less than 0.043 inch (1.1 mm) thick.
   2. Orient perforated metal with pattern as indicated on Drawings.

N. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.7 STEEL AND IRON FINISHES

A. Galvanized Railings:
   1. Hot-dip galvanize **exterior** steel railings, including hardware, after fabrication.
   2. Comply with ASTM A123/A123M for hot-dip galvanized railings.
   3. Comply with ASTM A153/A153M for hot-dip galvanized hardware.

B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner[**and as follows**].
   1. Comply with SSPC-SP 16.

D. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, hot-dip galvanize anchors to be embedded in exterior concrete or masonry.

E. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3.

F. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1 for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
   1. Shop prime uncoated railings with primers specified in Section 099113 "Exterior Painting" unless primers specified in Section 099600 "High-Performance Coatings" indicated.
   2. Do not apply primer to galvanized surfaces.

2.8 STAINLESS STEEL FINISHES

A. Stainless Steel Pipe and Tubing Finishes:
   1. 180-Grit Polished Finish: Uniform, directionally textured finish.

B. Stainless Steel Sheet and Plate Finishes:
   1. Directional Satin Finish: ASTM A480/A480, No. 4.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Perform cutting, drilling, and fitting required for installing railings.
   1. Fit exposed connections together to form tight, hairline joints.
   2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
   3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
   4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
   5. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
   6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3.5 m).

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. 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.

3.2 ANCHORING POSTS

A. Use stainless steel pipe sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with [**nonshrink, nonmetallic grout**] [**or**] [**anchoring cement**], mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Form or core-drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout mixed and placed to comply with anchoring material manufacturer's written instructions.

C. Anchor posts to metal surfaces with flanges, angle type, or floor type, as required by conditions, connected to posts and to metal supporting members as follows:

3.3 ATTACHING RAILINGS

A. Attach handrails to walls with wall brackets[, except where end flanges are used]. Provide brackets with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface.

B. Secure wall brackets and railing end flanges to building construction as follows:
   1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
   2. For hollow masonry anchorage, use toggle bolts.

C. Touchup Painting:
   1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

3.4 CLEANING

A. Clean by washing thoroughly with clean water and soap and rinsing with clean water.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

C. Touch up Finishing, touch up finish on field welds, bolted connections and abraded areas.

D. Protect finishes of railings from damage during construction period.

END OF SECTION 055213

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Miscellaneous steel framing and supports.
   2. Shelf angles.
   3. Miscellaneous steel trim.
   4. Pipe guards.
   5. Loose bearing and leveling plates.

B. Products furnished, but not installed, under this Section include the following:
   1. Loose steel lintels.
   2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
   3. Steel weld plates and angles for casting into concrete.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Fasteners.
   2. Shop primers.
   3. Shrinkage-resisting grout.
   4. Pipe guards and bollards.

B. Shop Drawings: Show fabrication and installation details Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

PART 2 - PRODUCTS

2.1 METALS

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.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 304.

D. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

E. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

F. Zinc-Coated Steel Wire Rope: ASTM A741.
   1. Wire Rope Fittings: Hot-dip galvanized-steel connectors with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.

G. Stainless Steel Wire Rope: Wire rope manufactured from stainless steel wire complying with ASTM A492, Type 316.
   1. Wire Rope Fittings: Stainless steel connectors, Type 316, with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.

2.2 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
   1. Provide stainless steel fasteners for fastening aluminum and stainless steel.
   2. Provide bronze fasteners for fastening bronze.

B. 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.

C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
   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).

2.3 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting.", Section 099123 "Interior Painting." and Section 099600 "High-Performance Coatings."

B. Universal Shop Primer: 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.

C. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat

D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

F. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

H. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

I. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

2.4 FABRICATION, GENERAL

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. 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.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.5 MISCELLANEOUS FRAMING AND SUPPORTS

A. 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. Where wood nailers are attached to girders with bolts or lag screws, drill or punch holes at 24 inches (600 mm) o.c.

B. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.

2.6 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19-mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.
   1. Provide mitered and welded units at corners.
   2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches (50 mm) larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize shelf angles located in exterior walls.

D. Prime shelf angles located in exterior walls with zinc-rich primer.

E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.7 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
   1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

2.8 PIPE BOLLARDS

A. Fabricate metal bollards from Schedule 40 steel pipe or 1/4-inch (6.4-mm) wall-thickness rectangular steel tubing as indicated].
   1. Cap bollards with 1/4-inch- (6.4-mm-) thick steel.

B. Prime steel bollards with primer specified in Section 099600 "High-Performance Coatings."

2.9 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize bearing and leveling plates.

C. Prime plates with primer specified in Section 099600 "High-Performance Coatings."

2.10 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Prime loose steel lintels located in exterior walls with zinc-rich primer.

2.11 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.12 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

2.13 STEEL AND IRON FINISHES

A. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
   1. Shop prime with primers specified in Section 099113 "Exterior Painting", primers specified in Section 099123 "Interior Painting" and primers specified in Section 099600 "High-Performance Coatings" are indicated.

B. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

C. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 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.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

A. Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor shelf angles securely to existing construction with expansion anchors.

C. Support steel beams on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

3.3 INSTALLATION OF BOLLARDS

A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.

B. Anchor bollards in 12 inch diameter x 42 inches deep concrete, set concrete flush with surface with a 1/8 inch slope away from bollard.

C. Fill bollards solidly with concrete.

3.4 INSTALLATION OF BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with shrinkage-resistant grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 REPAIRS

A. Touchup Painting:
   1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055000

SECTION 061053 – MISCELLANOUS ROUGH CARPENTRY

GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Framing with dimension lumber.
   2. Rooftop equipment bases and support curbs.
   3. Wood blocking, cants, and nailers.
   4. Utility shelving.
   5. Plywood backing panels

B. Related Requirements:
   1. Section 061600 "Sheathing" for sheathing, subflooring, and underlayment.

1.2 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal (38 mm actual) size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater size but less than 5 inches nominal (114 mm actual) size in least dimension.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
   3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
   4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Preservative-treated wood.
2. Fire-retardant-treated wood.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
   3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Treatment shall not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat all miscellaneous carpentry unless otherwise indicated.

2.3 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.
5. Utility shelving.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species: Western Woods, WCLIB or WWPA.

C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used if it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.4 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M or of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F1667.

C. Screws for Fastening to Metal Framing: ASTM C1002 length as recommended by screw manufacturer for material being fastened.

D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Expansion Anchos: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E488 conducted by a qualified independent testing and inspection agency.
   1. Material: Carbon Steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.
   2. Material: Stainless Steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 and 2 (ASTM F738M and ASTM F836M, Grade A1 or A4).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate[nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

C. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

D. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

E. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following: NES NER for power driven fasteners

3.2 INSTALLATION OF WOOD BLOCKING AND NAILER

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.3 PROTECTION

A. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061053

SECTION 061600 - SHEATHING

1.1 SUMMARY

A. Section Includes: Roof sheathing.

B. Related Requirements: Section 072500 "Weather Barriers" for water-resistive barrier applied over wall sheathing.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
   2. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5516.

B. Shop Drawings: For air-barrier and water-resistant glass-mat gypsum sheathing assemblies.
   1. Show locations and extent of sheathing, accessories, and assemblies specific to Project conditions.
   2. Include details for sheathing joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
   3. Include details of interfaces with other materials that form part of air barrier.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer. including list of ABAA-certified installers and supervisors employed by Installer, who work on Project and testing and inspecting agency.

B. Product Certificates: From air-barrier and water-resistant glass-mat gypsum sheathing manufacturer, certifying compatibility of sheathing accessory materials with Project materials that connect to or that come in contact with the sheathing.

C. Product Test Reports: For each air-barrier and water-resistant glass-mat gypsum sheathing assembly, indicating compliance with specified requirements, for tests performed by a qualified testing agency.

D. Evaluation Reports: For the following, from ICC-ES:

1. Fire-retardant-treated plywood.

E. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer of air-barrier and water-resistant glass-mat gypsum sheathing.
   1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.

B. Testing Agency Qualifications:
   1. For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: As tested according to ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 WOOD PANEL PRODUCTS

A. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

B. Factory mark panels to indicate compliance with applicable standard.

C. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

D. Application: Treat all plywood unless otherwise indicated

2.3 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
   1. Use treatment that does not promote corrosion of metal fasteners.
   2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
   3. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D5516 and design value adjustment factors shall be calculated according to ASTM D6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F (76 deg C) shall be not less than span ratings specified.

C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

E. Application: Treat all plywood unless otherwise indicated.
   1. Roof sheathing.

2.4 ROOF SHEATHING

A. Plywood Sheathing: DOC PS 1 sheathing.
   1. Span Rating: Not less than 24/0
   2. Nominal Thickness: Not less than1/2 inch (12.7 mm)

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   1. For **roof** sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M or of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Screws for Fastening Sheathing to Wood Framing: ASTM C1002.

2.6 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.

2.7 MISCELLANEOUS MATERIALS

A. Panel Sheathing Clips (H-Clips) to provide sheathing edge support, 20 gauge galvanize metal (Simpson Strong-Tie PSCL ¾ inch.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:
   1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
   2. ICC-ES evaluation report for fastener.

D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:
   1. Wall and Roof Sheathing:
      a. Nail to wood framing
      b. Space panels 1/8 inch (3 mm) apart at edges and ends.

END OF SECTION 061600

SECTION 06 40 23

INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Architectural wood cabinets.
2. Plastic-laminate-faced architectural cabinets.
3. Countertops.
4. Wood furring, blocking, shims, and hanging strips for installing architectural wood cabinets unless concealed within other construction before cabinet installation.

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product, including cabinet hardware and accessories and finishing materials and processes.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
2. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural wood cabinets.
3. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples for Verification: Veneer leaves representative of and selected from flitches to be used for transparent-finished cabinets.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in- service performance. Shop is a certified participant in A\/VI's Quality Certification Program.

B. Installer Qualifications: Fabricator of products.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockups, typical architectural wood cabinets, flush wood paneling, and ornamental woodwork as shown on Drawings.
   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar operations thst could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions"Article.

1.07 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.08 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that wood-veneer-faced architectural cabinets can be supported and installed as indicated.

PART 2 - PRODUCTS

2.01 ARCHITECTURAL CABINET FABRICATORS

A. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of wood-veneer-faced architectural cabinets and ornamental woodwork.

2.02 ARCHITECTURAL WOODWORK, GENERAL

A. Quality Standard: Unlessotherwise indicated, comply with the"Architectural Woodwork Standards" for grades of architectural woodwork indicated for construction, finishes, installation, and other requirements.
   1. Provide labels and certificates from AWI certification program indicating that woodwork, including installation, complies with requirements of grades specified.
   2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

B. Certified Wood: Wood cabinets for transparent finish shall be produced from wood certified as "FSC Pure"or "FSC Mixed Credit" according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and FSCSTD-40-004, "FSC StandardforChain of Custody Certification."

2.03 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS 7953-38, Fine Velvet Finish

A. Basis of Design Product: Subject to compliance with requirements, provide Wilsonart, Harvest Maple 7953-38, Fine Velvet Finish or approved comparable product.

B. Grade: Custom.

C. Type of Construction: Frameless.

D. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.

E. Laminate Cladding for Exposed Surfaces:
   1. Horizontal Surfaces: Grade HGS.
   2. Post formed Surfaces: Grade HCP.
   3. Vertical Surfaces: Grade HGS.
   4. Edges: Grade HTS.

F. Materials for Semiexposed Surfaces:
   1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.
      a. matching laminate in color, pattern, and finish.
      b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface Edges of Plastic-Laminate Shelves: PVC edge banding, 0.12 inch (3 mm) thick, of high-pressure decorative laminate, NEMA LD 3, Grade VGS.
   2. Drawer Sides and Backs: Solid-hardwood lumber.
   3. Drawer Bottoms: Hardwood plywood.

G. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

H. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
   1. Join subfronts, backs, and sides with glued dovetail joints.

2.04 SOLID-SURFACE-MATERIAL COUNTERTOPS

A. Basis of Design Product: Subject to compliance with requirements, provide Corian Cameo White or approved comparable product.

B. Configuration: Provide countertops with the following front and backsplash style:
   1. Front: Straight, slightly eased at top.
   2. Backsplash: Straight, slightly eased at corner.
   3. End splash: Matching backsplash.

C. Countertops: 1/2-inch- (12.7-min-) thick, solid surface material with front edge built up with same material.

D. Backsplashes: 1/2-inch- (12.7min-) thick, solid surface material

2.10 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard foreach type of woodwork and quality grade specified unless otherwise indicated.
   1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches (75 mm) wide.
   2. Wood Moisture Content: 4 to 9 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
   1. Recycled Content of Medium-Density Fiberboard and Particleboard: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 10 percent.
   2. Medium-Density Fiberboard: ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde.
   3. Particleboard: ANSIA208.1, Grade M-2, made with binder containing no urea formaldehyde.
   4. Veneer-Faced Panel Products (Hardwood Plywood): HPVAHP-1, made with adhesive containing no urea formaldehyde.

2.11 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
   1. Use treated materials that comply with requirements of referenced woodworking standard. Do not use materials that are warped, discolored, or otherwisedefective.
   2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreatedmaterials.
   3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

B. Fire-Retardant Fiberboard: Medium-density fiberboard panels complying with ANSIA208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E84.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Panel Source International, Inc.; Pyroblock Platinum.
      b. SierraPine; Medite FR.

2.12 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinetsexcept for items specified in Section 08 71 00 "Door Hardware."

B. Frameless Concealed Hinges (European Type): BHMAA156.9, B01602, 135degrees of opening, self- closing.

C. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

D. Drawer Slides: BHMAA156.9.
   1. Grade 1 and Grade 2: Side mounted and extending under bottom edge of drawer; full-extension type; zinc-plated steel with polymer rollers.
   2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steelball- bearing slides.
   3. For drawers not more than 3 inches (75 mm) high and not more than 24 inches (600 mm)wide, provide Grade 2.
   4. For drawers more than 3 inches (75 mm) high but not more than 6 inches (150 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1.
   5. For drawers more than 6 inches (150 mm) high or more than 24 inches (600 mm) wide, provide Grade 1HD-100.
   6. For file drawers, provide Grade 1HD-200.

E. Door Locks: BHMA A 156.11, E07121.

F. Drawer Locks: BHMA A156.11, E07041.

G. Door and Drawer Silencers: BHMAA156.16, L03011.

H. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
   1. Satin Stainless Steel: BHMA 630.
   2. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.13 MISCELLANEOUS MATERIALS

A. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
   1. Basis of Design Product: Subject to compliance with requirements, provide (PLAM-01) Wilsonart International, Color D96 -Shadow. Finish18 Linearity; (PLAM-02) Formica, Color 464-58 Graystone. Finish Matte; or comparable products by one of the following:
      a. Abet Laminati, Inc.
      b. Formica Corporation.

c. Lamin-Art, Inc.
d. Panolam Industries International, Inc.
e. \/Wilsonart International.

B. Solid Surface Material: Homogeneous solid sheets of filled plastic resin complying with ANSI 551.
1. Basis of Design Product: Subject to compliance with requirements, provide Corian by Dupont, color
Glacier White, Matte finish; or comparable products by one of the following:
a. Avonite Surfaces.
b. Formica Corporation.
c. Samsung Chemical USA, Inc.
d. Wilsonart International Holdings, Inc.
2. Type: Provide Standard Type unless Special Purpose Type is indicated.

C. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

D. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous- metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

E. Adhesives: Do not use adhesives that contain urea formaldehyde.

F. VOC Limits for Installation Adhesives: Use products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Wood Glues: 30 g/L
2. Multipurpose Construction Adhesives: 70 g/L.
3. Contact Adhesive: 80 g/L.
4. Special-Purpose Contact Adhesive (contact adhesive that is used to bond melamine covered board, metal, unsupported vinyl, rubber, or wood veneer 1/16 inch (1.6 mm) or less in thickness to any surface): 250 g/L.

2.14 FABRICATION

A. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
1. Corners of Cabinets: 1/16 inch (1.5 mm) unless otherwise indicated.
2. Edges of Solid-Wood (Lumber) Members: 1/16 inch (1.5 mm) unless otherwise indicated.

B. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against

field measurements before disassembling for shipment.

C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

D. Fabricate countertops in one piece with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid-surface-material manufacturer's written instructions for adhesives, seaters, fabrication, and finishing.
   1. Fabricate with loose backsplashes for field assembly.

2.15 SHOP FINISHING

A. General: Finish architectural wood cabinets at fabrication shop as specified in this Section. Defer only final touch up, cleaning, and polishing until after installation.

B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling fasteners, sealing concealed surfaces, and similar preparations for finishing architectural countersunk wood cabinets, as applicable to each unit of work.
   1. Back priming: Apply one coat of sealer or primer all exposed wood and unexposed wood.

PART 3 - EXECUTION

3.01 PREPARATION

A. Before installation, condition architectural woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and back priming.

3.02 CABINET INSTALLATION

A. Grade: Install cabinets to comply with same grade as item to be installed.

B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.

C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork.
   1. For shop finished items use filler matching finish of items being installed.

F. Cabinets: Install without distortion so doors and drawers fit openings properly and are

accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
2. Maintain veneer sequence matching of cabinets with transparent finish.
3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400 mm) o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch (38-mm) penetration into wood framing, blocking, or hanging strips.

G. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.
   1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are applied in shop.

3.03 COUNTERTOP INSTALLATION

A. Grade: Install countertops to comply with same grade as item to be installed.

B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.
   1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items.
   2. Seal edges of cutouts by saturating with varnish.

C. Field Jointing: Where possible, maKe in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
   1. Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches (150 mm) of front and back edges and at intervals not exceeding 24 inches (600 mm). Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

D. Install countertops level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

E. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts

F. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
   1. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line
   2. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c. and to walls with adhesive.
   3. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.04 ADJUSTING AND CLEANING

A. Repair damaged and defective architectural woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean architectural woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

SECTION 066400 - PLASTIC PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes plastic sheet paneling.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For plastic panelin and trim accessories.

1.3 QUALITY ASSURANCE

A. Testing Agency: Acceptable to authorities having jurisdiction

PART 2 - PRODUCTS

2.1 PLASTIC SHEET PANELING

A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D5319.
   1. Products: Basis of Design: Marlite Standard FRP, smooth surface S100. Color: White or approved comparable products from the following:
      a. Crane Composites, Inc.; Fire-X-Glasbord with Surfaseal
      b. Panolam Surface Systems
      c. USFRP
   2. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E84. Identify products with appropriate markings of applicable testing agency.
      a. Flame-Spread Index: 25 or less.
      b. Smoke-Developed Index: 450 or less.
   3. Nominal Thickness: Not less than 0.09 inch (2.3 mm).
   4. Surface Finish: Smooth

2.2 ACCESSORIES

A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners,[**outside corners,**] and caps as needed to conceal edges.
   1. Color: Match panels

B. Sealant: Mildew-resistant, single-component, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 079200 "Joint Sealants."

C. Concealed Mounting Splines: Continuous, H-shaped aliminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.

D. Adhesive: As recommended by plastic paneling manufacture.

PART 3 - EXECUTION

3.1. PREPARATION

A. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.

B. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

C. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels

3.2. INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install panels in a full spread of adhesive.

C. Install trim accessories with adhesive and nails or staples. Do not fasten through panels.

D. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.

E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

F. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 066400

SECTION 071800 - TRAFFIC COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes traffic coatings for the following applications:
   1. Pedestrian traffic.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include installation instructions and details, material descriptions, dry or wet film thickness requirements, and finish. Provide color chart for architect’s color selection.

B. Shop Drawings: For traffic coatings.
   1. Include details for treating substrate joints and cracks, flashings, deck penetrations, and other termination conditions that are not included in manufacturer's product data.

C. Samples for Verification: For each type of exposed finish, prepared on rigid backing.
   1. Provide stepped Samples on backing to illustrate buildup of traffic coatings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of traffic coating.

C. Field quality-control reports.

D. Sample Warranty: For manufacturer's warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For traffic coatings to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Apply traffic coatings within the range of ambient and substrate temperatures recommended in writing by manufacturer. Do not apply traffic coatings to damp or wet substrates, when temperatures are below 40 deg F (5 deg C), when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F (3 deg C) above dew point.
   1. Do not apply traffic coatings in snow, rain, fog, or mist, or when such weather conditions are imminent during the application and curing period. Apply only when frost-free conditions occur throughout the depth of substrate.

B. Do not install traffic coating until items that penetrate membrane have been installed.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace traffic coating that fails in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Adhesive or cohesive failures.
      b. Abrasion or tearing failures.
      c. Surface crazing or spalling.
      d. Intrusion of water, oils, gasoline, grease, salt, deicer chemicals, or acids into deck substrate.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations:
   1. Obtain traffic coatings including primers from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Material Compatibility: Provide primers; base coat, intermediate coat, and topcoat; and accessory materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

2.3 TRAFFIC COATING

A. Traffic Coating: Manufacturer's standard, traffic-bearing, seamless, high-solids-content, cold liquid-applied, elastomeric, water-resistant membrane system with integral wearing surface for pedestrian traffic service condition; according to ASTM C957/C957M.

B. Subject to compliance with requirements, provide pedestrian traffic coatings products by one of the following:
   1. Sika USA, Sikalast – 715 LoVOC Textured
   2. Tremco – Vulkum EWS with PUMA Technology
   3. Pecora Corporation – Pecora Deck 806 System

C. Preparatory and Base Coats: Polyurethane
   1. Aggregate Content: As recommended in writing by traffic-coating manufacturer for substrate and service conditions indicated

D. Topcoat: Polyurethane
   1. Thicknesses: Minimum **dry-**film thickness as recommended in writing by manufacturer for substrate and service conditions indicated measured excluding aggregate.
   2. Color: As selected by Architect from manufacturer's full range.

E. Aggregate: Manufacturer's standard aggregate for each use indicated of particle sizes, shape, and minimum hardness recommended in writing by traffic-coating manufacturer.

2.4 ACCESSORY MATERIALS

A. Joint Sealants: As specified in Section 079200 "Joint Sealants”

B. Adhesive: Contact adhesive recommended in writing by traffic-coating manufacturer.

C. Reinforcing Strip: Fiberglass mesh recommended in writing by traffic-coating manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, surface smoothness, and other conditions affecting performance of traffic-coating work.

B. Verify that substrates are visibly dry and free of moisture.
   1. Test for moisture according to ASTM D4263.
   2. Test for moisture content by measuring with an electronic moisture meter or method recommended in writing by traffic-coating manufacturer.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of traffic-coating work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.
   1. Begin coating application only after substrate construction and penetrating work have been completed.
   2. Begin coating application only after minimum concrete-curing and -drying period recommended in writing by traffic-coating manufacturer has passed and after substrates are dry.
   3. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Clean and prepare substrates according to ASTM C1127 and manufacturer's written instructions to produce clean, dust-free, dry substrate for traffic-coating application. Remove projections, fill voids, and seal joints if any, as recommended in writing by traffic-coating manufacturer.

B. Priming: Unless manufacturer recommends in writing against priming, prime substrates according to manufacturer's written instructions.
   1. Limit priming to areas that will be covered by traffic-coating material on same day. Reprime areas exposed for more time than recommended by manufacturer.

C. Schedule preparation work so dust and other contaminants from process do not fall on wet, newly coated surfaces.

D. Mask adjoining surfaces not receiving traffic coatings to prevent overspray, spillage, leaking, and migration of coatings. Prevent traffic-coating materials from entering deck substrate penetrations and clogging weep holes and drains.

E. Concrete Substrates: Mechanically abrade surface to a uniform profile acceptable to manufacturer, according to ASTM D4259. Do not acid etch.
   1. Remove grease, oil, paints, and other penetrating contaminants from concrete.
   2. Remove concrete ridges, and other projections.
   3. Remove laitance, glaze, efflorescence, curing compounds, concrete hardeners, form-release agents, and other incompatible materials that might affect coating adhesion.
   4. Remove remaining loose material to provide a sound surface patching concrete as required for a sound and clean surfaces according to ASTM D4258.

3.3 TERMINATIONS AND PENETRATIONS

A. Prepare vertical and horizontal surfaces at terminations and penetrations through traffic coatings and at expansion joints, drains, and sleeves according to ASTM C1127 and manufacturer's written instructions.

B. Provide sealant cants at penetrations and at reinforced and nonreinforced, deck-to-wall butt joints.

C. Terminate edges of deck-to-deck expansion joints with preparatory base-coat strip.

3.4 JOINT AND CRACK TREATMENT

A. Prepare, treat, rout, and fill joints and cracks in substrates according to ASTM C1127 and manufacturer's written recommendations. Before coating surfaces, remove dust and dirt from joints and cracks according to ASTM D4258.
   1. Comply with recommendations in ASTM C1193 for joint-sealant installation.

B. Apply reinforcing strip in traffic-coating system where recommended in writing by traffic-coating manufacturer.

3.5 TRAFFIC-COATING APPLICATION

A. Apply traffic coating according to ASTM C1127 and manufacturer's written instructions.

B. Apply coats of specified compositions for each type of traffic coating at locations as indicated on Drawings.

C. Start traffic-coating application in presence of manufacturer's technical representative.

D. Verify that wet-film thickness of each coat complies with requirements every 100 sq. ft. (9 sq. m).

E. Uniformly broadcast and embed aggregate in each coat indicated to receive aggregate according to manufacturer's written instructions. After coat dries, sweep away excess aggregate.

F. Apply traffic coatings to prepared wall terminations and vertical surfaces to height indicated; omit aggregate on vertical surfaces.

G. Cure traffic coatings. Prevent contamination and damage during coating application and curing.

3.6 FIELD QUALITY CONTROL

A. Final Traffic-Coating Inspection: Arrange for traffic-coating manufacturer's technical personnel to inspect membrane installation on completion.
   1. Notify Architect or Owner 48 hours in advance of date and time of inspection.

3.7 PROTECTING AND CLEANING

A. Protect traffic coatings from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071800

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Polyisocyanurate foam-plastic board insulation.
2. Glass-fiber blanket insulation.
3. Mineral-wool blanket insulation.
4. Mineral-wool board insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.
1. Sign, date, and post the certification in a conspicuous location on Project site.
2. 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.
3. Evaluation Reports: For foam plastic insulation from ICC-ES

1.4. DELIVERY, STORAGE AND HANDLING

A. Protect insulation materials from physical damage and from detioration due to moisture, soiling and other sources. Store inside and in a dry location. Comply with manufacture’s written instructions for handling, storing and protecting during installation.

B. Protect foam plastic board insulation as follows:
1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 CLOSED CELL SPRAY POLYURETHANE FOAM

A. Closed Cell Spray Polyurethane Foam: ASTM C1029, Type II, minimum density of 1.5 lb/cu.ft. (24 kg/cu.m) and a minimum aged R Value at 1 inch (25.4 mm) thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F (434 K x sq. m/ W at 24 deg C) (
   1. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
   2. Surface Burning Characteristics: Comply with ASTM E84 for foam thickness of 4 inches or less and per NFPA 286 for foam thickness greater than 4 inches.; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
      a. Flame Spread Index: 75 or less
      b. Smoke Developed Index: 450 or less.
   3. Products: Subject to compliance with requirements, provide one of the following:
      a. SWD Urethane
      b. Carlisle Spray Foam Insulation
      c. DOW

2.2 GLASS-FIBER BLANKET INSULATION

A. Glass-Fiber Blanket Insulation, Unfaced ASTM C665, Type I; passing ASTM E136 for combustion characteristics.
   1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
   2. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
   3. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12inches (305 mm) and wider in width.

B. Products: Subject to compliance with requirements, provide one of the following:
   1. Certain Teed Corporation
   2. Johns Manville, a Berkshire Hathaway Company
   3. Owens-Corning

2.3 MINERAL-WOOL BLANKET INSULATION

A. Mineral-Wool Blanket Insulation, Unfaced ASTM C665, Type I (blankets without membrane facing); consisting of fibers; passing ASTM E136 for combustion characteristics.
   1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
   2. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
   3. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.

B. Products: Subject to compliance with requirements, provide one of the following:
   1. Rockwool International
   2. Johns Manville, a Berkshire Hathaway Company
   3. Thermafiber Inc. an Owens-Corning Company

2.4 MINERAL-WOOL BOARD INSULATION

A. Mineral-Wool Board Insulation, Type III, Unfaced ASTM C612, Type III; passing ASTM E136 for combustion characteristics.
   1. Nominal Density: 8 lb/cu. ft. (128 kg/cu. m).
   2. Flame-Spread Index: Not more than 15 when tested in accordance with ASTM E84.
   3. Smoke-Developed Index: Not more than zero when tested in accordance with ASTM E84.
   4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.

B. Products: Subject to compliance with requirements, Basis of Design Thermafiber Rainbarrier 45 an Qwens-Corning Company, provide a comparable product by one of the following:
   1. Rockwool International
   2. Johns Manville, a Berkshire Hathaway Company

2.5 ACCESSORIES

A. Insulation for Miscellaneous Voids:45
   1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
   2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

C. Insulation Retaining Washers: self-locking washers formed from 0.016 inch (0.41 mm) thick galvanized steel sheet with bevel edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1 1/2inches (38 mm) square or in diameter. Proect ends with self-locking caps where retaining washers are exposed.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer's R-value label exposed after insulation is installed.

D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.2 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
   1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
   2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
   3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
   4. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
   1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
   2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

END OF SECTION 072100

SECTION 072713 - MODIFIED BITUMINOUS SHEET AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes self-adhering, vapor-retarding, modified bituminous sheet air barriers.

B. Related Requirements:
   1. Section 061600 "Sheathing" for wall sheathings and wall sheathing joint-and-penetration treatments.

1.2 DEFINITIONS

A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

C. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; and tested physical and performance properties of products.

B. Shop Drawings: For air-barrier assemblies.
   1. Show locations and extent of air barrier materials, accessories, and assemblies specific to Project conditions.
   2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
   3. Include details of interfaces with other materials that form part of air barrier.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by Installer, who work on Project.

B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with air barrier.

C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
   1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.

B. Mockups: Build mockups to set quality standards for materials and execution and for preconstruction testing.
      a. Coordinate construction of mockups to permit inspection and testing of air barrier before external insulation and cladding are installed.
      b. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

B. Protect stored materials from direct sunlight.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.
   1. Protect substrates from environmental conditions that affect air-barrier performance.
   2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. (0.2 L/s x sq. m of surface area at 75 Pa), when tested according to ASTM E2357.

2.3 SELF-ADHERING SHEET AIR BARRIER

A. Modified Bituminous Sheet: 60-mil- (1.524-mm-) thick, self-adhering sheet consisting of 60 mils with requirements, providing high melt bitumen with dimensional glass reinforcement and cross laminated polypropylene surface with a fleece top surface with release liner on adhesive side and formulated for application with primer that complies with VOC limits.

B. Basis of Design Product: Subject to compliance with requirements, Eagle Armor as manufactured by APOC, or approved comparable product.
   1. Physical and Performance Properties:
      a. Elongation at Break: >10 minimum of Modified Bitumen Portion per ASTM D5147. %
      b. Tear Resistance per ASTM D1970 (lbf/in) >60
      c. Moisture Vapor Permeability per ASSTM E96 <0.1
      d. Adhesion to plywood @ 40 deg. F. (ASTM D1970) > 8lbf/in
      e. Adhesion to plywood @ 75 deg. F. (ASTM D1970) > 25lbf/in
      f. Sealability around nail (ASTM D1970): Pass
      g. Waterproof integrity after low temperature lexibility: Pass
      h. Slip Resistance (ASTM D1970): Pass
      i. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
      j. UV Resistance: Can be exposed to sunlight for 180 days exposure according to manufacturer's written instructions.

2.4 ACCESSORY MATERIALS

A. Requirement: Provide primers, transition strips, termination strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
   1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
   2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
   3. Verify that substrates are visibly dry and free of moisture.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

H. Bridge isolation joints, expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

3.3 INSTALLATION

A. Install materials according to air-barrier manufacturer's written instructions and details and according to recommendations in ASTM D6135 to form a seal with adjacent construction and ensure continuity of air and water barrier.

B. When ambient and substrate temperatures range between 25 and 40 deg F (minus 4 and plus 5 deg C), install self-adhering, modified bituminous air-barrier sheet produced for low-temperature application. Do not install low-temperature sheet if ambient or substrate temperature is higher than 60 deg F (16 deg C).
   1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.

C. Prepare, treat, and seal inside and outside corners and vertical and horizontal surfaces at terminations and penetrations with termination mastic and according to ASTM D6135.

D. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier sheet on same day. Reprime areas exposed for more than 24 hours.

E. Apply and firmly adhere air-barrier sheets over area to receive air barrier. Accurately align sheets and maintain uniform 2-1/2-inch- (64-mm-) minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure airtight installation.
   1. Apply sheets in a shingled manner to shed water.
   2. Roll sheets firmly to enhance adhesion to substrate.

F. Apply continuous air-barrier sheets over accessory strips bridging substrate cracks, construction, and contraction joints.

G. Seal exposed edges of sheet at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

H. Install air-barrier sheet and accessory materials to form a seal with adjacent construction and to maintain a continuous air barrier.
   1. Coordinate air-barrier installation with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
   2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate.

I. At end of each working day, seal top edge of air-barrier material to substrate with termination mastic.

J. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

K. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air-barrier sheet extending 6 inches (150 mm) beyond repaired areas in all directions.

L. Do not cover air barrier until it has been tested and inspected by testing agency.

M. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.4 FIELD QUALITY CONTROL

A. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
2. Continuous structural support of air-barrier system has been provided.
3. Site conditions for application temperature and dryness of substrates have been maintained.
4. Maximum exposure time of materials to UV deterioration has not been exceeded.
5. Surfaces have been primed.
6. Laps in sheet materials have complied with the minimum requirements and have been shingled in the correct direction (or mastic applied on exposed edges), with no fishmouths.
7. Termination mastic has been applied on cut edges.
8. Air barrier has been firmly adhered to substrate.
9. Compatible materials have been used.
10. Transitions at changes in direction and structural support at gaps have been provided.
11. Connections between assemblies (air barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
12. All penetrations have been sealed.

D. Air barriers will be considered defective if they do not pass tests and inspections.
1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient air-barrier components for retesting as specified above.

E. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

F. Prepare test and inspection reports.

3.5 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
   1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.
   2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed Work, using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 072713

SECTION 073213 - CLAY ROOF TILES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Clay roof tiles.
   2. Ridge vents.
   3. Metal flashing and trim.

1.2 DEFINITIONS

A. Roofing Terminology: See ASTM D1079 and glossary in TRI/WSRCA's "Concrete and Clay Roof Tile Installation Manual" for definitions of terms related to roofing Work in this Section.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Clay roof tiles.
   2. Ridge vents.
   3. Butyl sealant.
   4. Elastomeric sealant.
   5. Mortar.
   6. Eave closure.
   7. Underlayment; See Section 072713 “Modified Bituminous Sheet Air Barrier”

B. Shop Drawings: For metal flashing and trim.

C. Samples for Verification: For the following products, in sizes indicated:
   1. Clay Roof Tiles: Full size, showing full range of color values and blends.
   2. Accessory Tiles: Full size, each type.
   3. Metal Flashing: 12 inches (305 mm) square.
   4. Ridge Vents: 12-inch- (305-mm-) long Sample.
   5. Eave Closures: In manufacturer's standard size.

1.5 INFORMATIONAL SUBMITTALS

A. Material Test Reports: For each type of clay roof tile, based on evaluation of comprehensive tests performed by a qualified testing agency.

B. Research Reports: From ICC-ES, indicating that product is suitable for intended use under applicable building codes for the following:
   1. Tile-attachment systems.
   2. Wire-tie tile-attachment systems.
   3. Polymer-modified bitumen sheet underlayment.
   4. Synthetic underlayment.

C. Sample Warranty: For manufacturer's materials warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing to include in maintenance manuals.

B. Materials warranties.

C. Roofing Installer's warranty.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Clay Roof Tiles: 100 sq. ft. (9.3 sq. m) of each type, in unbroken bundles.

1.8 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Build mockups for clay roof tiles including related roofing materials.
      a. Size: 48 inches (1219 mm) long by 48 inches (1219 mm) wide
      b. Include gutter and downspout complying with requirements in Section 076200 "Sheet Metal Flashing and Trim."
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store underlayment rolls in a dry, well-ventilated location protected from weather, sunlight, and moisture in accordance with manufacturer's written instructions.
   1. Store on end, on pallets or other raised surfaces. Do not double-stack rolls.

B. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing Work is not in progress.

C. Handle, store, and place roofing materials in a manner to prevent damage to roof deck or structural supporting members.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Proceed with installation only when existing and forecasted weather conditions permit product installation and related Work to be performed in accordance with manufacturer's written instructions and warranty requirements.
   1. Install self-adhering, polymer-modified bitumen sheet underlayment within the range of ambient and substrate temperatures recommended in writing by manufacturer.

1.11 WARRANTY

A. Materials Warranty: Manufacturer agrees to repair or replace clay roof tiles that fail in materials within specified warranty period.
   1. Warranty Period: 50 years from date of Substantial Completion.

B. Roofing Installer's Warranty: On warranty form at end of this Section, signed by Installer, in which Installer agrees to repair or replace components of clay-tile roofing that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of product from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Exterior Fire-Test Exposure: Provide clay roof tiles and related roofing materials identical to those of assemblies tested for Class A fire resistance in accordance with ASTM E108 or UL 790 by Underwriters Laboratories or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

2.3 CLAY ROOF TILES

A. Clay Roof Tiles: ASTM C1167, molded- or extruded-clay roof tile units of shape and configuration indicated, kiln fired, and free of surface imperfections. Provide with fastening holes prepunched at factory before firing.
   1. Basis of Design Products: Subject to compliance with requirements, provide US Tile by Boral, one (1) piece “S” Tile or an approved comparable product
   2. Durability: Grade 1
   3. High-Profile Shape: Type I, Spanish or "S"

a. Accessory Tiles: Ridge, ridge end, hip and hip starter, header course, [L-shaped rake edge, starter, end band, terminal, eave closure and top fixture units.

4. Size: 18inches x 13 inches (457.2 mm x 330.2 mm).
5. Finish and Texture: Matte, smooth
6. Color: Newport Blend, Red

2.4 UNDERLAYMENT MATERIALS (See Section 072713 “Modified Bituminous Sheet Air Barrier”)

2.5 ATTIC VENTS

A. Basis of Design Product: Subject to compliance with requirements, provide O’Hagin’s Inc. Clay “S” vent, galvanized, or an approved comparable product.

2.6 ACCESSORIES

A. Asphalt Roofing Cement: ASTM D4586/D4586M Type II, asbestos free.

B. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied.

C. Elastomeric Sealant: ASTM C920, Type S, Grade NS, one-part, non-sag, elastomeric polymer sealant of class and use classifications required to seal joints in clay-tile roofing and remain watertight; recommended in writing by manufacturer for applications indicated.

D. Cold-Applied Adhesive: Manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with underlayments.

E. Mortar: ASTM C270, Type M, natural color

F. Wood Nailers: Comply with requirements for pressure-preservative-treated wood in Section 061053 "Miscellaneous Rough Carpentry."

2.6 FASTENERS

A. Roofing Nails: ASTM F1667, stainless steel, 0.120-inch- (3.05-mm-) or copper, 0.135-inch- (3.43-mm-) diameter shank, sharp-pointed, conventional roofing nails with barbed shanks; minimum 3/8-inch- (10-mm-) diameter head; of sufficient length to penetrate 3/4 inch (19 mm) into substrate or extend at least 1/8 inch (3 mm) through thickness of the sheathing, whichever is less.

1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.

B. Underlayment Nails: stainless steel, wire nails with low-profile metal or plastic caps, 1-inch- (25-mm-) minimum diameter.

C. Nails for Wood Nailers: ASTM F1667; common or box, steel wire, flat head, and smooth shank.

2.7 METAL FLASHING AND TRIM

A. General: Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."

B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for design, dimensions, metal, and other characteristics of the item unless otherwise specified in this Section or indicated on Drawings.

1. Apron Flashings: Fabricate with lower flange extending a minimum of 6 inches (152 mm) over and 4 inches (102 mm) beyond each side of downslope tile roofing and 6 inches (152 mm) up the vertical surface.
2. Step Flashings: Fabricate with a headlap of 4 inches (102 mm) and a minimum extension of 5 inches (127 mm) both horizontally and vertically.
3. Channel Flashings: Fabricate with vertical surface extending a minimum of 5 inches (127 mm) above the clay roof tile and 6 inches (152 mm) beneath the tile roofing, with a 1-inch- (25-mm-) high vertical return to form a runoff channel.
4. Rake Pan Flashings: Fabricate with vertical surface extending over fasciae and 6 inches (152 mm) beneath the tile roofing, with a 1-inch- (25-mm-) high vertical return to form a runoff channel.
5. Counterflashings: Fabricate to cover 4 inches (102 mm) of base flashing measured vertically; and in lengths required so that no step exceeds 8 inches (203 mm) and overall length is no more than 10 feet (3 m)
   a. Provide metal reglets for installation.
6. Valley Flashings: Fabricate from metal sheet not less than 24 inches (610 mm) wide in lengths not exceeding 10 feet (3 m) with 1-inch- (25-mm-) high, inverted-V profile water diverter at center of valley and equal flange widths of not less than 11 inches (279 **mm).**.
   a. Hem flange edges for fastening with metal cleats.
7. Drip Edges: Fabricate in lengths not exceeding 10 feet (3 m) with minimum 2-inch (51-mm) roof-deck flange and 1-1/2-inch (38-mm) fascia flange with 3/8-inch (10-mm) drip at lower edge.

C. Vent-Pipe Flashings: ASTM B749, Type L51121, at least 1/16 inch (1.6 mm) thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof and extending at least 4 inches (102 mm) from pipe onto roof.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.

2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored and that provisions have been made for flashings and penetrations through roofing.
3. Verify that vent stacks and other penetrations through roofing are installed and securely fastened.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT MATERIALS

A. Comply with clay-roof-tile and underlayment manufacturers' written installation instructions and with recommendations in NRCA's "The NRCA Roofing Manual: Steep-Slope Roof Systems" applicable to products and applications indicated unless more stringent requirements are specified in this Section or indicated on Drawings.
1. Cover ridge, hip wood nailers with underlayment strips.

B. Self-Adhering Modified Bitumen Sheet: Install, wrinkle free.
1. Comply with low-temperature installation restrictions of underlayment manufacturer.
2. Install lapped in direction that sheds water.
3. Lap sides not less than 4 inches (102 mm).
4. Lap ends not less than 6 inches (152 mm), staggered 24 inches (610 mm) between succeeding courses.
5. Roll laps with roller.
6. Single-Layer Installation: Install over entire roof deck.
    a. Eaves: Extend from edges of eaves 24 inches (610 mm) beyond interior face of exterior wall.
    b. Rakes: Extend from edges of rakes 24 inches (610 mm) beyond interior face of exterior wall.
    c. Valleys: Extend from lowest to highest point 18 inches (457 mm) on each side of centerline.
    d. Hips: Extend 18 inches (457 mm) on each side.
    e. Ridges: Extend 36 inches (914 mm) on each side
    f. Sidewalls: Extend 18 inches (457 mm) beyond sidewalls and return vertically against sidewalls not less than 4 inches (102 mm).
    g. Roof Penetrating Elements: Extend 18 inches (457 mm) beyond penetrating elements and return vertically against penetrating elements not less than 4 inches (102 mm).
    h. Roof-Slope Transitions: Extend 18 inches (457 mm) on each roof slope.

3.3 INSTALLATION OF METAL FLASHING AND TRIM

A. Install metal flashings and other sheet metal to comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."

1. Install in accordance with clay-roof-tile manufacturer's written instructions and recommendations in NRCA's "The NRCA Roofing Manual: Steep-Slope Roof Systems."

B. Apron Flashings: Extend lower flange over and beyond each side of downslope tile roofing and up the vertical surface.

C. Step Flashings: Install with a headlap of 4 inches (102 mm) and extend both horizontally and vertically. Install with lower edge of flashing just upslope of, and concealed by, butt of overlying tile. Fasten to roof deck only.

D. Cricket and Backer Flashings: Install against roof-penetrating elements, extending concealed flange beneath upslope tile roofing and beyond each side.

E. Channel Flashings: Install over underlayment materials and fasten to roof deck.

F. Rake Pan Flashings: Install over underlayment materials and fasten to roof deck.

G. Counterflashings: Coordinate with installation of base flashing and fit tightly to base flashing. Lap joints a minimum of 4 inches (102 mm) secured in a waterproof manner.
1. Install in reglets or receivers.

H. Valley Flashings: Install centered in valleys, lapping ends at least 8 inches (203 mm) in direction that sheds water. Fasten upper end of each length to roof deck beneath overlap.
1. Secure hemmed flange edges into metal cleats spaced 12 inches (305 mm) apart and fastened to roof deck.
2. Adhere minimum 9-inch- (229-mm-) wide strips of self-adhering, polymer-modified bitumen sheet to metal flanges and to underlying self-adhering,-modified bitumen sheet Place strips parallel to and over flanges so that they will be just concealed by installed tile.
3. Provide a closure at the end of the inverted-V profile of the valley metal to minimize water and ice infiltration.

I. Rake Drip Edges: Install over underlayment materials and fasten to roof deck.

J. Eave Drip Edges: Install below underlayment materials and fasten to roof deck.

K. Pipe Flashings: Form flashing around pipe penetrations and tile roofing. Fasten and seal to tile roofing.

3.4 INSTALLATION OF WOOD NAILERS

A. Install wood nailers securely fastened to roof deck at the following locations:
1. Hips.
2. Ridges.
3. Rakes.

B. Install beveled wood-cant nailers at eaves and securely fasten to roof deck.

C. Install nominal 1-by-2-inch (25-by-51-mm) wood-batten nailers horizontally over 1/2-inch- (13-mm-) high, pressure-preservative-treated wood lath strips in 48-inch (1219-mm) lengths with ends separated by 1/2 inch (13 mm), at spacing required by clay-roof-tile manufacturer, and securely fasten to roof deck.
   1. Install nominal 1-by-2-inch (25-by-51-mm) wood counter battens vertically spaced 4 inches (610 mm) apart and securely fasten to roof deck.

3.5 INSTALLATION OF CLAY ROOF TILES

A. Install clay roof tiles in accordance with manufacturer's written instructions and recommendations in TRI/WSRCA's "Concrete and Clay Roof Tile Installation Manual" and NRCA's "The NRCA Roofing Manual: Steep-Slope Roof Systems" unless more stringent requirements are specified in this Section or indicated on Drawings.
   1. Install to resist wind forces resulting from design wind speeds indicated on Drawings.
   2. Maintain uniform exposure and coursing of clay roof tiles throughout roof.
   3. Extend tiles 2 inches (51 mm) over eave fasciae.
   4. Nail Fastening: Drive nails to clear the clay roof tile so the tile hangs from the nail and is not drawn up.
   5. Wire-Tie Fastening: Install wire-tie systems and fasten clay roof tiles in accordance with manufacturer's written instructions.
   6. Mortar Setting: Install clay roof tiles in accordance with manufacturer's written instructions and acceptance criteria of authorities having jurisdiction.
   7. Tile Locks: Install to support and lock overlying tile butts to underlying tiles.
   8. Cut and fit clay roof tiles neatly around roof vents, pipes, ventilators, and other projections through roof. Fill voids with mortar.
   9. Install clay roof tiles with color blend approved by Architect.

B. High-Profile Clay-Roof-Tile Installation:
   1. Install tile eave closure with mortar.
   2. Provide minimum 3-inch (76-mm) lap between succeeding courses of clay roof tiles.
   3. Install rake tiles indicated.
   4. Install ridge tiles with laps facing away from prevailing wind. Seal laps with butyl sealant..

C. Open Valleys: Cut clay roof tiles at open valleys to form straight lines. Maintain uniform width of exposed open valley from highest to lowest point.
   1. Drill or notch cut valley tiles and wire-tie to fastener placed clear of valley metal flashings.
   2. Do not nail tiles to metal flashings.

D. Remove and replace damaged or broken clay roof tiles.

3.6 ROOFING INSTALLER'S WARRANTY

A. WHEREAS <**Insert name**> of <**Insert address**>, herein called the "Roofing Installer," has performed roofing and associated work ("the work") on the following project:

   1. Owner: <**Insert name of Owner**>.

2. Owner Address: <**Insert address**>.
3. Building Name/Type: <**Insert information**>.
4. Building Address: <**Insert address**>.
5. Area of the Work: <**Insert information**>.
6. Acceptance Date: <**Insert date**>.
7. Warranty Period: <**Insert time**>.
8. Expiration Date: <**Insert date**>.

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant the work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that, during Warranty Period, Roofing Installer will, at Roofing Installer's own cost and expense, make or cause to be made such repairs to or replacements of the work as are necessary to correct faulty and defective work and as are necessary to maintain the work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to the work and other parts of the building, and to building contents, caused by:

    a. Lightning;
    b. Peak gust wind speed exceeding <**Insert wind speed**> mph (m/s);
    c. Fire;
    d. Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
    e. Faulty construction of copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
    f. Vapor condensation on bottom of roofing; and
    g. Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When the work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to the work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of the work.
4. During Warranty Period, if Owner allows alteration of the work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of the alterations, but only to the extent the alterations affect the work covered by this Warranty. If Owner engages Roofing Installer to perform the alterations, Warranty shall not become null and void unless Roofing Installer, before starting the alterations, notified Owner in writing, showing reasonable cause for claim, that the alterations would likely damage or deteriorate the work, thereby reasonably justifying a limitation or termination of this Warranty.

5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a use or service more severe than originally specified, this Warranty shall become null and void on date of the change, but only to the extent the change affects the work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect the work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on the work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of the work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this <**Insert day**> day of <**Insert month**>, <**Insert year**>.

1. Authorized Signature: <**Insert signature**>.
2. Name: <**Insert name**>.
3. Title: <**Insert title**>.

END OF SECTION 073213

SECTION 075700 - COATED FOAMED ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Spray-applied, coated, polyurethane foam roofing.
   2. Walkways.

1.2 DEFINITIONS

A. Applicator: A qualified person employed to apply spray-applied, coated, polyurethane foam roofing.

B. Installer: A qualified firm contracted to install spray-applied, coated, polyurethane foam roofing.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

1.5 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Research reports.

C. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified coated-foamed-roofing installer who is approved, authorized, or licensed by coating manufacturer for installation of coating manufacturer's product over polyurethane foam.
   1. Engage an installer who participates in and who has fulfilled requirements of the SPFA program for company accreditation as "SPFA PCP Accredited Company Roofing," with individual applicator certification for personnel assigned to work on Project.

B. Comply with recommendations in SPFA AY-104.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace coated foamed roofing that does not comply with requirements or that does not remain watertight within specified warranty period.
   1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Coated Foamed Roofing System: Obtain coating and polyurethane foam from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Coated foamed roofing shall withstand exposure to weather without failure due to defective manufacture, installation, or other defects in construction. Membrane roofing shall remain watertight.
   1. Material Compatibility: Provide polyurethane foam, coatings, substrate board, and auxiliary materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Fire-Test-Response Characteristics: Provide coated foamed roofing with the fire-test-response characteristics indicated, as determined by testing identical systems according to test methods below for deck type and slopes indicated by a qualified testing and inspecting agency that is acceptable to authorities having jurisdiction.
   1. Class A roof covering according to ASTM E108.
   2. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
      a. Flame-Spread Index: 75 or less.
   3. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

C. Wind-Uplift Resistance: Design roofing system to resist the following wind-uplift pressures when tested according to FM 4474, UL 580, or UL 1897:
   1. Zone 1 (Corner Uplift Pressure) 42 lbf/sq. ft. (kPa/sq. m)
   2. Zone 2 (Perimeter Uplift Pressure) 42 lbf/sq. ft. (kPa/sq. m)
   3. Zone 3 (Field of Roof Uplift Pressures) 25 lbf/sq.ft. (kPa/sq.m)
   4. Fire/Windstorm Classification: Class 1A-90
   5. Hail-Resistance Classification: MH

2.3 POLYURETHANE FOAM

A. Polyurethane Foam: Rigid, cellular polyurethane; complying with ASTM C1029, Type III; spray applied, with fire retardants as required, and acceptable to coating manufacturer.
   1. In-Place Density: 2.8 to 3.0 lb/cu. ft. (44.9 to 48.1 kg/cu. m); ASTM D1622/D1622M.
   2. Compressive strength parallel (ASTM D1621): 40 psi minimum at yield.
   3. Tensile Strength parallel (ASTM D1623): 60 psi
   4. Shear Strength perpendicular (ASTM C273): 35 psi
   5. Thermal Conductivity (ASTM C177): 12 max.BTU/sq. ft. /deg.F/inches (ungaged).
   6. Closed Cell content (ASTM D1940): 90% minimum
   7. Water absorption (ASTM D5270): 0.10 lbs/sq. ft.
   8. Dimensional Stability (ASTM D2126): 28 days, 15% maximum
   9. Flammability: Class A (ASTM E108) or Underwriters Laboratory 790

2.4 ACRYLIC COATINGS

A. Acrylic Coating: Liquid acrylic elastomeric emulsion coating system specifically formulated for coating spray-applied polyurethane foam roofing.
   1. Topcoat Color: White
   2. Vapor Permeance: Minimum 5.0 perms (286 ng/Pa x s x sq. m) at 20 mils (0.5 mm) thick according to ASTM E96/E96M, Desiccant Method, Procedure A.

2.5 SUBSTRATE BOARD

A. Thermal Barrier: Water-resistant gypsum board with fiberglass mat laminated to both sides, ASTM C1177/C1177M, Type X, 5/8 inch (16 mm).

B. Thermal-Barrier Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals Standard 4470, and designed and sized for fastening thermal barrier to substrate.

2.6 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended in writing by roofing manufacturer for intended use.
   1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Primer: Polyurethane-foam manufacturer's standard factory-formulated primer.

C. Vapor Retarder: As recommended in writing by coated foamed roofing manufacturer

D. Mineral Granules: Ceramic-coated roofing granules, No. 11 screen size with 100 percent passing No. 8 (2.36-mm) sieve and 98 percent of mass retained by No. 40 (0.42-mm) sieve.
   1. Color: Buff white

E. Walkway Pads: Factory formed of nonwoven PVC strands, porous, UV stabilized, of 5/16-inch (8-mm) nominal thickness, and approved by coating manufacturer. Provide pad sizes indicated.
   1. Color: Gray

F. Sealant: ASTM C920, Class 25, Use NT, Grade NS, Type S, one-component, neutral- or acid-curing silicone, and as recommended in writing by coated foamed roofing manufacturer for substrate and joint conditions and for compatibility with roofing materials.

G. Sheet Flashing and Accessories: Types recommended in writing by coated foamed roofing manufacturer, provided at locations indicated and as recommended.

PART 3 - EXECUTION

3.1 SUBSTRATE BOARD

A. General: Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together over plywood substrate.

B. Apply weather barrier over substrate thermal barrier board using the same weather barrier as specified in Section 072713 “Modified Bituminous Air Barrier”.

3.2 SURFACE PREPARATION

A. General: Clean and prepare substrate according to coated foamed roofing manufacturer's written instructions. Provide clean, dust-free, dew-free, and dry substrate for coated foamed roofing application.

B. Prepare substrate for re-covering according to Section 070150.19 "Preparation for Re-Roofing" and to coated foamed roofing manufacturer's written instructions.

C. Cover and mask adjoining surfaces not receiving coated foamed roofing to prevent overspray or spillage affecting other construction. Temporarily close off roof drains, removing roof-drain plugs when not doing coated foamed roofing work or when rain is forecast.

D. Prime substrate as recommended in writing by coated foamed roofing manufacturer.

E. Fill, cover, or tape joints and cracks in substrate that exceed a width of 1/4 inch (6 mm). Remove dust and dirt from narrower joints and cracks before applying polyurethane foam.

F. Install vapor retarder according to coated foamed roofing manufacturer's written instructions.

3.3 POLYURETHANE FOAM APPLICATION

A. General: Mix and apply polyurethane foam according to ASTM D5469/D5469M and coated foamed roofing manufacturer's written instructions.

B. Apply polyurethane foam in lift thicknesses of not less than 1/2 inch (13 mm) and not more than 1-1/2 inches (38 mm).

C. Uniformly apply total thickness of polyurethane foam indicated, but not less than 1 inch (25 mm), to a surface tolerance of plus 1/4 inch (6 mm) and no minus.
   1. Slope to Drain: Vary thickness uniformly and fill low spots to achieve minimum 1/4-inch-per-foot (1:48) slope to drain unless otherwise indicated.

D. Unless otherwise indicated, extend polyurethane foam at least 4 inches (100 mm) above elevation of adjacent roof field.

E. Surface Finish: Provide finished surface of polyurethane foam within the following range of surface textures as defined by ASTM D5469/D5469M:
   1. Texture: Smooth to verge of popcorn

F. Remove and replace polyurethane foam not complying with surface-texture limitations. Remove defective thickness and prepare and reapply polyurethane foam with acceptable, uniform results.

3.4 COATING APPLICATION

A. Apply coating system to polyurethane foam by spray, roller, or other suitable application method according to coating manufacturer's written instructions.

B. Apply base coat and one or more topcoats to obtain a uniform, seamless membrane free of blisters and pinholes. Apply each coat at right angles to preceding coat, using contrasting color tints for successive coats.
   1. Acrylic Coating: Apply coating system to a minimum dry film thickness recommended in writing by coated foamed roofing manufacturer.

C. Height at Terminations: Apply coating system at wall terminations and other vertical surfaces to extend vertically beyond polyurethane foam by a minimum of 4 inches (100 mm).

D. Mineral Granules: Apply mineral granules over wet topcoat, using pressure equipment at the rate of 0.5 lb/sq. ft. (2.45 kg/sq. m). Remove excess granules after topcoat has cured.

E. Sealant: Apply sealant to perimeter and other terminations where indicated on Drawings or required by coated foamed roofing manufacturer.

F. Walkways: Install roof walkways at locations indicated and as follows:
   1. Preformed Walkway-Pad Walkways: Adhere walkway pads to substrate with compatible adhesive according to coated foamed roofing manufacturer's written instructions.

G. Cure coatings according to manufacturer's written instructions, taking care to prevent contamination and damage during application stages and curing. Do not permit traffic on uncured coatings.

END OF SECTION 075700

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Manufactured reglets with counterflashing.
   2. Formed low-slope roof sheet metal fabrications.
   3. Formed steep-slope roof sheet metal fabrications.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Shop Drawings: For sheet metal flashing and trim.
   1. Include plans, elevations, sections, and attachment details.
   2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
   3. Include identification of material, thickness, weight, and finish for each item and location in Project.
   4. Include details for forming, including profiles, shapes, seams, and dimensions.
   5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
   6. Include details of termination points and assemblies.
   7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
   8. Include details of roof-penetration flashing.
   9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.
   10. Include details of special conditions.
   11. Include details of connections to adjoining work.

B. Samples: For each exposed product and for each color and texture specified, 12 inches (300 mm) long by actual width.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of coping and roof edge flashing that is ANSI/SPRI/FM 4435/ES-1 tested and FM Approvals approved.

B. Evaluation Reports: For copings and roof edge flashing, from an agency acceptable to authority having jurisdiction showing compliance with ANSI/SPRI/FM 4435/ES-1.

C. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Special warranty.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
   1. For copings and roof edge flashings that are ANSI/SPRI/FM 4435/ES-1 tested and, shop shall be listed as able to fabricate required details as tested and approved.

1.7 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
      b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing"

and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. SPRI Wind Design Standard: Manufacture and install roof edge flashings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:
   1. Design Pressure: As indicated on Drawings

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces..

2.2 SHEET METALS

A. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet in accordance with ASTM A653/A653M, G90 (Z275) coating designation, prepainted by coil-coating process to comply with ASTM A755/A755M.
   1. Surface: Smooth, flat and with manufacturer's standard clear acrylic coating on both sides.
   2. Exposed Coil-Coated Finish:
      a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   3. Color: As selected by Architect from manufacturer's full range.
   4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil (0.013 mm).

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet Underlayment: Minimum 30 mils (0.76 mm) thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer in accordance with underlayment manufacturer's written instructions.
   1. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F (29 deg C) or lower.

2.4 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners**,** solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
   1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
      a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
      b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
   2. Fasteners for Galvanized Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329.

C. Solder:
   1. For Zinc-Coated (Galvanized) Steel: ASTM B32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead with maximum lead content of 0.2 percent.

D. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

F. Bituminous Coating: Cold-applied asphalt emulsion in accordance with ASTM D1187/D1187M.

2.5 FABRICATION, GENERAL

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.
   1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
   2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
   3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
   4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
   5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:
   1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

G. Seams:
1. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
2. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.

2.6 ROOF-DRAINAGE SHEET METAL FABRICATIONS

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing : Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long sections. Furnish with 6-inch- (150-mm-) wide, joint cover plates. Shop fabricate interior and exterior corners.
1. Fabricate from the following materials:
a. Galvanized Steel: 0.028 inch (0.71 mm) thick.

B. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
1. Galvanized Steel: 0.028 inch (0.71 mm) thick.

C. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
1. Galvanized Steel: 0.022 inch (0.56 mm) thick.

D. Roof-Penetration Flashing: Fabricate from the following materials:
1. Galvanized Steel: 0.028 inch (0.71 mm) thick.

2.8 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

1. Galvanized Steel: 0.022 inch (0.56 mm) thick.

B. Valley Flashing: Fabricate from the following materials:
   1. Galvanized Steel: 0.028 inch (0.71 mm) thick.

C. Drip Edges: Fabricate from the following materials:
   1. Galvanized Steel: 0.022 inch (0.56 mm) thick.

D. Eave, Rake, Ridge, and Hip: Flashing: Fabricate from the following materials:
   1. Galvanized Steel: 0.022 inch (0.56 mm) thick.

PART 3 - EXECUTION

3.1 INSTALLATION OF UNDERLAYMENT

A. Self-Adhering, High-Temperature Sheet Underlayment:
   1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
   2. Prime substrate if recommended by underlayment manufacturer.
   3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
   4. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses.
   5. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps and edges with roller.
   6. Roll laps and edges with roller.
   7. Cover underlayment within 14 days.

3.2 INSTALLATION, GENERAL

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.
   1. Install fasteners**,** solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, or sealant.
   3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
   4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
   5. Space individual cleats not more than 12 inches (300 mm) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
   6. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
   7. Do not field cut sheet metal flashing and trim by torch.
   8. Do not use graphic pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by

painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
   1. Space movement joints at maximum of 10 feet (3 m) with no joints within 24 inches (600 mm) of corner or intersection.
   2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.

D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws, Secure to substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.
   1. Use sealant-filled joints unless otherwise indicated.
      a. Embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant.
      b. Form joints to completely conceal sealant.
      c. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way.
      d. Adjust setting proportionately for installation at higher ambient temperatures.
         1) Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
   2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter.
   1. Pretin edges of sheets with solder to width of 1-1/2 inches (38 mm); however, reduce pretinning where pretinned surface would show in completed Work.
   2. Do not use torches for soldering.
   3. Heat surfaces to receive solder, and flow solder into joint.
      a. Fill joint completely.
      b. Completely remove flux and spatter from exposed surfaces.

3.3 INSTALLATION OF ROOF-DRAINAGE SYSTEM

A. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

3.4 INSTALLATION OF ROOF FLASHINGS

A. Install sheet metal flashing and trim to comply with performance requirements and cited sheet metal standard.
   1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.

2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing:
1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch (75-mm) centers.
3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.

C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches (100 mm) over base flashing. Install stainless steel draw band and tighten.

D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.
1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
2. Extend counterflashing 4 inches (100 mm) over base flashing.
3. Lap counterflashing joints minimum of 4 inches (100 mm).

E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.5 INSTALLATION OF WALL FLASHINGS

A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

3.6 INSTALLATION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.7 CLEANING

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

3.8 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 076200

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Penetration firestopping systems for the following applications:
      a. Penetrations in fire-resistance-rated walls.
      b. Penetrations in horizontal assemblies.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.
   1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Product Test Reports: For each penetration firestopping system, for test performed by a qualified testing agency.

C. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Approval according to FM Approval 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

B. Fire Test Response Characteristics:
   1. Preform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Test per testing standards referenced in “Penetration Firestopping Systems” Article. Provide rated systems complying with the following requirements:

a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
1). UL in it's "Fire Resistance Directory".

1.5. PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufactures or when substrates are wet because of rain, frost, condensation or other caused.

B. Install and cure penetration firestopping materials per manufacture's written instructions using natural means of ventilations or, where this is inadequate, forced air circulation.

1.6. COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design,

B. Coordinate sizing of sleeves, openings, core drilled holes or cut openings to accommodate penetration firestopping systems.

PART 2 *PRODUCTS*

2,1, PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:
1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
1) UL in its "Fire Resistance Directory."

2.2. PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Manufactures subject to compliance with requirements, provide products from one of the following:
1. M Fire Protection Products
2. Grace Construction Products, W. R. Grace & Co.
3. Hilti Inc.

4. Rector Seal
5. Specified Technologies Inc.
6. Tremco Inc.

C. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
   1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg (74.7 Pa).
   1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at and no more than 50-cfm (0.024-cu. m/s) cumulative total for any 100 sq. ft. (9.3 sq. m) at both ambient and elevated temperatures.

E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E84.

F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
   1. Permanent forming/damming/backing materials
   2. Substrate Primers
   3. Collars
   4. Steel Sleeves

PART 3 EXECUTION

3.1 INSTALLATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work. Clean out openings immediately to comply with manufacture’s written instructions A.General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.
   2. Install fill materials by proven techniques to produce the following results:
   3. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
   5. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   6. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.2. IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches (76 mm) high and with minimum 0.375-inch (9.5-mm) strokes.
   1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet (4.57 m) from end of wall and at intervals not exceeding 30 feet (9.14 m).

B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing and inspecting agency.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.

3.3. FIELD QUALITY CONTROL

A. Engage a qualified testing agency to perform tests and inspections according to ASTM E2174.

B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.4. CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufactures and that do not damage materials in which openings occur.

C. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION 078413

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Nonstaining silicone joint sealants.
   2. Urethane joint sealants.
   3. Mildew-resistant joint sealants.
   4. Latex joint sealants.
   5. Butyl Joint sealants
   6. Urethane Joint sealant for exterior paving areas

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product data for each joint sealant product.

B. Samples: Manufacturer's standard color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Joint-sealant schedule.

1.4 INFORMATIONAL SUBMITTALS

A. Field Quality-Control Submittals:
   1. Field-Adhesion-Test Reports: For each sealant application tested Include the following for each joint sealant and substrate material to be tested:
      a. Joint sealant location and designation
      b. Manufacturer and Product Name
      c. Type of substrate material
      d. Test Results
      e. Number of samples required.

B. Preconstruction Field Adhesion Test Reports: Indicate which sealants ans joint preparation methods resulted in optimum adhesion to joint substrates base on testing specified in Preconstruction Testing Article.

C. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Warranty Documentation:
   1. Manufacturers' special warranties.
   2. Installer's special warranties.

1.6 QUALITY ASSURANCE

A. Qualifications:
   1. Installers: Authorized representative who is trained and approved by manufacturer.
   2. Testing Agency: Qualified in accordance with ASTM C1021 to conduct the testing indicated.

1.7. FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1 When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacture or are below 40 deg. F (5 deg C).
   2 When joint substrates are wet
   3 Where joint widths are less than those allowed by joint sealant manufacture for applications indicated.
   4 Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7. WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
   1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
   2. Disintegration of joint substrates from causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range of colors.

C. VOC Content of interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following:
   1. Architectural Sealants shall have a VOC content of 250 g/L or less.
   2. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.
   3. Sealants and sealant primers for porous substrates shall have a VOC content of 775 g/L or less.

2.2 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested in accordance with ASTM C1248.

B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.
   1. Manufactures: Subject to compliance with requirements, provide products by one of the following:
      a. Dow Corning Corporation
      b. GE Construction Sealants; Movement Performance Materials Inc.
      c. May National Associates, Inc.; a subsidiary of Sika Corporation
      d. Pecora Corporation
      e. Tremco Incorporated

2.3 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
   1. Manufactures: Subject to compliance with requirements, provide products by one of the following:
      a. BASF Construction Chemicals – Construction Systems
      b. Bostik Inc.
      c. Pecora Corporation
      d. Polymeric Systems Inc.
      e. Sika Corporation

f. Tremco Incorporated
g. Schnee-Morehead Inc.; an ITW Company

B. Urethane, P, T, : Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Class 25.
1. Manufactures: Subject to compliance with requirements, provide products by one of the following:
a. BASF Construction Chemicals – Construction Systems
b. Bostik Inc.
c. Pecora Corporation
d. Polymeric Systems Inc.
e. Sika Corporation
f. Tremco Incorporated
g. Schnee-Morehead Inc.; an ITW Company

2.4 MILDEW RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
1. Manufactures: Subject to compliance with requirements, provide products by one of the following:
a. Dow Corning Corporation
b. GE Construction Sealants; Movement Performance Materials Inc.
c. May National Associates, Inc.; a subsidiary of Sika Corporation
d. Pecora Corporation
e. Tremco Incorporated

2.5. BUTYL JOINT SEALANTS

A. Butyl Rubber Base Joint Sealants: ASTM C1311
Manufactures: Subject to compliance with requirements, provide products by one of the following:
1. Bostik Inc.
2. Pecora Corporation

2.6. LATEX JOINT SEALANTS.

A. Acrylic Latex acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.
1. Manufactures: Subject to compliance with requirements, provide products by one of the following:
a. BASF Construction Chemicals – Construction Systems
b. Pecora Corporation
c. May National Associates, Inc.; a subsidiary of Sika Corporation
d. Tremco Incorporated

2.5 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin) and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
   1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
   2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.

3. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.2 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

3. Provide concave joint profile in accordance with Figure 8A in ASTM C1193 unless otherwise indicated
4. Provide recessed joint configuration of recess depth and at locations indicated on Drawings in accordance with Figure 8C in ASTM C1193.
    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

G. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

H. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
    a. Extent of Testing: Test completed and cured sealant joints as follows:
        1) Perform 10 tests for the first 1000 ft. (300 m) of joint length for each kind of sealant and joint substrate.
        2) Perform one test for each 1000 ft. (300 m) of joint length thereafter or one test per each floor per elevation.
    b. Test Method: Test joint sealants in accordance with Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
        1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
    c. Inspect tested joints and report on the following:
        1) Whether sealants filled joint cavities and are free of voids.
        2) Whether sealant dimensions and configurations comply with specified requirements.
        3) Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
    d. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.

e. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

2. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

C. Prepare test and inspection reports.

3.4 JOINT-SEALANT SCHEDULE

A. Exterior joints in horizontal traffic surfaces
1. Joint Locations:
a. Control and expansion joints in. brick pavers.
b. Isolation and contraction joints in cast-in-place concrete slabs.
c. Joints between plant-precast architectural concrete paving units.
d. Joints in stone paving units**,** including steps.
e. Tile control and expansion joints.
f. Joints between different materials listed above.
g. Other joints as indicated on Drawings.
2. Joint Sealant: Urethane, P, T.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Exterior joints in vertical surfaces and horizontal nontraffic surfaces
1. Joint Locations:
a. Construction joints in cast-in-place concrete.
b. Joints between plant-precast architectural concrete units.
c. Joints between different materials listed above.
d. Perimeter joints between materials listed above and frames of doors, windows and louvers..
e. Control and expansion joints
f. Other joint s as indicated on Drawings.
2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Interior joints in horizontal traffic surfaces[:
1. Joint Locations:
a. Isolation joints in cast-in-place concrete slabs.
b. Other joints as indicated on Drawings.
2. Joint Sealant: Urethane, S, P, 25, T, NT
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Interior joints in vertical surfaces and horizontal nontraffic surfaces:
1. Joint Locations:
a. Control and expansion joints on exposed interior surfaces of exterior walls.
b. Tile control and expansion joints.

c. Vertical joints on exposed surfaces of walls and partitions.
d. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, S, NS, 25, NT
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement:
1. Joint Locations:
a. Control joints on exposed interior surfaces of exterior walls.
b. Perimeter joints between interior wall surfaces and frames of interior doors and windows
c. Other joints as indicated on Drawings.
2. Joint Sealant: Acrylic latex
3. Joint-Sealant Color: Match Architect's sample

F. Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces:
1. Joint Locations:
a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Tile control and expansion joints where indicated.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT
3. Joint-Sealant Color As selected by Architect from manufacturer's full range of colors.

G. Concealed mastics:
1. Joint Locations:
a. Aluminum thresholds.
b. Sill plates.
c. Other joints as indicated on Drawings.
2. Joint Sealant: Butyl-rubber based
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Interior standard hollow-metal doors and frames.
   2. Exterior standard hollow-metal doors and frames.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include the following:
   1. Elevations of each door type.
   2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   4. Locations of reinforcement and preparation for hardware
   5. Details of each different wall openings
   6. Details of electrical raceway and preparation for electrified hardware, access control systems and security systems.
   7. Details of anchorages, joints, field splices and connections
   8. Details of accessories
   9. Details of moldings, removeable stops and glazing

C. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Field quality control reports.

1.4 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.5 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies shall meet the qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:
   1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

B. Egress Door Inspector Qualifications: Inspector for field quality control inspections of egress door assemblies shall meet the qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:
   1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

1.6. DELIVERY, STORAGE AND HANDLING

A. Deliver Hollow Metals doors and frames packaged, or crated to provide protection during transit and Project site storage. Do not use nonvented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack weld to jambs and mullions

C. Store Hollow Metal doors and frames vertically under cover at Project site with Head up. Place on minimum 4 inch high wood blocking and provide a minimum ¼ inch (6 mm) space between each stacked door to permit air circulation.

1.7. COORDINATION

A. Coordinate anchorage for hollow metal frames. Furnish setting drawings, templetes and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts and items with integral anchors. Deliver such items to project site in time for installation.

B. Coordinate requirements for installation of door hardware, electrified door hardware and access control and security systems.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufactures: Subject to compliance with requirements, provide products by one of the following:
   1. Ceco Door, ASSA ABLOY
   2. Curries Company, ASSA ABLOY
   3. Fleming Door Products Ltd., Assa Abloy Group Company
   4. Republic Doors and Frrames
   5. Steelcraft, an Allegion brand

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated on Drawings, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

B. Fire-Rated, Borrowed-Lite Assemblies: Assemblies complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing in accordance with NFPA 257 or UL 9.

C. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.50 deg Btu/F x h x sq. ft. (2.84 W/K x sq. m) when tested in accordance with ASTM C518.

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B. At locations indicated in the Door and Frame Schedule.
   1. Doors:
      a. Type: As indicated in the Door and Frame Schedule.
      b. Thickness: 1-3/4 inches (44.5 mm).
      c. Face: Uncoated steel sheet, minimum thickness of 0.042 inch (1.0 mm).
      d. Edge Construction: Model 2, Seamless.
      e. Core: Kraft-paper honeycomb
      f. Fire-Rated Core: Manufacturer's standard laminated mineral board core for fire-rated doors.
   2. Frames:
      a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
      b. Construction: Full profile welded.

2.4 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A. At locations indicated for all exterior hollow metal door and frames..
   1. Doors:
      a. Type: As indicated in the Door and Frame Schedule.
      b. Thickness: 1-3/4 inches (44.5 mm).
      c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A40 (ZF120) coating.
      d. Edge Construction: Model 2, Seamless.

e. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
f. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
g. Core: Polyurethane or Polyisocyanurate
h. Fire-Rated Core: Manufacturer's standard laminated mineral board core for fire-rated doors.

2. Frames:
   a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A40 (ZF120) coating.
   b. Construction: Full profile welded
3. Exposed Finish: Prime coated

2.5 BORROWED LITES

A. Fabricate of uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm).

B. Construction: Full profile welded.

C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.

D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.6 FRAME ANCHORS

A. Jamb Anchors:
   1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
   2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches (610 mm) of frame height above 7 feet (2.1 m).
   3. Postinstalled Expansion Anchor: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.
   1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

2.7 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

C. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.

D. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

E. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

F. Glazing: Comply with requirements in Section 088000 "Glazing."

2.8 FABRICATION

A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
   1. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding.
   2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
      a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
      b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule, and templates.
   1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
   2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

D. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with mitered hairline joints.
   1. Provide stops and moldings flush with face of door, and with **square** stops unless otherwise indicated.
   2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
   3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
   4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
   5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

2.9 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
   1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.
   1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
      a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
      b. Install frames with removable stops located on secure side of opening.
   2. Fire-Rated Openings: Install frames in accordance with NFPA 80.
   3. Floor Anchors: Secure with postinstalled expansion anchors.

a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

4. Solidly pack mineral-fiber insulation inside frames.
5. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
6. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
   a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

B. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
   1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.
   2. Fire-Rated Doors: Install doors with clearances in accordance with NFPA 80.
   3. Smoke-Control Doors: Install doors in accordance with NFPA 105.

C. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.
   1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
   2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.

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.

3.4 REPAIR

A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

B. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Five-ply flush wood veneer-faced doors for transparent finish.
   2. Factory finishing flush wood doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:
   1. Door core materials and construction.
   2. Door edge construction
   3. Door face type and characteristics.
   4. Door louvers.
   5. Door trim for openings.
   6. Door frame construction.
   7. Factory-machining criteria.
   8. Factory**:** finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:
   1. Door schedule indicating door and frame location, type, size, fire protection rating, and swing.
   2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
   3. Details of frame for each frame type, including dimensions and profile.
   4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
   5. Dimensions and locations of blocking for hardware attachment, including blocking for mortise hardware.
   6. Clearances and undercuts.
   7. Requirements for veneer matching.
   8. Door to be factory finished and application requirements.
   9. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples: For factory-finished doors.

1.3 INFORMATIONAL SUBMITTALS

A. Sample Warranty for Special Warranty
   1. Warranty period for Solid Core Interior Doors: Life of Installation
   2. Warranty shall include installation and finishing that may be required due to repair or replacement of defective doors.

B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.4 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification

B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.5 QUALITY ASSURANCE

A. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

.6. DELIVERY, STORAGE AND HANDLING

A. Comply with requirements of referenced standard and manufacturer’s written instructions.

B. Package door individually in carboard carton and wrap bundles of doors in plastic sheeting.

C. Mark each door on top and bottom rail with opening number used on shop drawings.

D. Do not deliver or install doors until spaces are enclosed and weathertight, wet work spaces is complete and dry, HVAC system is operating and maintaining ambient temperature and humidity conditions at occupany levels during remainder of construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURES

A. Basis of Design Products: Subject to compliance with requirements, provide VT Industries Select White Maple, Clear Finish (CL18) or approved comparable products by one of the following:
1. Aloma Hardwoods, Inc.
2. Graham Wood Doors, ASSA ABLOY Group Co.
3. Eggers Industries
4. Marshfield Door Systems, Inc.

B. Souce limitations: Obtain flush wood doors from a single manufacture.

2.2 FLUSH WOOD DOORS GENERAL

A. Quality Standard: In addition to requirements specified, comply with "Architectural Woodwork Standards."

1. Provide labels and certificates from AWI certification program indicating that doors comply with requirements of grades specified.

2.3 SOLID-CORE, FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Doors [

B. Performance Grade: ANSI/WDMA I.S. 1A Extra Heavy Duty and Heavy Duty Doors
   1. Performance Grade:
      a. ANSI/WDMA I.S. 1A Heavy Duty unless otherwise indicated on Drawings.
      b. ANSI/WDMA I.S. 1A Extra Heavy Duty: Classrooms, public toilets, janitor's closets, assembly spaces, exits and patient rooms.
   2. Architectural Woodwork Standards ANSI/WDMA I.S. 1A Grade: Premium.
   3. Faces: Single-ply wood veneer not less than 1/50 inch (0.508 mm) thick.
      a. Species: Select white maple, all Sapwood.
      b. Cut: Plain Sliced
      c. Match between Veneer Leaves: Book match.
      d. Assembly of Veneer Leaves on Door Faces: Center-balance match.
      e. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
      f. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 10 feet (3 m) to 20 feet (6 m) or more.
      g. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
      h. Blueprint Match: Where indicated, provide doors with faces produced from same flitches as adjacent wood paneling and arranged to provide blueprint match with wood paneling. Comply with requirements in Section 064216 "Flush Wood Paneling."
   4. Exposed Vertical and Top Edges: Same species as faces or a compatible species - Architectural Woodwork Standards edge Type A.
   5. Core for Non-Fire-Rated Doors: WDMA I.S. 10 Structural composite lumber
      a. Screw Withdrawal, Face: 700 lbf (3100 N)
      b. Screw Withdrawal, Edge: 400 lbf (1780 N)

2.4 LIGHT FRAMES AND LOUVERS

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
   1. Wood Species: Same species as door faces
   2. Profile: Flush rectangular beads

B. Wood Louvers: Door manufacturer's standard solid-wood louvers unless otherwise indicated.
   1. Wood Species: Same species as door faces
   2. Profile: Flat

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.
   1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
   2. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.
   1. Locate hardware to comply with DHI-WDHS-3.
   2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
   3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
   4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
   5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Openings: Factory cut and trim openings through doors.
   1. Light Openings: Trim openings with moldings of material and profile indicated.
   2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."
   3. Louvers: Factory install louvers in prepared openings.

2.6 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.
   1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
   2. Finish faces, all four edges, edges of cutouts, and mortises.
   3. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Transparent Finish:
   1. Architectural Woodwork Standards, ANSI/WDMA I.S. 1A Grade: Premium
   2. Finish: Architectural Woodwork Standards System-11, Polyurethane, Catalyzed.
   3. Effect: Open-grain finish
   4. Sheen: Satin

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Install doors within frames to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Install frames level, plumb, true, and straight, frames provided and installed in Section 081113 “Hollow Metal Doors and Frames”

D. Job-Fitted Doors:
   1. Align and fit doors in frames with uniform clearances and bevels as indicated below.
      a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.
   2. Machine doors for hardware.
   3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
   4. Clearances:
      a. Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors.
      b. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
      c. Where threshold is shown or scheduled, provide1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.
      d. Comply with NFPA 80 for fire-rated doors.
   5. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
   6. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock edge; trim stiles and rails only to extent permitted by labeling agency.

E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

F. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

G. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly

3.2 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: 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.

END OF SECTION 081416

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Access doors and frames for walls and ceilings

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of access door and frame and for each finish specified.

1.3 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection[**and temperature-rise limit**] ratings indicated, according to NFPA 252 or UL 10B.

2.2 ACCESS DOORS AND FRAMES

A. Manufactures: Subject to compliance with requirements, provide products from one of the following:
   1. Acudor Products, Inc.
   2. Babcock-Davis
   3. Jensen Industries, Division of Broan-Nutone, LLC
   4. J.L. Industries, Inc. Division of Activar Construction Products Group
   5. Karp Associates, Inc.
   6. Larsen’s Manufacturing Company
   7. Milcor, Inc.
   8. Nystrom, Inc.

B. Flush Access Doors with Exposed Flanges
   1. Description: Face of door flush with frame, with exposed flange and concealed hinge.

2. Locations: Walls of non-gypsum board
3. Door Size: As required to access component.
4. Frame Material: Same material, thickness, and finish as door
5. Latch and Lock: Cam latch, key operated

C. Flush Access Doors with Concealed Flanges
1. Description: Face of door flush with frame; with concealed flange for gypsum board or plaster walls and ceilings installation and concealed hinge.
2. Door Size: As required to access component.
3. Uncoated Steel Sheet for Door: Nominal 0.060 inch (1.52 mm), 16 gage, factory primed.
4. Frame Material: Same material and thickness as door
5. Latch and Lock: Cam latch, key operated

2.3 MATERIALS

A. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.

B. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

C. Stainless Steel Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, **Type 304** Remove tool and die marks and stretch lines, or blend into finish.

D. Frame Anchors: Same material as door face.

E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.4 FABRICATION

A. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

B. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

C. Latch and Lock Hardware:
1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
2. Keys: Furnish two keys per lock and key all locks alike.

2.5 FINISHES

A. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
   1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Adjust doors and hardware, after installation, for proper operation.

3.2 FIELD QUALITY CONTROL

A. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

B. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

END OF SECTION 083113

SECTION 08 41 13

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Aluminum-framed interior storefront systems.
   2. Aluminum-framed interior entrance door systems.

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
   1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
   2. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum- framed entrances and storefronts, showing the following:
      a. Joinery, including concealed welds.
      b. Anchorage.
      c. Expansion provisions.
      d. Glazing.
      e. Flashing and drainage.
   3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
   4. Include point-to-point wiring diagrams showing the following:
      a. Power requirements for each electrically operated door hardware.
      b. Location and types of switches, signal device, conduit sizes, and number and size of wires.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

E. Delegated-Design Submittal: For aluminum-framed entrances and storefronts including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the state in which Project is located.

B. Quality-Control Program: Developed specifically for Project, including fabrication and installation, according to recommendations in ASTM C1401. Include periodic quality-control reports.

C. Source quality-control reports.

D. Sample Warranties: For special warranties.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

B. Maintenance Data for Structural Sealant: For structural-sealant-glazed storefront to include in maintenance manuals. Include ASTM C1401 recommendations for post-installation-phase quality-control program.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
   1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

C. Structural-Sealant Glazing: Comply with ASTM C1401 for design and installation of storefront systems that include structural glazing.

1.07 MOCKUPS

A. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockup of typical wall area as shown on Drawings.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 WARRANTY

A. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within

specified warranty period.

1. Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Delta E units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c. Cracking, peeling, or chipping.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, registered in the State of Arizona, to design aluminum-framed entrances and storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
   1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
   2. Failure also includes the following:
      a. Thermal stresses transferring to building structure.
      b. Glass breakage.
      c. Noise or vibration created by wind and thermal and structural movements.
      d. Loosening or weakening of fasteners, attachments, and other components.
      e. Failure of operating units.

C. Structural-Sealant Joints: Designed to carry gravity loads of glazing.

D. Structural Sealant: ASTM C1184. Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed, aluminum-framed entrances and storefronts without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.
   1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
   2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate, because sealant-to-substrate bond strength exceeds sealant's internal strength.

2.03 STOREFRONT SYSTEMS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Arcadia, Inc.; AR451+ Series or approved comparable product by one of the following:
   1. EFCO Corporation.
   2. Kawneer North America, an Arconic company.
   3. U.S. Aluminum; a brand of C.R. Laurence.
   4. YKK AP America Inc.

B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
   1. Interior Framing Construction: Nonthermal.
   2. Glazing System: Retained mechanically with gaskets on two sides and structural sealant on two sides.
   3. Glazing Plane: Front.
   4. Finish: Black anodic finish.
   5. Fabrication Method: Field-fabricated stick system.
   6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   7. Steel Reinforcement: As required by manufacturer.

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.

2.04 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.
   1. Door Construction: 1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
   2. Door Design: As indicated.
   3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
   4. Finish: Match adjacent storefront framing finish.

2.05 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 08 71 00 "Door Hardware."

B. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door, to comply with requirements in this Section.
   1. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
   2. Opening-Force Requirements: Not more than 5 lbf (22.2 N) to fully open door.

2.06 GLAZING

A. Glazing: Comply with Section 08 80 00 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Structural Glazing Sealants: ASTM C1184 chemically curing silicone formulation that is compatible with system components with which it comes in contact; specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in storefront system indicated.
   1. Color: Black.

D. Weatherseal Sealants: ASTM C920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural- sealant-glazed storefront manufacturers for this use.
   1. Color: Match structural sealant.

2.07 MATERIALS

A. Sheet and Plate: ASTM B209 (ASTM B209M).

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221 (ASTM B221M).

2.08 ACCESSORIES

A. Automatic Door Operators: Section 08 71 13 "Automatic Door Operators."

B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
   2. Reinforce members as required to receive fastener threads.
   3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

C. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil (0.762- mm) thickness per coat.

D. Rigid PVC Filler.

2.09 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Accurately fitted joints with ends coped or mitered.
   3. Physical and thermal isolation of glazing from framing members.
   4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   5. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

C. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

D. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.

E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
   1. At interior and exterior doors, provide compression weather stripping at fixed stops.

F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
   1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
   2. At exterior doors, provide weather sweeps applied to door bottoms.

G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.10 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

2.11 SOURCE QUALITY CONTROL

A. Structural Sealant: Perform quality-control procedures complying with ASTM C1401 recommendations, including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Seal perimeter and other joints watertight unless otherwise indicated.

G. Metal Protection:
   1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
   2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Install joint filler behind sealant as recommended by sealant manufacturer.

I. Install components plumb and true in alignment with established lines and grades.

3.03 INSTALLATION OF GLAZING

A. Install glazing as specified in Section 08 80 00 "Glazing."

3.04 INSTALLATION OF STRUCTURAL GLAZING

A. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

B. Set glazing into framing according to sealant manufacturer and framing manufacturer's written instructions and standard practice. Use a spacer or backer as recommended by manufacturer.

C. Set glazing with proper orientation so that coatings face exterior or interior as specified.

D. Hold glazing in place using temporary retainers of type and spacing recommended by manufacturer, until structural sealant joint has cured.

E. Apply structural sealant to completely fill cavity, according to sealant manufacturer and framing manufacturer's written instructions and in compliance with local codes.

F. Apply structural sealant at temperatures indicated by sealant manufacturer for type of sealant.

G. Allow structural sealant to cure according to manufacturer's written instructions.

H. Clean and protect glass as indicated in Section 08 80 00 "Glazing."

3.05 INSTALLATION OF WEATHERSEAL SEALANT

A. After structural sealant has completely cured, remove temporary retainers and insert backer rod between lites of glass as recommended by sealant manufacturer.

B. Install weatherseal sealant to completely fill cavity, according to sealant manufacturer's written instructions, to produce weatherproof joints.

3.06 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOORS

A. Install entrance doors to produce smooth operation and tight fit at contact points.
   1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
   2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.07 ERECTION TOLERANCES

A. Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
   1. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
   2. Level: 1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
   3. Alignment:
      a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
      b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
      c. Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).
   4. Location: Limit variation from plane to 1/8 inch in 12 feet (3.2 mm in 3.6 m); 1/2 inch (12.7 mm) over total length.

END OF SECTION

SECTION 085123.13 - HOT-ROLLED STEEL WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Hot-rolled steel windows.

B. Related Requirements:
   1. Section 099123 "Interior Painting" and Section 099113 "Exterior Painting" for on-site painting of factory prime-coated windows.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.

B. Shop Drawings:
   1. Plans, elevations, sections, and details.
   2. Detail attachments to other work, and between units, if any.
   3. Hardware and required clearances.
   4. Mullion details, including reinforcement and stiffeners.
   5. Munton details.
   6. Flashing details.
   7. Glazing details.
   8. Accessories.

C. Samples for Verification: Actual sample of finished products for each type of hot-rolled steel window including weather stripping, glazing bead, and hardware.
   1. Size: Manufacturers' standard size.

1.4 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:
   1. Product Test Reports: For each hot-rolled steel window, for tests performed by a qualified testing agency.

B. Field Quality-Control Submittals:

1. Field quality-control reports.

C. Qualification Statements: For Installer and manufacturer

D. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For hot-rolled steel windows.

B. Warranty Documentation:
1. Manufacturers' special warranties.
2. Installer's special warranties.

1.6 QUALITY ASSURANCE

A. Qualifications:
1. Manufacturers: A manufacturer capable of fabricating hot-rolled steel windows that meet performance requirements indicated and of documenting performance by labels, test reports, and calculations.
2. Installers: Entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 MOCKUPS

A. Build mockups **to** demonstrate aesthetic effects and to and set quality standards for fabrication and installation.
1. Build mockup as indicated on Drawings.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 FIELD CONDITIONS

A. Field measure all window openings prior to fabrication to insure window frame proper fit in all existing window openings.

1.9 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace components of hot-rolled steel windows that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Structural failures, including but not limited to excessive deflection

b. Faulty operation of Casement window hardware and widow operation.
c. Deterioration of metals, metal finishes and other materials beyond normal use.

2. Warranty Period:
   a. Window: Ten (10) years from date of Substantial Completion.
   b. Finish: Paint finish by others, See Interior and Exterior Paint Specifications

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufactures: Basis of Design subject to compliance with requirements, provide Torrance Steel Window Company Century 2000 Series windows or approved comparable product by one of the following:
   1. Hope”s Windows, Inc.
   2. SeeKircher Steel Window

2.2 SOURCE LIMITATIONS

A. Obtain hot-rolled steel windows from single source from single manufacturer.

2.3 PERFORMANCE REQUIREMENTS

A. SWI Standards: Comply with applicable requirements in SWI's "Architect's Guide to Steel Windows and Doors" and "Specifications - Solid Hot Rolled Sections," except where more stringent requirements are indicated.

B. Structural Wind Loads: As indicated on Drawings.

C. Deflection Limits: Design glass framing system to limit deflection of glass edges in a direction perpendicular to glass plane to less than 1/175 of glass-edge length for each individual glazing light or 3/4 inch (19 mm), whichever is less, at design pressures.

D. Structural: Test in accordance with ASTM E330/E330M as follows:
   1. When tested at positive and negative wind-load design pressures, hot-rolled steel windows do not evidence deflection exceeding specified limits.
   2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
   3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

E. Air Leakage for Weather-Stripped Sash: Not more than 0.37 cfm/ft. (0.18 L/s/m) of sash crack length at a differential pressure across the windows of 6.24 lbf/sq. ft. (298 Pa) when tested in accordance with ASTM E283/E283M.

F. Air Leakage for Non-Weather-Stripped Sash: Not more than 1.0 cfm/ft. (0.47 L/s/m) of sash crack length at a differential pressure across the windows of 1.56 lbf/sq. ft. (75 Pa) when tested in accordance with ASTM E283/E283M.

G. Water Penetration for Weather-Stripped Sash: No leakage for 15 minutes when window is subjected to a rate of flow of 5 gal./h/sq. ft. (0.05 L/s/sq. m) with a differential pressure across the window of 2.86 lbf/sq. ft. (137 Pa) when tested in accordance with ASTM E331.

2.4 HOT-ROLLED STEEL WINDOWS

A. Types: Provide the following window types in locations indicated on Drawings:
1. Casement: Outswing
2. Fixed.

B. ot-Rolled Steel Windows: Provide frame and sash members formed from hot-rolled, new billet steel sections. Provide combined weight of frame and sash members and depth of frame or sash members according to the SWI specifications category for Heavy Intermediate hot-rolled steel windows.

C. Window Finish: Factory primed

D. Mullions: Formed of hot-rolled steel matching window units; with anchors for support to structure and for installation of window units and having sufficient strength to withstand design pressure indicated. Provide mullions of profile indicated and with cover plates. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections.

E. Muntins: Solid hot-rolled steel T-shaped sections fully welded to perimeter frame with intersections interlocked and welded.

F. Glazing Stops: Provide manufacturer's standard screw-applied or snap-on glazing stops fabricated from formed steel or stainless steel; coordinate with Section 088000 "Glazing" for glazing system indicated. Finish glazing stops with same finish as window units if fabricated of steel; otherwise, provide manufacturer's standard finish. Match color to window units.

G. Glazing Clips: Where face glazing (without glazing stops) is indicated, furnish glazing clips for concealment in glazing compound.

H. Weather Stripping: Manufacturer's standard compressible weather stripping, complying with AAMA 701/702, ASTM C509, or ASTM C864 and designed for permanently resilient sealing under compression and for complete concealment when sash is closed.

2.5 GLAZING

A. Glass and Glazing System: See Section 088000 "Glazing" for glass units and glazing requirements for hot-rolled steel windows.

2.6 HARDWARE

A. General: Provide manufacturer's standard backed enamel solid-bronze hardware, with operating components of stainless steel, carbon steel complying with AAMA 907, brass, bronze, or other corrosion-resistant material designed to smoothly operate, tightly close, and securely lock hot-rolled seel window sash; and sized to accommodate sash weight and dimensions.

B. Casement Window Hardware:
   1. Operation:
      a. Gear-Type Rotary Operator: Complying with AAMA 901 when tested in accordance with ASTM E405, Test Method A; located on jamb at sill.
         1) Provide operating device that opens and closes sashes simultaneously, securely closing them at both jambs without use of additional manually controlled locking devices.
         2) Roto Operator Handle Type and Style: As selected by Architect from manufacturer's full range of types and styles.
   2. Hinges:
      a. Butt Hinges: Heavy-duty, three-knuckle butt hinges with nylon bushings; two per sash.
      b. Extension Hinges or Pivots: Nonfriction type; two per sash.
   3. Locks:
      a. Type: Cam handle with keeper
         1) Style: As selected by Architect from manufacturer's full range of styles.

2.7 ACCESSORIES

A. Fasteners: Provide fasteners of bronze, brass, stainless steel, or other metal that are warranted by manufacturer to be noncorrosive and compatible with trim, hardware, anchors, and other components of hot-rolled steel windows.
   1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

B. Anchors, Clips, and Window Accessories: Provide units of stainless steel, hot-dip zinc-coated steel, bronze, brass, or iron complying with ASTM A123/A123M. Provide units with sufficient strength to withstand design pressure indicated.
   1. Windborne-Debris-Impact Resistance: Provide anchors and clips of same design used to pass windborne-debris-impact-resistance testing.

C. Sealant: For sealants required within fabricated windows, provide manufacturer's standard, permanently elastic, nonshrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.

2.8 FABRICATION

A. Fabricate hot-rolled steel windows of type and in sizes indicated to comply with SWI standards. Include a complete system for assembly of components and anchorage of window units.

B. Provide units that are reglazable without dismantling framing.

C. Prepare windows for site glazing.

D. Subframes and Operable Sash: Formed of hot-rolled steel of profile indicated. Miter or cope corners, and weld and dress joints smooth.

E. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

F. Provide weep holes and internal water passages to conduct infiltrating water to the exterior.

G. Provide water-shed members above casement sash.

2.9 STEEL FINISHES

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" After cleaning, apply a conversion coating suited to the organic coating to be applied over it.

B. Factory Prime Finish: After surface preparation and pretreatment, apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough-opening dimensions, levelness of sill plate, and clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight window installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF HOT-ROLLED STEEL WINDOWS

A. SWI Publication: Comply with applicable requirements in SWI's "Guidelines on How to Install Steel Windows," except where more stringent requirements are indicated.

B. Comply with manufacturer's written instructions for installing windows, hardware, operators, accessories, and other components.

C. Install windows level, plumb, square, true to line, without distortion or impediment to thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

D. Set sill members in bed of sealant or with gaskets, as indicated, to provide weathertight construction.

E. Install windows and components to drain condensation, water-penetrating joints, and moisture migrating within windows to the exterior.

F. Separate corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials according to ASTM E2112.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:
   1. Test windows for air leakage and water penetration in accordance with AAMA 502, Test Method A or B, by applying same test pressures required for performance.
   2. Testing Extent: Three windows as selected by Architect and a qualified independent testing and inspecting agency. Test windows immediately after installation.
   3. Window will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts as recommended in writing by manufacturer.

B. Clean factory-finished steel surfaces immediately after installing windows. Comply with manufacturer's written instructions for final cleaning and maintenance. Avoid damaging protective coatings and finishes.

C. Protect window surfaces from contact with contaminating substances resulting from construction operations. Remove contaminants immediately in accordance with manufacturer's written instructions.

END OF SECTION 085123.13

SECTION 08710 – FINISH HARDWARE

PART 1 - GENERAL

1.1. SUMMARY

A. SECTION INCLUDES
1. Finish hardware for doors.
2. Electronic hardware.
3. Thresholds & weatherstripping
4. Keying System
5. Templates
6. Hardware schedule

1.2. REFERENCES

A. Publications of agencies and organizations listed below form a part of this specification section to the extent referenced.
1. DHI - Recommended Locations for Builders' Hardware.
2. NFPA 80 - Standards for Fire Doors and Windows.
3. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures.
4. UL - Building Material Directory.
5. DHI - Door and Hardware Institute
6. WHI - Warnock Hersey
7. BHMA - Builders Hardware Manufacturers Association
8. ANSI – American National Standards Institute
9. IBC - International Building Code Edition as adopted and amended by local building code authorities

1.4. SUBMITTALS

A. Schedules: Submit detailed finish hardware schedule and product data in accordance with section 01 35 00. Furnish a typewritten schedule in DHI vertical format complete with catalog cuts. Schedule shall be complete, including, size, type, manufacturers name and number, and finish of each item required. Include complete schedule of keying system.

B. Samples: If requested, submit sample of each type of finish hardware proposed for the project. If approved, samples may be used on project.

C. Templates: Furnish templates required for fabrication of hollow metal doors and frames, aluminum and glass doors, or other items related to hardware

1.5. QUALITY ASSURANCE

A. Hardware supplier shall have a minimum of three years experience in supplying hardware for projects of this size and scope and shall have in his employ a certified Architectural Hardware Consultant (AHC) to prepare submittals and coordinate proper preparation for and installation of hardware. The hardware supplier needs to be an authorized factory stocking dealer of the specified products that are being supplied for the project and in good standings with the factory.

B. Manufacturers and model numbers listed are to establish a standard of quality. Hardware manufacturers that are not listed will need to be prior approved by the architect, provide required data and physical samples and submitted in accordance with Section 01 25 00.

C. Regulatory requirements: Conform to code requirements applicable to fire rated doors and frames and to accessibility for the physically handicapped.

1.6. DELIVERY, STORAGE AND HANDLING

A. Package each item of hardware in original containers and mark each to correspond with heading numbers on the hardware schedule.

B. Include necessary instructions, templates, drawings and fasteners for proper installation.

C. Store off the floor in a clean dry area out of the way of work in progress

1.7. WARRANTY

A. Provide warranty of hardware items for one year.
   1. Provide a Thirty-year warranty for door Closers.
   2. Provide a Ten-year warranty for door Lever locks.
   3. Provide a Three-year warranty for door Exit devices.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Catalog numbers of manufacturers listed have been used to establish the quality required. Other manufactures to be prior approved by architect per paragraph 1.5, B.

Hinges	Ives
Locks	Schlage
Closers	LCN
Flat goods	Ives
Exit Device	Von Duprin
Cores	Schlage
OH Stop	GJ

2.2 MATERIALS

B. Screws and Fasteners: Furnish all exposed fasteners to match item being secured. Make all fasteners of the same material as item being fastened except provide stainless steel or brass for securing aluminum items.

C. Hinges:
   1. Full mortise template hinges, ball bearing type.
   2. Non-removable pin and heavy weight.
   3. Furnish quantity of hinges as follows:
      a. Doors over 60" to 84" high: 3 hinges
      b. Doors over 84" to 120": 4 hinges

4. Furnish hinge sizes as follows:
   a. For 1 3/4" doors to 3'0" wide: 4.5" x 4.5"
   b. For 1 3/4" doors over 3'0" wide: 5 x 4.5"
   c. Width of hinges adjusted to clear adjacent trim.

C. Locksets and Latchsets
1. Bored type locksets complying with ANSI 156.2 Series 4000 & 1000 Grade 1.
2. Provide 2 3/4" backsets unless job conditions dictate otherwise.
3. Provide strikes with extended lip where required.
4. Schlage ND Series (SPA) levers specified as the standard of quality.
5. Schlage L9000 Series (17A) levers specified as the standard of quality
6. Schlage CO-100 Wireless lock specified as the standard of quality.

D. Exit Devices
1. All to be U.L. approved for casualty. Fire doors equipped with rated exit dev, meeting fire label requirements.
2. Provide all exit devices from one manufacturer.
3. Von Duprin 99 series specified as the standard of quality Match existing.
4. Provide cylinders as required by exit device for proper operation

E. Door Closers
1. Bodies close grained malleable iron with three separate control valves, including backcheck, ANSI Grade 1.
2. Closers to match adjacent hardware.
3. Provide all closers with thru bolts.
4. All closers to comply with Americans with Disabilities Act requirements.
5. LCN 4040XP Series specified as the standard of quality.

F. Kick Plates
1. Provide .050 x 10" high x 2" less than door width for single doors and 1" less than door width for pairs.
2. Ives 8400 series specified as the standard of quality.

G. Push Plates
1. Provide .050 x 6" x 16" push plates unless conditions dictate otherwise.
2. Ives 8200 series specified as the standard of quality.

H. Pull Plates
1. Provide .050 x 4" x 16" plate with 10" c/c pull.
2. Ives 8303 series specified as the standard of quality

I. Flush Bolts
1. Manual flush bolts equal to Ives FB as listed in hardware sets.
2. Provide extension rods where conditions dictate.

J. Door Stops
1. Wall stops shall be used whenever possible. Use dome type floor stops where wall stops cannot be used.
2. Ives WS401/402 specified as the standard of quality.

K. Silencers
1. Provide 3 for each single door and 2 for each pair of doors. Not require doors having seals.

L. Thresholds and Weather stripping as listed in hardware sets.

2.3 FINISHES

A. Provide matching finishes for hardware items at each door opening to the greatest extent possible, except as otherwise indicated.

B. Provide finishes which comply with those established by BHMA listed in "Materials and Finishes Standard 13B01".

C. Finishes for this project are as follows 626 Interior Black Exterior

1.	Hinges	631
2.	Locksets	622/643E or 626 at CO-100 owner preference
3.	Exit Devices	315
4.	Flat Goods	630/BLK
5.	Stops	630/BLK
6.	Closers	693

2.4 KEYING

A Key all locks into New master key system in accordance with owner's instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors, frames and related items for conditions that would prevent proper application of finish hardware. Do not proceed until defects have been corrected.

3.2 INSTALLATION

A. Install each item in accordance with manufacturer's instructions and recommendations. Set units level, plumb and true to line and location. Do not install surface mounted items until finishes have been completed on substrate.

3.3 ADJUST AND CLEAN

A. At final completion hardware shall be left clean and free from disfigurement. Make a final adjustment to closers and other items of hardware. Where hardware is found defective repair, or replace or otherwise correct as required.

B. The hardware sets are intended to establish a type and standard of quality. It is the responsibility of the contractor to review the drawings and specifications and bring to the attention of the architect any discrepancies prior to the bid. The successful suppliers bid will be considered complete and no extras will be considered.

C. Elevation riser diagrams included in this section and/or section 28 1300 are based on the electrified products listed in the hardware sets. Any deviation from specified hardware products shall make the elevation riser diagrams null and void. If non-specified products are submitted on, material supplier to provide new elevation riser diagrams as part of their submittal package.

3.4. **HARDWARE SCHEDULE:** Provide the following finish hardware items:

~= Hardware Item Requiring Electrical Coordination

HARDWARE GROUP NO. 01
For use on Door #(s):
001 201
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP			631	IVE
1	EA	PANIC DEVICE	99-L-06			315	VON
1	EA	RIM CYLINDER	20-057			622	SCH
1	EA	CLOSER	4040XP SCUSH			693	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS			BLK	IVE
1	SET	WEATHERSTRIP	8303BK			BK	ZER
1	EA	DOOR SWEEP	39BK			BK	ZER
1	EA	THRESHOLD	8655BK-223			BK	ZER

HARDWARE GROUP NO. 02
For use on Door #(s):
100
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
8	EA	HINGE	5BB1HW 5 X 4.5 NRP			631	IVE
1	EA	POWER TRANSFER	EPT10		~	695	VON
1	EA	REMOVABLE MULLION	KR4954B STAB			695	VON
1	EA	PANIC DEVICE	99-EO			315	VON
1	EA	ELECT PANIC DEV	QEL-99-L-06		~	315	VON
1	EA	RIM CYLINDER	20-057			622	SCH
1	EA	MORTISE CYLINDER	20-061			622	SCH
1	EA	ARCHED ST CLOSER	4040XP ST-2480-2			693	LCN
1	EA	ADA OPERATOR	4642 WMS		~	693	LCN
1	EA	WEATHER RING	8310-801			BLK	LCN
2	EA	ACTUATOR, TOUCH	8310-853T		~	630	LCN
2	EA	MOUNT BOX	8310-867S			689	LCN
1	EA	MTG PLATE	FOR ADA OPERATOR			BLK	B/O
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS			BLK	IVE
2	EA	FLOOR STOP	FS436			622	IVE
1	EA	RAIN DRIP	142BK			BK	ZER
2	SET	WEATHERSTRIP	8303BK			BK	ZER
2	EA	DOOR SWEEP	39BK			BK	ZER
1	EA	THRESHOLD	546BK-223			BK	ZER
1	EA	KEY SWITCH	653-04 L2		~	630	SCE
1	EA	WIRING DIAGRAMS	ELEVATION 3101.3		~		VON

4642 OPERATOR INSTALLED ON HEADER MOUNTING PLATE BY OTHERS. (ST)= SPECIAL TEMPLATE
CLOSER FOR ARCH MUST HAVE ARCH DIMENSIONS FOR CLOSER BRACKET.
ADA OPERATOR FOR RHR ACTIVE DOOR. KEYSWITCH TO SHUT OUTSIDE ACTUATOR OFF AFTER HOURS.

HARDWARE GROUP NO. 03

For use on Door #(s):

100.1

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP			631	IVE
1	EA	POWER TRANSFER	EPT10		✓	695	VON
1	EA	REMOVABLE MULLION	KR4954B STAB			695	VON
1	EA	PANIC DEVICE	99-EO			315	VON
1	EA	ELECT PANIC DEV	QEL-99-L-06		✓	315	VON
1	EA	RIM CYLINDER	20-057			622	SCH
1	EA	MORTISE CYLINDER	20-061			622	SCH
1	EA	OH STOP & HOLDER	100H			BLK	GLY
1	EA	OH STOP	100S			BLK	GLY
1	EA	CLOSER	4040XP REG			693	LCN
1	EA	SURF. AUTO OPERATOR	4631 WMS		✓	693	LCN
1	EA	WEATHER RING	8310-801			BLK	LCN
2	EA	ACTUATOR, TOUCH	8310-853T		✓	630	LCN
2	EA	MOUNT BOX	8310-867S			689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS			BLK	IVE
2	SET	WEATHERSTRIP	8303BK			BK	ZER
2	EA	DOOR SWEEP	111BK			BK	ZER
1	EA	THRESHOLD	546BK-223			BK	ZER
1	EA	WIRING DIAGRAMS	ELEVATION 3101.4		✓		VON

HOLD OPEN OVERHEAD HOLDER FOR LHR INACTIVE DOOR.
ADA OPERATOR FOR RHR ACTIVE DOOR.

HARDWARE GROUP NO. 04

For use on Door #(s):

126 125

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5		631	IVE
2	EA	PUSH PLATE	8200 6" X 16"		BLK	IVE
2	EA	PULL PLATE	8303 10" 4" X 16"		BLK	IVE
2	EA	CLOSER	4040XP REG		693	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS		BLK	IVE
2	EA	WALL STOP	WS406/407CCV		622	IVE
2	EA	SILENCER	SR64		GRY	IVE

HARDWARE GROUP NO. 05

For use on Door #(s):

101 102 104 107 110 119
120 121

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		631	IVE
1	EA	WIRELESS LOCK	CO-100-CY-70-KP-RHO-R		643e	SCE
1	EA	CLOSER	4040XP REG		693	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		BLK	IVE
1	EA	WALL STOP	WS406/407CCV		622	IVE
3	EA	SILENCER	SR64		GRY	IVE

HARDWARE GROUP NO. 06

For use on Door #(s):

115B

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		631	IVE
1	EA	PASSAGE SET	ND10S RHO		622	SCH
1	EA	CLOSER	4040XP EDA		693	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		BLK	IVE
1	EA	WALL STOP	WS406/407CCV		622	IVE
1	EA	DOOR SEAL	188S		BK	ZER

HARDWARE GROUP NO. 07

For use on Door #(s):

105 115D 117J 123

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		631	IVE
1	EA	STOREROOM LOCK	ND80TD RHO		622	SCH
1	EA	CLOSER	4040XP REG		693	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		BLK	IVE
1	EA	WALL STOP	WS406/407CCV		622	IVE
3	EA	SILENCER	SR64		GRY	IVE

HARDWARE GROUP NO. 08

For use on Door #(s):

119.5

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		631	IVE
1	EA	REMOVABLE MULLION	KR4954B STAB		695	VON
1	EA	PANIC DEVICE	99-EO		315	VON
1	EA	PANIC DEVICE	99-L-06		315	VON
1	EA	RIM CYLINDER	20-057		622	SCH
1	EA	MORTISE CYLINDER	20-061		622	SCH
2	EA	CLOSER	4040XP SCUSH		693	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS		BLK	IVE
1	EA	RAIN DRIP	142BK		BK	ZER
2	SET	WEATHERSTRIP	8303BK		BK	ZER
2	EA	DOOR SWEEP	39BK		BK	ZER
1	EA	THRESHOLD	8655BK-223		BK	ZER

HARDWARE GROUP NO. 09

For use on Door #(s):

127 129 129.1 129.2

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		631	IVE
1	EA	REMOVABLE MULLION	KR4954B STAB		695	VON
1	EA	PANIC DEVICE	99-EO		315	VON
1	EA	PANIC DEVICE	99-L-06		315	VON
1	EA	RIM CYLINDER	20-057		622	SCH
1	EA	MORTISE CYLINDER	20-061		622	SCH
2	EA	OH STOP	90S		BLK	GLY
2	EA	CLOSER	4040XP REG		693	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS		BLK	IVE
2	SET	WEATHERSTRIP	8303BK		BK	ZER
1	EA	MULLION SEAL	8780N		BK	ZER
2	EA	DOOR SWEEP	111BK		BK	ZER
1	EA	THRESHOLD	546BK-223		BK	ZER

HARDWARE GROUP NO. 10
For use on Door #(s):
126.1
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		631	IVE
1	EA	PANIC DEVICE	99-L-06		315	VON
1	EA	RIM CYLINDER	20-057		622	SCH
1	EA	CLOSER	4040XP SCUSH		693	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		BLK	IVE
1	EA	RAIN DRIP	142BK		BK	ZER
1	SET	WEATHERSTRIP	8303BK		BK	ZER
1	EA	DOOR SWEEP	39BK		BK	ZER
1	EA	THRESHOLD	8655BK-223		BK	ZER

HARDWARE GROUP NO. 11
For use on Door #(s):
103 106 109 110.1 119.4
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		631	IVE
1	EA	WIRELESS LOCK	CO-100-CY-70-KP-RHO-R	✓	643e	SCE
1	EA	OH STOP	90S		BLK	GLY
1	EA	CLOSER	4040XP REG		693	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		BLK	IVE
3	EA	SILENCER	SR64		GRY	IVE

HARDWARE GROUP NO. 12
For use on Door #(s):
117L
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		631	IVE
1	EA	PRIV W/INDICATOR	L9440 06A L583-363 L283-722		622	SCH
1	EA	CLOSER	4040XP EDA		693	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		BLK	IVE
1	EA	WALL STOP	WS406/407CCV		622	IVE
1	EA	DOOR SEAL	188S		BK	ZER

HARDWARE GROUP NO. 13
For use on Door #(s):
111.1 111
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		631	IVE
1	EA	PANIC DEVICE	99-EO		315	VON
1	EA	ELEC EXIT DEVICE TRIM	CO-100-993R-70-KP-RHO-R	✓	643e	SCE
1	EA	CLOSER	4040XP SCUSH		693	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		BLK	IVE
3	EA	SILENCER	SR64		GRY	IVE

1
02/25/2022

HARDWARE GROUP NO. 14

For use on Door #(s):

112.2 112

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		631	IVE
1	EA	CLSSRM DEADBOLT	L463TD		626	SCH
1	EA	PUSH PLATE	8200 6" X 16"		BLK	IVE
1	EA	PULL PLATE	8303 10" 4" X 16"		BLK	IVE
1	EA	CLOSER	4040XP SCUSH		693	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		BLK	IVE
3	EA	SILENCER	SR64		GRY	IVE

HARDWARE GROUP NO. 15

For use on Door #(s):

128 112.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5 NRP		631	IVE
1	EA	PANIC DEVICE	99-L-06		315	VON
1	EA	RIM CYLINDER	20-057		622	SCH
1	EA	CLOSER	4040XP SCUSH		693	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		BLK	IVE
1	EA	RAIN DRIP	142BK		BK	ZER
1	SET	WEATHERSTRIP	8303BK		BK	ZER
1	EA	DOOR SWEEP	39BK		BK	ZER
1	EA	THRESHOLD	8655BK-223		BK	ZER

HARDWARE GROUP NO. 16

For use on Door #(s):

119.1 119.2 119.3

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		631	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO		622	SCH
1	EA	CLOSER	4040XP SCUSH		693	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		BLK	IVE
1	SET	WEATHERSTRIP	8303BK		BK	ZER
1	EA	DOOR SWEEP	39BK		BK	ZER
1	EA	THRESHOLD	8655BK-223		BK	ZER

HARDWARE GROUP NO. 17

For use on Door #(s):

113 114

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		631	IVE
1	EA	PUSH PLATE	8200 6" X 16"		BLK	IVE
1	EA	PULL PLATE	8303 10" 4" X 16"		BLK	IVE
1	EA	CLOSER	4040XP REG		693	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		BLK	IVE
1	EA	WALL STOP	WS406/407CCV		622	IVE
3	EA	SILENCER	SR64		GRY	IVE

HARDWARE GROUP NO. 18

For use on Door #(s):

115C

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		631	IVE
1	EA	STOREROOM LOCK	ND80TD RHO		622	SCH
1	EA	CLOSER	4040XP EDA		693	LCN
1	EA	WALL STOP	WS406/407CCV		622	IVE
3	EA	SILENCER	SR64		GRY	IVE

HARDWARE GROUP NO. 19

For use on Door #(s):

116

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		631	IVE
1	EA	PANIC HARDWARE	99-L-NL-06		315	VON
1	EA	RIM CYLINDER	20-057		622	SCH
1	EA	CLOSER	4040XP SCUSH		693	LCN
1	EA	RAIN DRIP	142BK		BK	ZER
1	SET	WEATHERSTRIP	8303BK		BK	ZER
1	EA	DOOR SWEEP	39BK		BK	ZER
1	EA	THRESHOLD	8655BK-223		BK	ZER

HARDWARE GROUP NO. 20
For use on Door #(s):
116A
Provide each UEP door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		631	IVE
2	EA	MANUAL FLSHBLT	FB458 12"		BLK	IVE
1	EA	DUST PROOF STRIKE	DP1		613	IVE
1	EA	STOREROOM LOCK	ND80TD RHO		622	SCH
1	EA	OH STOP	90S		BLK	GLY
1	EA	CLOSER	4040XP SCUSH		693	LCN
1	EA	RAIN DRIP	142BK		BK	ZER
1	SET	WEATHERSTRIP	8303BK		BK	ZER
2	EA	DOOR SWEEP	39BK		BK	ZER
1	EA	ASTRAGAL	43 X 188S		SP	ZER
1	EA	THRESHOLD	8655BK-223		BK	ZER

HARDWARE GROUP NO. 21
For use on Door #(s):
117
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		631	IVE
1	EA	OFFICE LOCK	ND53TD RHO		622	SCH
1	EA	MORTISE CYLINDER	20-061		626	SCH
1	EA	ELECTRIC STRIKE	6211AL FSE	↙	630	VON
1	EA	OH STOP	90S		BLK	GLY
1	EA	SURF. AUTO OPERATOR	4631 WMS	↙	693	LCN
2	EA	WEATHER RING	8310-801		BLK	LCN
2	EA	MOUNT BOX	8310-867S		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		BLK	IVE
1	EA	KEY SWITCH	653-04 L2	↙	630	SCE
1	EA	WIRING DIAGRAMS	ELEVATION 1138.1	↙		VON
1	EA	SEALS	BY FRAME SUPPLIER			ALF

KEYSWITCH TO SHUT OUTSIDE ACTUATOR OFF AFTER HOURS.

HARDWARE GROUP NO. 22
For use on Door #(s):
117.1
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		631	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO		622	SCH
1	EA	CLOSER	4040XP EDA		693	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		BLK	IVE
1	EA	WALL STOP	WS406/407CCV		622	IVE
3	EA	SILENCER	SR64		GRY	IVE

HARDWARE GROUP NO. 23

For use on Door #(s):

117A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		631	IVE
1	EA	STOREROOM LOCK	ND80TD RHO		622	SCH
1	EA	CLOSER	4040XP SCUSH		693	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		BLK	IVE
3	EA	SILENCER	SR64		GRY	IVE

HARDWARE GROUP NO. 24

For use on Door #(s):

117C 117E 117F 117G

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		631	IVE
1	EA	PASSAGE SET	ND10S RHO		622	SCH
1	EA	WALL STOP	WS406/407CCV		622	IVE
1	EA	DOOR SEAL	188S		BK	ZER

HARDWARE GROUP NO. 25

For use on Door #(s):

124

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		631	IVE
1	EA	PRIV W/INDICATOR	L9440 06A L583-363 L283-722		622	SCH
1	EA	CLOSER	4040XP REG		693	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		BLK	IVE
1	EA	WALL STOP	WS406/407CCV		622	IVE
1	EA	DOOR SEAL	188S		BK	ZER

HARDWARE GROUP NO. 26

For use on Door #(s):

112A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5 NRP		631	IVE
1	EA	STOREROOM LOCK	ND80TD RHO		622	SCH
1	EA	OH STOP	90S		BLK	GLY
3	EA	SILENCER	SR64		GRY	IVE

HARDWARE GROUP NO. 27
For use on Door #(s):
118
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		631	IVE
1	EA	POWER TRANSFER	EPT10	✓	695	VON
1	EA	REMOVABLE MULLION	KR4954B STAB		695	VON
1	EA	PANIC DEVICE	99-EO		315	VON
1	EA	ELECT PANIC DEV	QEL-99-L-06	✓	315	VON
1	EA	RIM CYLINDER	20-057		622	SCH
1	EA	MORTISE CYLINDER	20-061		622	SCH
2	EA	OH STOP	100S		BLK	GLY
1	EA	CLOSER	4040XP EDA		693	LCN
1	EA	ADA OPERATOR	4642 WMS	✓	693	LCN
1	EA	WEATHER RING	8310-801		BLK	LCN
2	EA	ACTUATOR, TOUCH	8310-853T	✓	630	LCN
2	EA	MOUNT BOX	8310-867S		689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS		BLK	IVE
1	EA	RAIN DRIP	142BK		BK	ZER
2	SET	WEATHERSTRIP	8303BK		BK	ZER
2	EA	DOOR SWEEP	39BK		BK	ZER
1	EA	THRESHOLD	546BK-223		BK	ZER
1	EA	KEY SWITCH	653-04 L2	✓	630	SCE
1	EA	WIRING DIAGRAMS	ELEVATION 3101.3	✓		VON

ADA OPERATOR FOR RHR ACTIVE DOOR. KEYSWITCH TO SHUT OUTSIDE ACTUATOR OFF AFTER HOURS.

HARDWARE GROUP NO. 28
For use on Door #(s):
117M
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	631	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO	622	SCH
1	EA	OH STOP	90S	BLK	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	BLK	IVE
3	EA	SILENCER	SR64	GRY	IVE

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Glass products.
      a. Laminated glass.
      b. Insulating glass.
      c. Tempered Monolithic glass
   2. Glazing sealants.
   3. Glazing tapes.
   4. Miscellaneous glazing materials.

1.2 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site**.**

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches (300 mm) square.

C. Delegated Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For glass.

B. Product test reports.

C. Preconstruction adhesion and compatibility test report.

D. Sample warranties.

1.6 QUALITY ASSURANCE

A. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

1.7 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
   1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
   1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.
   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.

B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:
   1. Design Wind Pressures: As indicated on Drawings.
   2. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.

C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
   1. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
   2. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
   3. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.2 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
   2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements". Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.3 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.

B. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

C. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

2.4 LAMINATED GLASS

A. Laminated Glass (LT) with Low E: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
   1. Construction: Laminate glass with polyvinyl butyral interlayer and Low E coating on surface 2 to comply with interlayer manufacturer's written instructions.
   2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
   3. Interlayer Color: Clear unless otherwise indicated.

2.5 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.
   1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
   2. Perimeter Spacer: Aluminum, black color anodic finish

2.6 GLAZING SEALANTS

A. General:
   1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
   2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
   3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.

B. Neutral-Curing Silicone Glazing Sealant, Class 50: Complying with ASTM C920, Type S, Grade NS, Use NT.

2.7 MISCELLANEOUS GLAZING MATERIALS

A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

B. Setting Blocks: Neoprene with Shore A durometer hardness of 85, plus or minus 5.

C. Spacers: Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

D. Edge Blocks: Neoprene Shore A durometer hardness per manufacturer's written instructions.

E. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

PART 3 - EXECUTION

3.1 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

3.3. GASKET GLAZING (DRY) INTERIOR UNITS

A. Cut compression gaskets to lengths recommended by gasket manufacture to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners

and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacture.

3.4. SEALANT GLAZING (WET)

E. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

F. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

G. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.5. CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
   1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

3.6. GLASS SCHEDULE

A. Clear Glass Type GL02 Fully tempered float glass.
   1. Minimum Thickness: 3/8 inches (9.54 mm)

B. LAMINATED GLASS SCHEDULE
   1. Glass Type GL01: Low Iron Clear Laminated Glass Two plies of annealed float glass with Low E on Surface 2.

2. Basis-of-Design Product: Minimum Thickness of Each Glass Ply: 4 mm
3. Interlayer Thickness: 0.060 inch (1.52 mm)

C. INSULATING GLASS SCHEDULE

1. Clear Insulating Glass Type IGU01
   a. Basis-of-Design Product:, Solarban 60 Low E by Vitro Architectural Glass
   b. Overall Unit Thickness: 5/8 inch (16 mm)
   c. Minimum Thickness of Each Glass Lite: 3 mm
   d. Outdoor Lite: Heat-strengthened float glass
   e. Low E Coating on second surface
   f. Interspace Content: Argon.
   g. Indoor Lite: Heat-strengthened float glass.
   h. Winter U-Value 0.26
   i. Solar Heat Gain Coefficient 0.40
   j. Visible Light Transmittance 72%
2. Clear Insulating Glass Type IGU02
   a. Basis-of-Design Product:, Solarban 60 Starphire by Vitro Architectural Glass
   b. Overall Unit Thickness: 1 inch (25.4 mm)
   c. Minimum Thickness of Each Glass Lite: 6 mm
   d. Outdoor and Interior Lite; Fully Tempered
   e. Interspace Content: Air
   f. Winter U-Value 0.29
   g. Solar Heat Gain Coefficient 0.41
   h. Visible Light Transmittance 74%

END OF SECTION

SECTION 088300 - MIRRORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silvered flat glass mirrors.

B. Related Requirements:
1. Section 102800 "Toilet, Bath, and Laundry Accessories" for metal-framed mirrors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Mirrors: Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.

B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachment details.

C. Samples: For each type of the following:
1. Mirrors: 12 inches (300 mm) square, including edge treatment on two adjoining edges.
2. Mirror Clips: Full size.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of mirror

C. Preconstruction 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.

D. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For mirrors to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified Installer, who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect mirrors in accordance with mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide an approved compatible product by one of the following:
   1. Meek Mirrors
   2. Lenoir Mirror Company
   3. Technical Glass Products, Inc.
   4. General Glass International
   5. C.L. Laurence

B. Source Limitation for Mirrors: Obtain mirrors from single source from single manufacturer.

C. Source Limitations for Mirror Accessories: Obtain mirror-glazing accessories from single source.

2.2 SILVERED FLAT GLASS MIRRORS

A. Mirrors, General: ASTM C1503**;** manufactured using copper-free, low-lead mirror coating process.

B. Tempered Glass Mirrors: Mirror Glazing Quality for blemish requirements and complying with ASTM C1048 for Kind FT, Condition A, tempered float glass before silver coating is applied; clear.
   1. Nominal Thickness: 6.0 mm.

2.3 MISCELLANEOUS MATERIALS

A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

2.4 MIRROR HARDWARE

A. Stainless Steel J-Channels: Stainless Steel with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover edges of mirrors in a single piece.
   1. Type 304, Stainless Steel J Channel Bottom and Side Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch (9.5 and 22 mm) in height, respectively, and a thickness of not less than 0.04 inch (1.0 mm), Satin finish.

2.5 FABRICATION

A. Shop fabricate mirrors to greatest extent possible.

B. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts, so they fit closely around penetrations in mirrors.

C. Mirror Edge Treatment: Flat polished
   1. Seal edges of mirrors with edge sealer after edge to prevent chemical or atmospheric penetration of glass coating. Edge treatment to be sealed and finished in the factory.

PART 3 - EXECUTION

3.1. EXAMINATION

A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.

B. Verify compatibility with and suitability of substrates, including compatibility of existing finishes or primers with mirror mastic.

C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2. PREPARATION

A. Comply with mastic manufacturer's written installation instructions for preparation of substrates,including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3. INSTALLATION

A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced National Glass Association (NGA) publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
   1. NGA Publications: "Glazing Manual" and "Installation Techniques Designed to Prolong the Life of Flat Glass Mirrors."

B. Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
   1. Stainless Steel J-Channels: Provide setting blocks 1/8 inch (3 mm) thick by 4 inches (100 mm) long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4 inch (6.4 mm) wide by 3/8 inch (9.5 mm) long at bottom channel.
   2. J-Channels and Cleat: Fasten J-channel directly to wall and attach top trim to continuous cleat fastened directly to wall.
   3. Install mastic as follows:
      a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
      b. 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.
      c. After mastic is applied, align mirrors and press into place while maintaining a minimum airspace of 1/8 inch (3 mm) between back of mirrors and mounting surface.

2.6 CLEANING AND PROTECTION

A. Protect mirrors from breakage and contaminating substances resulting from construction operations.

B. Do not permit edges of mirrors to be exposed to standing water.

C. Maintain environmental conditions that prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

D. Clean exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Clean mirrors as recommended in writing by mirror manufacturer and NGA's publication "Proper Procedures for Cleaning Flat Glass Mirrors."

END OF SECTION O88300

SECTION 08 87 00

GLAZING SURFACE FILMS

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes Decorative film overlay.

1.02. COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances and adequate sealant thickness with reasonable tolerances.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product

B. Shop Drawings: For decorative film overlay applications requiring seams. Show locations of seams

C. Glass Samples: 12 inches (300 mm) square, for each decorative film overlay on type of glass indicated.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of decorative film overlay to be include in maintenance manuals

1.06 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who has completed installation of decorative film overlays similar in material, design, and extent to that indicated for the Project with a record of successful in-service performance.

1.07 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install decorative glass film until spaces are eclosed and weathertight, wet work in spaces is complete and dry and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 – PRODUCTS

2.01 DECORATIVE SURFACE FILM OVERLAY

A. Decorative Film Overlay: Translucent dimensionally stable, Vinyl pressure sensitive vinyl film that has a transparent synthetic liner, and can be applied to glass, acrylic or polycarbonate
1. Basis of Design Product: Subject to compliance with requirements, provide 3M Crystal Glass Finishes, Dusted (7725SE-314) or approved comparable product by one of the following:
a. Solyx Films
b. Liumar
2. Shading Coefficient: 0.93
3. Visible Light Transmission: 85

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine glazing surfaces to receive glazing film with installer present for compliance with requirements of glazing film manufacture.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean and prepare glazing surfaces to receive glazing film in accordance with glazing film manufacturer’s written instruction.

3.03 INSTALLATION

A. Apply glazing film to glazing surfaces at locations indicated on the drawings

B. Apply glazing film squarely align to glass edges uniformly, smooth and free from tears, air bubbles, wrinkles and rough edges.
1. Apply glazing film in single sheet completely overlaying side of glass as indicated on Drawings.

2. Where seams are required, locate seams as indicated on the Shop Drawings

3.04 CLEANING AND PROTECTION

A. Protect decorative film overlays from damage immediately after installation by attaching crossed streamers to framing and held away from glass surface. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

B. Protect decorative film overlays from contact with contaminating substances resulting from construction operations if despite such protection, contaminaltion substances do come into contact with decorative film overlays, remove substances immediately as recommended in writing by film manufacture.

END OF SECTION

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Non-load-bearing steel framing systems for interior partitions.
   2. Suspension systems for interior ceilings and soffits.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of code-compliance certification for studs and tracks.

B. Evaluation reports for certified under an independent third party inspection program from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.4 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association or the Steel Stud Manufacturers Association.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

C. Horizontal Deflection: For non-composit wall assemblies, limited to L/240 of the wsll height based on horizontal loading of 5 lbs/ft sq. (239 Pa).

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C754 for conditions indicated.
   1. Steel Sheet Components: Comply with ASTM C645 requirements for steel unless otherwise indicated.
   2. Protective Coating: ASTM A653/A653M, G40 (Z120) hot-dip galvanized unless otherwise indicated.

B. Studs and Tracks: ASTM C645. Use either conventional steel studs and tracks or embossed, high-strength steel studs and tracks.
   1. Minimum Base-Steel Thickness: 0.0296 inch (0.752 mm).
   2. Depth: As indicated on Drawings

C. Slip-Type Head Joints: Where indicated, provide[**one of**] the following:
   1. Single Long-Leg Track System: ASTM C645 top track with 2-inch- (51-mm-) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top track and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.

D. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
   1. Minimum Base-Steel Thickness: 0.0329 inch (0.836 mm).

F. Cold-Rolled Channel Bridging: Steel, 0.0538-inch (1.367-mm) minimum base-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
   1. Depth: 1-1/2 inches (38 mm)
   2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.068-inch- (1.72-mm-) thick, galvanized steel.

G. Hat-Shaped, Rigid Furring Channels: ASTM C645.
   1. Minimum Base-Steel Thickness: 0.0329 inch (0.836 mm).
   2. Depth: 7/8 inch (22.2 mm).

H. Resilient Furring Channels: 1/2-inch- (13-mm-) deep, steel sheet members designed to reduce sound transmission.
   1. Configuration: Asymmetrical

I. Cold-Rolled Furring Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
   1. Depth: As indicated on Drawings.
   2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch (0.8 mm).
   3. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

J. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), minimum uncoated-steel thickness of 0.0179 inch (0.455 mm), and depth required to fit insulation thickness indicated.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

B. Hanger Attachments to Concrete:
   1. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01. AC193, AC58 or AC308 as appropriate for the substrate.
      a. Uses: Securing hangers to structure.
      b. Type: Torque-controlled, expansion anchor
      c. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941 (ASTM F1941M), Class Fe/Zn 5, unless otherwise indicated.
   2. Power Actuated Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, base on ICC-ES AC70.

C. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) in diameter.

D. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.0538 inch (1.367 mm) and minimum 1/2-inch- (13-mm-) wide flanges.
   1. Depth: 1-1/2 inches (38 mm).

E. Furring Channels (Furring Members):
   1. Cold-Rolled Channels: 0.0538-inch (1.367-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges, 3/4 inch (19 mm) deep.
   2. Steel Studs and Tracks: ASTM C645.
      a. Minimum Base-Steel Thickness: 0.0269 inch (0.683 mm)
      b. Depth: As indicated on Drawings
   3. Hat-Shaped, Rigid Furring Channels: ASTM C645, 7/8 inch (22 mm) deep.
      a. Minimum Base-Steel Thickness: 0.0329 inch (0.836 mm)
   4. Resilient Furring Channels: 1/2-inch- (13-mm-) deep members designed to reduce sound transmission.
      a. Configuration: Asymmetrical

F. Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct hung system comprosed of main beams and cross furring members that interlock.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.
   1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide[**one of**] the following:
   1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.
   1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.2 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

B. Install studs so flanges within framing system point in same direction.

C. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
   1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
   2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
      a. Install two studs at each jamb unless otherwise indicated.
      b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
      c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
    a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

D. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

3.3 INSTALLING CEILING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
    a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
    a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards
3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not attach hangers to steel roof deck.
6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092400 - CEMENT PLASTERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Exterior vertical plasterwork (stucco).

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.

C. Store materials inside under cover and keep them dry and protected against damage from weather, moisture, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

D. Samples for Verification: For each type of factory-prepared finish coat and for each color and texture specified, 12 by 12 inches (305 by 305 mm), and prepared on rigid backing. (Finish to match existing Stucco)

1.4 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Build mockups for each substrate and finish texture indicated for cement plastering, including accessories.
      a. Size: 100 sq. ft. (9 sq. m) in surface area.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 FIELD CONDITIONS

A. Comply with ASTM C926 requirements.

B. Exterior Plasterwork:

1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
2. Apply plaster when ambient temperature is greater than 40 deg F (4.4 deg C).
3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: Where indicated, provide cement plaster assemblies identical to those of assemblies tested for fire resistance according to ASTM E119 by a qualified testing agency.

2.2 METAL LATH

A. Expanded-Metal Lath: ASTM C847, cold-rolled carbon-steel sheet with ASTM A653/A653M, G60 (Z180), hot-dip galvanized-zinc coating.
1. Diamond-Mesh Lath: Self-furring, 3.4 lb/sq. yd. (1.8 kg/sq. m).

B. Paper Backing: FS UU-B-790a, Type I, Grade B, Style 1a vapor-retardant paper
1. Provide paper-backed lath

2.3 ACCESSORIES

A. General: Comply with ASTM C1063, and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.

B. Metal Accessories:\
1. Foundation Weep Screed: Fabricated from hot-dip galvanized-steel sheet, ASTM A653/A653M, G60 (Z180) zinc coating.
2. External- (Outside-) Corner Reinforcement: Fabricated from metal lath with ASTM A653/A653M, G60 (Z180), hot-dip galvanized-zinc coating.
3. Cornerbeads: Fabricated from zinc-coated (galvanized) steel
   a. Smallnose cornerbead with expanded flanges; use unless otherwise indicated.
4. Casing Beads: Fabricated from zinc-coated (galvanized) steel; square-edged style; with expanded flanges.
5. Control Joints: Fabricated from zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
6. Expansion Joints: Fabricated from zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.

2.4 MISCELLANEOUS MATERIALS

A. Water for Mixing and Finishing Plaster: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.

B. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch (13 mm) long, free of contaminants, manufactured for use in cement plaster.

C. Bonding Compound: ASTM C932.

D. Fasteners for Attaching Metal Lath to Substrates: ASTM C1063.

E. Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch (1.21-mm) diameter unless otherwise indicated.

2.5 PLASTER MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I
   1. Color for Finish Coats: White

B. Lime: ASTM C206, Type S; or ASTM C207, Type S.

C. Sand Aggregate: ASTM C897.
   1. Color for Job-Mixed Finish Coats: White

D. Ready-Mixed Finish-Coat Plaster: Mill-mixed portland cement, aggregates, coloring agents, and proprietary ingredients.
   1. Color: As selected by Architect from manufacturer's full range.

2.6 PLASTER MIXES

A. General: Comply with ASTM C926 for applications indicated.
   1. Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. yd. (0.6 kg of fiber/cu. m) of cementitious materials.

B. Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork as follows:
   1. Portland Cement Mixes
      a. Scratch Coat: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
      b. Brown Coat: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.

C. Job-Mixed Finish-Coat Mixes:

1. Portland Cement Mix: For cementitious materials, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 1-1/2 to 3 parts aggregate per part of cementitious material.

D. Factory-Prepared Finish-Coat Mixes: For ready-mixed finish-coat plasters comply with manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

B. Prepare smooth, solid substrates for plaster according to ASTM C926.

3.3 INSTALLATION, GENERAL

A. Fire-Resistance-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.

3.4 INSTALLING METAL LATH

A. Metal Lath: Install according to ASTM C1063.
   1. On Solid Surfaces, Not Otherwise Furred: Install self-furring, diamond-mesh lath.

3.5 INSTALLING ACCESSORIES

A. Install according to ASTM C1063 and at locations indicated on Drawings.

B. Reinforcement for External (Outside) Corners:
   1. Install lath-type, external-corner reinforcement, cornerbead at exterior locations.
   2. Install cornerbead at interior locations.

C. Control Joints: Locate as approved by Architect for visual effect and as follows:
   1. As required to delineate plasterwork into areas (panels) of the following maximum sizes:
      a. Vertical Surfaces: 144 sq. ft. (13.4 sq. m).
      b. Horizontal and Other Nonvertical Surfaces: 100 sq. ft. (9.3 sq. m).
   2. At distances between control joints of not greater than 18 feet (5.5 m) o.c.

3. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
4. Where control joints occur in surface of construction directly behind plaster.
5. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

3.6 PLASTER APPLICATION

A. General: Comply with ASTM C926.
   1. Do not deviate more than plus or minus 1/4 inch in 10 feet (6 mm in 3 m) from a true plane in finished plaster surfaces when measured by a 10-foot (3-m) straightedge placed on surface.
   2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
   3. Provide plaster surfaces that are ready to receive field-applied finishes indicated.

B. Bonding Compound: Apply on substrates for direct application of plaster.

C. Walls; Base-Coat Mixes for Use over Metal Lath: For scratch and brown coats, for three-coat plasterwork with 3/4-inch (19-mm) total thickness, minimum, as follows:
   1. Portland cement mixes.

D. Plaster Finish Coats: Apply to provide finish to match existing building finish.

E. Concealed Exterior Plasterwork: Where plaster application is used as a base for adhered finishes, omit finish coat.

3.7 PLASTER REPAIRS

A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.8 CLEANING AND PROTECTION

A. Remove temporary protection and enclosure of other work after plastering is complete. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION 092400

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior gypsum board.
   2. Exterior gypsum board for ceilings and soffits.
   3. Tile backing panels.
   4. Texture finishes.

B. Related Requirements:
   1. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.
   2. Section 093013 "Ceramic Tiling" for cementitious backer units installed as substrates for ceramic tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product..

1.3 QUALITY ASSURANCE

A. Mockups: Build mockups of at least 100 sq. ft. (9 sq. m) in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.
   1. Build mockups for the following:
      a. Each level of gypsum board finish indicated for use in exposed locations.
      b. Each texture finish indicated.
   2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
   3. Simulate finished lighting conditions for review of mockups.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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.

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.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, provide products from one of the following:
   1. United States Gypsum Company
   2. National Gypsum Company
   3. Georgia-Pacific Building Products
   4. CertainTeed Corporation

B. Gypsum Board, Type X: ASTM C1396/C1396M.
   1. Thickness: 5/8 inch (15.9 mm).
   2. Long Edges: Tapered

C. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.
   1. Core: 5/8 inch (15.9 mm), Type X.

2. Long Edges: Tapered.
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.4 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

A. Glass-Mat Gypsum Sheathing Board: ASTM C1177/C1177M, with fiberglass mat laminated to both sides and with manufacturer's standard edges.
1. Core: 5/8 inch (15.9 mm), Type X.

2.5 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: ASTM C1178/C1178M, with manufacturer's standard edges.
1. Core: 5/8 inch (15.9 mm), Type X.
2. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.
1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, or paper-faced galvanized-steel sheet.
2. Shapes:
   a. Cornerbead.
   b. LC-Bead: J-shaped; exposed long flange receives joint compound.
   c. L-Bead: L-shaped; exposed long flange receives joint compound.
   d. Expansion (Control) Joint

B. Exterior Trim: ASTM C1047.

1. Material: Hot-dip galvanized-steel sheet, or rolled zinc
2. Shapes:
   a. Cornerbead.
   b. LC-Bead: J-shaped; exposed long flange receives joint compound.
   c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

2.7 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:
1. Interior Gypsum Board: Paper.
2. Exterior Gypsum Soffit Board: Paper.
3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
4. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
      a. Use setting-type compound for installing paper-faced metal trim accessories.
   3. Fill Coat: For second coat, use drying-type, all-purpose compound.
   4. Finish Coat: For third coat, use drying-type, all-purpose compound.
   5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound

D. Joint Compound for Exterior Applications:
   1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
   2. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

E. Joint Compound for Tile Backing Panels:
   1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

2.8 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
   1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
   2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
   1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.]

E. Acoustical Sealant: Manufacture’s standard nonsag, paintable, nonstaining latex sealant complying with ASTM C834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90.

F. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
   1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
   2. Fit gypsum panels around ducts, pipes, and conduits.
   3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.

J. STC-Rated Assemblies: 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.

K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
   1. Wallboard Type: As indicated on Drawings
   2. Type X: As indicated on Drawings and where required for fire-resistance-rated assembly.
   3. Mold-Resistant Type: At Toilet Rooms, Janitors Closets and other wet areas.
   4. Glass-Mat Interior Type: As indicated on Drawings

B. Single-Layer Application:
   1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
   2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
      a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
      b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
   3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
   4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:
   1. 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 one framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
   2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
   3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with

vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.

4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. Curved Surfaces:
   1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- (300-mm-) long straight sections at ends of curves and tangent to them.
   2. For double-layer construction, fasten base layer to studs with screws 16 inches (400 mm) o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches (300 mm) o.c.

3.4 INSTALLATION OF EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

A. Apply panels perpendicular to supports, with end joints staggered and located over supports.
   1. Install with 1/4-inch (6.4-mm) open space where panels abut other construction or structural penetrations.
   2. Fasten with corrosion-resistant screws.

3.5 INSTALLATION OF TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.6 INSTALLATION OF TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:
   1. Cornerbead: Use at outside corners unless otherwise indicated.
   2. LC-Bead: Use at exposed panel edges
   3. L-Bead: Use where indicated

D. Exterior Trim: Install in the following locations:
   1. Cornerbead: Use at outside corners.
   2. LC-Bead: Use at exposed panel edges

3.7 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints**,** rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
   1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
   2. Level 2: Panels that are substrate for tile.
   3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
      a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
   4. Level 5: Where indicated on Drawings
      a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

E. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

3.8 INSTALLATION OF TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written instructions.

3.9 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Ceramic mosaic tile.
   2. Quarry Tile
   3. Thresholds
   4. Wall backing material
   5. Crack isolation membranes

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples:
   1. Each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide samples of each color blend.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Installer is a Five-Star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America].
   2. Installer employs only Ceramic Tile Education Foundation Certified Installers or installers recognized by the U.S. Department of Labor as Journeyman Tile Layers for Project.

3. Installer employs at least one installer for Project that has completed the Advanced Certification for Tile Installers (ACT) certification for installation of mud floors membranes, gauged porcelain tile/gauged porcelain tile panels and slabs and large format tile.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide Standard-grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

2.2 TILE PRODUCTS

A. Factory-Mounted Mosaic Ceramic Tile Type Unglazed
   1. Basis of Design Products: As indicated in the Finish Legend on Drawings
   2. Thickness: 1/4 inch (6.4 mm).
   3. Face: Plain with cushion edges.
   4. Surface: Smooth
   5. Tile Color and Pattern: As indicated by manufacturer's designations in Finish Schedule
   6. Grout Color: As indicated in the Finish Legend on Drawings
   7. Trim: Schluter Schiene Straight Edge Trim 5/16 inch, Satin Anodized aluminum.

B. Square Edge Quarry Tile
   1. Basis of Design Products: As indicated in the Finish Legend on Drawings.
   2. Thickness: 1/2 inches (12.8 mm).
   3. Face Surface: Smooth, Matte Finish
   4. Tile Color and Pattern: As indicated in the Finish Legend on Drawings
   5. Grout Color: As indicated in the Finish Legend on Drawings
   6. Wall Base: Round Top Cove: 5 inches (127 mm) by 6 inches (152.4 mm) by ½ inch (12.8 mm) thick.

C. Color Body Porcelain Tile
   1. Basis of Design Products: As indicated in the Finish Legend on Drawings.
   2. Thickness: 3/8 inches (9.5 mm).
   3. Face Surface: Light Polished Finish
   4. Tile Color and Pattern: As indicated in the Finish Legend on Drawings
   5. Grout Color: As indicated in the Finish Legend on Drawings
   6. Wall Base: Round Top Cove: 5 inches (127 mm) by 6 inches (152.4 mm) by ½ inch (12.8 mm) thick.

2.3 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
   1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch (1.5 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch (12.7 mm) or less above adjacent floor surface.

B. Marble Thresholds: ASTM C503/C503M, with a minimum abrasion resistance of 10 according to ASTM C1353 or ASTM C241/C241M and with honed finish.
   1. Description: Uniform, fine- to medium-grained white stone with gray veining.

C. Granite Thresholds: ASTM C615/C615M, with polished finish.
   1. Description: Uniform, fine to medium-grained, black stone without veining

2.4 TILE BACKING PANELS

A. See Specification Section 092900 “Gypsum Board”

2.5 CRACK ISOLATION MEMBRANES

A. General: Manufacturer's standard product**,** selected from the following, that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Crack Isolation Membrane, Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch (0.2-mm) nominal thickness.

2.6 SETTING MATERIALS

A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.

B. Modified Dry-Set Mortar (Thinset): ANSI A118.4.
   1. For wall applications, provide nonsagging mortar.

2.7 GROUT MATERIALS

A. High-Performance Tile Grout: ANSI A118.7.
   1. Polymer Type:
      a. Dry, redispersible form, prepackaged with other dry ingredients.
      b. Liquid-latex form for addition to prepackaged dry-grout mix.

2.8 MISCELLANEOUS MATERIALS

A. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness. Schluter
   1. Schiene Straight Edge .Trim 5/16 inch, Satin Anodized aluminum.

B. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
   2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
   1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting bed thickness so that tiles are flush.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
   1. Ceramic Mosaic Tile: 1/8 inch (3.2 mm).

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
   1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

J. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

K. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile and at top of wall tile wainscot.

L. Floor Sealer: Apply floor sealer to cementitious grout joints in tile floors according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

M. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

3.4 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:
   1. TCNA F113 Thinset mortar
      a. Ceramic Tile Type: Mosaic
      b. Thinset Mortar: Standard dry-set or Latex Portland cement mortar.

c. Grout: High-performance unsanded grout.

B. Interior Quarry Tile Installations, Concrete Subfloor
1. TCNA F115-03 Thinset
2. Thinset Motor: Epoxy Adhesive
3. Grout: Furan Resin Grout

C. Interior Wall Installations, Thinset or Metal Studs or Furring:
1. TCNA W245 or TCNA W248: Thinset mortar on glass-mat, water-resistant gypsum backer board.
a. Ceramic Tile Type: Mosaic
b. Thinset Mortar: Standard dry-set or portland cement mortar.
c. Grout: High-performance unsanded grout.

END OF SECTION 093013

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for interior ceilings.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:
   1. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- (150-mm-) long Samples of each type, finish, and color.
   2. Clips: Full-size hold-down clips.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Ceiling suspension-system members.
   2. Structural members to which suspension systems will be attached.
   3. Method of attaching hangers to building structure.
   4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
   5. Size and location of initial access modules for acoustical panels.
   6. Items penetrating finished ceiling and ceiling-mounted items including the following:
      a. Lighting fixtures.
      b. Diffusers.
      c. Grilles.
      d. Speakers.
      e. Sprinklers.
      f. Access panels.
      g. Perimeter moldings.
   7. Show operation of hinged and sliding components covered by or adjacent to acoustical panels.
   8. Minimum Drawing Scale: 1/8 inch = 1 foot

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials**,** from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Acoustical Ceiling Units: Full-size panels equal to 3 percent of quantity installed.
   2. Suspension-System Components: Quantity of each exposed component equal to 3 percent of quantity installed.
   3. Hold-Down Clips: Equal to 3 percent of quantity installed.

1.7 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Build mockup of typical ceiling area as shown on Drawings.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: Class A according to ASTM E1264.
   2. Smoke-Developed Index: 50 or less.

2.3. ACOUSTICAL PANELS (ACP-02)

A. Basis of Design Product: Subject to compliance with requirements, provide products indicated on the drawings (Armstrong, LYRA PB Direct Apply, 24 inches (609.6 mm) x 24 inches (609.6 mm), color white) or approved comparable product by one of the following:
   1. Certain Teed Corporation
   2. USG Corpoation

B. Acoustical Panel Schedule: Provide manufacture's standard panels according to ASTM E1264 and designed by type, form, pattern, acoustical rating and light reflrctance unless otherwise indicated.

C. Classification: Provide follows:
   1. Type and Form: Type XII, fiberglass with plant based binder, surface finish acoustically transparent membrane with factory applied latex paint, Form 2.
   2. Pattern: E

D. Color: White

E. Light Reflectance: LR not less than 0.88

F. Noise Reduction Coefficient (NRC): Not less than 0.95

G. Antimicrobial Treatment: Manufacture's standard broad spectrum, antimicrobial formulation that imhibits fungus, mold, mildew and gram positive and gram negative bacteria and showing no mold, mildew or bacterial growth when tested according to ASTM D3273, ASTM D3274 or ASTM G21 and evaluated according to ASTM D3274 or ASTM G21.

2.4. ACOUSTICAL PANELS (ACP-03)

A Basis of Design Provide fire res: Subject to compliance with requirements, provide products indicated on the drawings (Armstrong, Calla, 24 inches x 48 inches, white) or approved comparable product by one of the following:

1. Certain Teed Corporation
2. USG Corporation

H. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

I. Classification: Provide panels as follows:
1. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted;
2. Pattern: E (lightly textured)

J. Color: White

K. Light Reflectance (LR): Not less than 0.85.

L. Ceiling Attenuation Class (CAC): Not less than 35.

M. Noise Reduction Coefficient (NRC): Not less than 0.85.

N. Articulation Class (AC): Not less than 170.

O. Edge/Joint Detail: Square.

P. Thickness: 15/16 inch.

Q. Modular Size: 24 by 24 inches (610 by 610 mm)

R. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273, ASTM D3274, or ASTM G21 and evaluated according to ASTM D3274 or ASTM G21.

2.5. METAL SUSPENSION SYSTEM

A Design Product: Subject to compliance with requirements, provide product by Armstrong Prelude XL or approved product by one of the following:
Certain Teed Corporation

B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C635/C635M and designated by type, structural classification, and finish indicated.

C. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 (Z90) coating designation; with prefinished 15/16-inch- (24-mm-) wide metal caps on flanges.
1. Structural Classification: Heavy duty Intermediate system.
2. End Condition of Cross Runners: Override (stepped) or butt-edge type.

3. Face Design: Flat, flush.
4. Cap Material: Cold-rolled steel
5. Cap Finish: Painted white

2.6. ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:
1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch- (2.69-mm-) diameter wire.

C. Hold-Down Clips: Manufacturer's standard hold-down.

2.7. METAL EDGE MOLDINGS AND TRIM

A. Basis of Design Product: Subject to compliance with requirements, provide product by Armstrong AXIOM Classic 4 inch or approved product by another manufacture.

B. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with design requirements. (Miter corners)
1. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils (0.04 mm). Comply with ASTM C635/C635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.8. ACOUSTICAL SEALANT

A. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

PART 3 - EXECUTION

3.1. EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2. PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3. INSTALLATION

A. Install acoustical panel ceilings according to ASTM C636/C636M and manufacturer's written instructions.

B. Suspend ceiling hangers from building's structural members and as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, counter splaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
7. Do not attach hangers to steel deck tabs.
8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
9. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
   1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
   2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends. Miter corners accurately and connect securely.
   3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.
   1. Arrange directionally patterned acoustical panels as follows:
      a. Install panels with pattern running in one direction parallel to axis of space.
      b. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
      c. Install hold-down clips in areas indicated; space according to panel manufacturer's written instructions unless otherwise indicated.
      d. Hold-Down Clips: Space 24 inches (610 mm) o.c. on all cross runners.

3.4. ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m) , non-cumulative.

B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m) non-cumulative.

3.5. CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096229 - CORK FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Cork floor tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of cork flooring.
   1. Include cork flooring layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
   2. Show details of special patterns.

C. Samples for Verification: Full-size units of each type, color, pattern, and finish of cork flooring required.

D. Product Schedule: For cork flooring.

E. Sample Warranty

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of cork flooring to include in maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials**,** from the same product run**,** that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Cork Flooring: Furnish one box for every 50 boxes or fraction thereof, of each type, color, pattern, and finish of cork flooring installed.

1.5 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Coordinate mockups in this Section with mockups specified in other Sections.
      a. Size: Minimum 100 sq. ft. (9.3 sq. m) for each cork flooring type, color, pattern, and finish, in locations directed by Architect.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

B. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques require by the manufacture for cork flooring installations.

C. Store cork flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store cork flooring on flat surfaces.

D. Cork flooring shall comply with the requirements of FloorScore Certifications

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F (18 deg C) or more than 75 deg F (24 deg C) where relative humidity is between 45 and 65 percent, in spaces to receive cork flooring during the following periods:
1. 72 hours before installation.
2. During installation.
3. 72 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F (18 deg C) or more than 75 deg F (24 deg C).

C. Close spaces to traffic during cork flooring installation.

D. Close spaces to traffic for 72 hours after cork flooring installation.

E. Install cork flooring after other finishing operations, including painting, have been completed.

1.8. WARRANTY

A. Manufacture warrants that material be free from defect in material or workmanship for a period of 5 years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 CORK FLOOR TILE

A. Basis of Design Products: Subject to compliance with requirements, provide To Market, Unicork flooring or an approved comparable product.

B. Composition: 100 percent natural cork bark and recycled cork granules and set in a natural or synthetic, flexible resin matrix; homogeneous and uniform in composition throughout the tile thickness.

C. Nominal Density: Manufacturer's standard

D. Nominal Thickness: 0.196 inch (5.0 mm)

E. Size: 23.63 by 17.17 inches (600.2 by 436.1 mm)

F. Dimensional Stability: Passes ASTM F2199

G. Color: TMU 52 (Hickory)

H. Edge: Square

I. Factory Finish: 2 coats of lacquer

J. Smoke Density: ASTM E662-97 – Passes <450 (NFPA 258)

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by cork flooring manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit cork flooring and substrate conditions indicated.

2.4 FIELD-APPLIED FINISHES

A. Sealer: Product as recommended by cork flooring manufacturer.

B. Finish Coatings: Products as recommended by cork flooring manufacturer.
   1. 3rd coat of lacquer over factory applied 2 coats
   2. One coat of water diluted Manufactures Polymer finish coat.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of cork flooring.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to cork flooring manufacturer's written instructions to ensure adhesion of cork flooring.

B. Concrete Substrates: Prepare according to ASTM F710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by cork flooring manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by cork flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
   4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. (304.8 sq. m) and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
      a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
      b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install cork flooring until materials are the same temperature as space where they are to be installed.
   1. At least 72 hours in advance of installation, move cork flooring products and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by cork flooring.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing cork flooring.

B. Mix together floor tiles from each carton to ensure uniform distribution of shade.

C. Discard broken, cracked, chipped, or deformed floor tiles.

D. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

E. Lay floor tiles square with room axis and in pattern indicated

F. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

G. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

H. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

I. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in installation areas. Maintain overall continuity of appearance between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

J. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 FIELD-APPLIED FINISHES

A. Apply finishes according to cork flooring manufacturer's written instructions.

B. Cork Sealer: Apply coat(s).

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting cork flooring.

B. Perform the following operations immediately after completing cork flooring installation:
   1. Remove blemishes from surfaces.
      a. Remove installation adhesive from surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

C. Protect cork flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover cork flooring until Substantial Completion.

END OF SECTION 096229

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Thermoset-rubber base.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

1.3. MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials from the same product run that matches products installed and that are prepackaged with protective covering for storage and identified with labels describing contents.
   1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof of each type, color, pattern and size of resilient product installed.

1.4. DELIVERY, STORAGE AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintain within range recommended by the manufacture, but not less than 50 deg. F (!0 deg. C) or more than 90 deg. F (32deg C).

1.5. FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by the manufacture but not less than 70 deg. F (21 deg. C) or more than 95 deg. F (35 deg, C).
   1. 48 hours before installation
   2. 48 hours after installation.

B. After installation and until Substantial Completion, maintain temperatures within range recommended by the manufacture, but not less than 55 deg. F (13 deg. C) or more than 95 deg. F (10 deg. C)

C. Install resilient products after other finishing operations, including painting have been completed.

PART 2 - PRODUCTS

2.1. PERFORMANCE REQUIREMENTS

A. Resilient Base shall comply with requirements of FloorScore Certification.

B. Basis of Design Product: Subject to compliance with requirements, provide Roppe, Pinnacle Rubber Base, Color #100 Black and #193 Brown, No Toe where designated on the Room Finish Schedule, or comparable product from one of the following:
1. Flexco
2. Johnsonite
3. Armstrong Flooring Division, Armstrong World Industries Inc.
4, Allstate Rubber Corp.

C. Product Standard: ASTM F1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).4
1. Style and Location:
a. Style A, Straight:

D. Thickness: 0.125 inch (3.2 mm).

E. Height: 4 inches (102 mm)

F. Lengths: Cut lengths 48 inches (1219 mm) long or coils in manufacturer's standard length.

G. Outside Corners: Preformed

H. Inside Corners: Preformed

2.2. RUBBER MOLDING ACCESSORY

A. Basis of Design Product: Subject to compliance with requirements, provide Roppe or a comparable product from one of the following:
1. Flexco
2. Johnsonite
3. Armstrong Flooring Division, Armstrong World Industries Inc.
4, Allstate Rubber Corp.

B. Rubber carpet edge for glue-down applications, reducer strip for resilient floor

C. Profile and Dimensions: As indicated

D. Locations: Provide rubber molding accessories in areas indicated

E. Colors: As selected by the Architect from the full range of industries colors.

2.3. INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient stair-tread manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

3.2. RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

3.3. RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.4. CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Preform the following operations immediately after completing resilient product installation:
   1. Remove adhesive and other blemishes from surface and clean removing any and all marks.

C. Protect resilient products from mars, marks, indentations and othe damage from construction operations and placement of equipment and fixtures during remainder of construction period.

END OF SECTION 096513

SECTION 096723 - RESINOUS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Resinous flooring.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review manufacturer's written instructions for substrate preparation and environmental conditions affecting resinous flooring installation.
   2. Review manufacturer's written instructions for installing resinous flooring systems.
   3. Review protection measures for adjacent construction and installed flooring, floor drainage requirements, curbs, base details, and so forth.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include manufacturer's technical data, installation instructions, and recommendations for each resinous flooring component required.

B. Samples for Verification: For each resinous flooring system required and for each color and texture specified, 6 inches (150 mm) square, applied to a rigid backing by Installer for this Project.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material Certificates: For each resinous flooring component.

C. Material Test Reports: For each resinous flooring system, by a qualified testing agency.

D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
   1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Apply full-thickness mockups on 96-inch- (2400-mm-) square floor area selected by Architect.
   2. Simulate finished lighting conditions for Architect's review of mockups.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring installation.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring installation.

C. Close spaces to traffic during resinous flooring installation and for 24 hours after installation unless manufacturer recommends a longer period.

1.9. WARRANTY

A. Warranty: Manufacturer agrees to repair or replace components of liquid linoleum flooring installation that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Limited Commercial Warranty for 10 Years from date of Substantial Completion.
   1. Includes first year repair or replacement for material and cost of labor
   2. Includes second year repair or replacement for material and 50% cost of labor
   3. Includes third through the 10th year, repair or replacement for the cost of material only.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Flammability: based on ASTM E648 Flooring Radiant Panel Test – Passes, Class 1; equal to or less than 0.45 watts/sq. cm.

B. Smoke Density per ASTM E662 – Passes equal to or less than 450

2.2 RESINOUS FLOORING

A. Resinous Flooring System: Abrasion-, impact-, and chemical-resistant, aggregate-filled, resin-based monolithic floor surfacing designed to produce a seamless floor.
   1. Resilient Flooring shall comply with requirements of FloorScore Certification.

B. Basis of Design Product: Subject to compliance with requirements, provide Mannington Legato Liquid Linoleum flooring with Quantum Guard Elite, or approved comparable product.

C. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Obtain secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from manufacturer recommended in writing by manufacturer of primary materials.

D. System Characteristics:
   1. Color and Pattern: As indicated by manufacturer's product designation in the drawings Finish Schedule.
   2. Wearing Surface: Manufacturer's standard wearing surface. (Mannington Quantum Guard Elite).
   3. Overall System Thickness: 85 mils (2.2 mm)

E. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested in accordance with test methods indicated:
   1. Static Load per ASTM F970: Passes – Residual indent = 0.005 inches
   2. Static Load per ASTM F970 Mod. - Passes – 2000 PSI; Residual indent = 0.005 inches
   3. Slip Resistance (SCOF) per UL 410 – Passes – Plus or equal 0.5
   4. Resistance to Heat per ASTM F1514 – Passes – equal to or less than 8 Delta E Color Change
   5. Flexibility per ASTM F137 – Passes - 1 inch Mandrel, No Crack /Break

F. System Chemical Resistance: Test specimens of cured resinous flooring system are unaffected when tested in accordance with ASTM F925 in the following reagents for no fewer than seven days:

G. Primer: Type recommended in writing by resinous flooring manufacturer for substrate and resinous flooring system indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resinous flooring systems.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare and clean substrates in accordance with resinous flooring manufacturer's written instructions for substrate indicated to ensure adhesion.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
   1. Roughen concrete substrates as follows:
      a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
      b. Comply with requirements in SSPC-SP 13/NACE No. 6, with a Concrete Surface Profile of 3 or greater in accordance with ICRI Technical Guideline No. 310.2R, unless manufacturer's written instructions are more stringent.
   2. Repair damaged and deteriorated concrete in accordance with resinous flooring manufacturer's written instructions.
   3. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. (304.8 sq. m) and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
      a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
      b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
   4. Alkalinity and Adhesion Testing: Perform tests recommended in writing by resinous flooring manufacturer. Proceed with installation only after substrate alkalinity is not less than 6 or more than 9 pH unless otherwise recommended in writing by flooring manufacturer,

C. Patching and Filling: Use patching and fill material to fill holes and depressions in substrates in accordance with manufacturer's written instructions.

1. Control Joint Treatment: Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring in accordance with manufacturer's written instructions.

D. Resinous Materials: Mix components and prepare materials in accordance with resinous flooring manufacturer's written instructions.

3.3 INSTALLATION

A. Apply components of resinous flooring system in accordance with manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness specified.
1. Coordinate installation of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
2. Cure resinous flooring components in accordance with manufacturer's written instructions. Prevent contamination during installation and curing processes.
3. Expansion and Isolation Joint Treatment: At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.

B. Primer: Apply primer over prepared substrate at spreading rate recommended in writing by manufacturer.

C. Self-Leveling Body Coats: Apply self-leveling slurry body coats in thickness specified for flooring system.

D. Topcoats: Apply topcoats in number indicated for flooring system specified, at spreading rates recommended in writing by manufacturer, and to produce wearing surface specified.

3.4 PROTECTION

A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION 096723

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Modular carpet tile.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For carpet tile installation, plans showing the following:
   1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
   2. Carpet tile type, color, and dye lot.
   3. Type of subfloor.
   4. Type of installation.
   5. Pattern of installation.
   6. Pattern type, location, and direction.
   7. Pile direction.
   8. Type, color, and location of insets and borders.
   9. Type, color, and location of edge, transition, and other accessory strips.
   10. Transition details to other flooring materials.

C. Samples: For each exposed product and for each color and texture required.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data: For carpet tiles to include in maintenance manuals the following:
   1. Methods for maintaining carpet tile, including cleaning and stain removal products and procedures and manufacture’s recommended maintenance schedule.
   2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.6. MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Carpet Tile: Full size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yds. (8.3 sq. m).

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

B. Mock-ups: Build mock-ups to verify selections made under sample submittal, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
   1. Build mock-up at locations as selected by the Architect.
   2. Subject to compliance with requirements, approved mock-ups may become part of the completed work if undisturbed at time of Substantial Completion.

1.7 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: 15 years from date of Substantial Completion for Stain Resistance
   2. Warranty Period:15 years from date of Substantial Completion for Color Safe., Bleach Resistant
   3. Warranty Period: Lifetime from date of Substantial Completion for Wear and Backing.

1.8. FIELD CONDITIONS/DE AND HANDLINGLIVERY/STORAGE

A. Comply with CRI's "Carpet Installation Standard" for delivery/storage and handling

B. Comply with CRI's "Carpet Installation Standard" for temperature, humidity and ventilation limitations.

C. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry and ambient temperature and humidity conditions are maintained at levels planned for building occupants during remainder of the construction period.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

E. Install Carpet tiles after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1. CARPET TILE (CPT -01)

A. Basis of Design Product: Subject to compliance with requirements, provide Mannington Urban Grid Collection, Urrban Patina, Span–Modular, District 13219 or approved comparable product.

B. Color: As indicated by manufacturer's designations

C. Dye Method: Solution

D. Construction: Textured Patterned Loop

E. Fiber Content: 100 percent regenerated Type 6 nylon 6

F. Density: 5,538 (205.78kg/m cubed)

G. Pile Thickness: 0.091 inches (2.31 mm) for finished carpet tile according to ASTM D6859.

H. Stitches per inch: 8.83 inch (34.76 per 10 cm).

I. Gage: 5/64 inch (50.39 per 10 cm).

J. Total Weight: 14 oz./sq. yd. (5.42 g/sq. m).

K. Backing System: Infinity 2 Modular

L. Size: 18 by 36 inches (457 by 914 mm)

M. Installation Method: Monolithic

N. Applied Treatments:
1. Soil-Resistance Treatment: Manufacturer's standard treatment
2. Antimicrobial Treatment: Manufacturer's standard treatment that protects carpet tiles as follows:
   a. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.

O. Performance Characteristics:
1. Critical Radiant Flux Classification: Not less than 0.49 W/sq. cm according to NFPA 253.
2. Delamination: Not less *than 3.5 lbf/in. (0.6 N/mm)* according to ASTM D3936.
3. Dimensional Tolerance: Within 1/32 inch (0.8 mm) of specified size dimensions, as determined by physical measurement.
4. Dimensional Stability: 0.2 percent or less according to ISO 2551 (Aachen Test).
5. Noise Reduction Coefficient (NRC) 0.15 according to ASTM C423.
6. Carpet Wear per ASTM D5252. Moderate to Slight Change after 12000 cycles
7. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.

8. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) according to AATCC 16, Option E.
9. Electrostatic Propensity: Less than **2** kV according to AATCC 134.

2.2. CARPET TILE (CPT-02

A. Basis of Design Product: Subject to compliance with requirements, provide Mannington Liaison Entryway: Ruffian II – Terracotta Terrain 6502 or approved comparable product.

B. Color: As indicated by manufacturer's designations

C. Dye Method: Solution

D. Construction: Tip Sheared Patterned Loop

E. Fiber Content: Type 6/6 nylon

F. Density: 8,825 (327.92 kg/m sq.)

G. Pile Thickness: 0.155 inches (3.94 mm) for finished carpet tile according to ASTM D6859.

H. Stitches per inch 9.0 inch (35.43 per 10 cm).

I. Gage: 5/32 inch (2.20 per 10 cm).

J. Total Weight: 38 oz./sq. yd. (12.88 g/sq. m).

K. Backing System: Infinity II Modular

L. Size: 24 by 24 inches (60.96 by 60.96 cm)

M. Installation Method: Monolithic

N. Applied Treatments:
1. Soil-Resistance Treatment: Manufacturer's standard treatment
2. Antimicrobial Treatment: **Manufacturer's standard treatment** that protects carpet tiles as follows:
   a. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.

O. Performance Characteristics:
1. Critical Radiant Flux Classification: Not less than 0.48 W/sq. cm according to NFPA 253.
2. Delamination: Not less than 3.5 lbf/in. (0.6 N/mm) according to ASTM D3936.
3. Dimensional Tolerance: Within 1/32 inch (0.8 mm) of specified size dimensions, as determined by physical measurement.
4. Dimensional Stability: 0.2 percent or less according to ISO 2551 (Aachen Test).

5. Noise Reduction Coefficient (NRC): 0.15 according to ASTM C423.
6. Carpet Wear per ASTM D5252. Moderate to Slight Change after 12000 cycles
7. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
8. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) according to AATCC 16, Option E.
9. Electrostatic Propensity: Less than **2** kV according toAATCC 134.

INSTALLATION ACCESSORIES

P. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

Q. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

PART 2 - EXECUTION

2.1 EXAMINATION

A. Concrete Slabs:

1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. (304.8 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
   a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
   b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
   c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

2.2 PREPARATION

A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider, and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

D. Metal Substrates: Clean grease, oil, soil and rust, and prime if recommended in writing by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

2.3 INSTALLATION

A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Maintain pile-direction patterns indicated on Drawings.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

I. Access Flooring: Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

J. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 097723 - FABRIC-WRAPPED PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes shop-fabricated, fabric-wrapped wall panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include fabric facing, panel edge, core material, and mounting indicated.

B. Shop Drawings: For panel assembly and installation.
1. Include plans, elevations, sections, and mounting devices and details.
2. Include details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge profile and core materials.
3. Include details at cutouts and penetrations for other work.
4. Include direction of fabric weave and pattern matching.

C. Samples for Verification: For the following products:
1. Fabric: Full-width by approximately 36-inch- (900-mm-) long Sample, but not smaller than required to show complete pattern repeat, from dye lot to be used for the Work, and with specified treatments applied. Mark top and face of fabric.
2. Panel Edge: 12-inch- (300-mm-) long Sample(s) showing each edge profile, corner, and finish.
3. Core Material: 12-inch- (300-mm-) square Sample at corner.
4. Mounting Devices: Full-size Samples.
5. Assembled Panels: Approximately 36 by 36 inches (900 by 900 mm), including joints and mounting methods.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Elevations and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Electrical outlets, switches, and thermostats.
2. Items penetrating or covered by panels including the following:
a. Lighting fixtures.
b. Air outlets and inlets.
c. Speakers.
d. Alarms.
e. Sprinklers.
f. Access panels.

B. Product Certificates: For each type of panel.

C. Sample Warranty: For manufacturer's special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of panel to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal instructions.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials from same production run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Fabric: For each fabric, color, and pattern installed, provide length equal to 10 percent of amount installed, but no fewer than 10 sq. yd. (9 sq. m) full width of bolt.
   2. Mounting Devices: Full-size units equal to 5 percent of amount installed, but no fewer than five devices, including unopened adhesives.

1.6 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials, fabrication, and installation.
   1. Build mockup of typical wall area as shown on Drawings.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. \Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with fabric and panel manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials and panels in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install panels until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Lighting: Do not install panels until **a** lighting level of not less than 50 fc (538 lx) is provided on surfaces to receive the panels.

C. Air-Quality Limitations: Protect panels from exposure to airborne odors such as tobacco smoke, and install panels under conditions free from odor contamination of ambient air.

D. Field Measurements: Verify panel locations and actual dimensions of openings and penetrations by field measurements before fabrication, and indicate them on Shop Drawings.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace panels and components that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Fabric sagging, distorting, or releasing from panel edge.
      b. Warping of core.
   2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fabric-wrapped wall panels from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: Panels shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
   1. Surface-Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency. (Class A)
      a. Flame-Spread Index: 25 or less.
      b. Smoke-Developed Index: 450 or less.
   2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

2.3 FABRIC-WRAPPED WALL PANELS

A. Fabric-Wrapped Wall Panel Manufacturer's standard panel construction consisting of facing material stretched over front face of edge-framed core and bonded or attached to edges and back of frame.

1. Basis of Design: Subject to compliance to requirements, provide Stretch wall panels by Fabritrak with 1 inch thick TerraCore Poly Tackable Panels or approved comparable products.
2. Panel Shape: Flat.
3. Mounting: Back mounted with manufacturer's standard metal clips or bar hangers, secured to substrate.
4. Core Overlay: low denier polyester fibers with high density for impact resistance.1 inch (26 mm) thick
5. Edge Construction: Manufacturer's standard extruded PVC frame
6. Edge Profile: Square
7. Corner Detail in Elevation: Square with continuous edge profile indicated.
8. Facing Material: DesignTex Everywhere Texture in Ember 4147-701, 55 inches wide.
9. Nominal Overall Panel Thickness: 1 inch (25 mm)
10. Panel Width: As indicated on Drawings
11. Panel Height: As indicated on Drawings
12. NRC: 0.80 / SAA: 0.88

FABRICATION

B. Standard Construction: Use manufacturer's standard construction unless otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.

C. Edge Hardening: For cores, chemically harden core edges and areas of core where mounting devices are attached.

D. Facing Material[and Lining Material Apply fabric fully covering visible surfaces of panel; with material stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter.
   1. Square Corners: Tailor corners.
   2. Fabrics with Directional or Repeating Patterns or Directional Weave: Mark fabric top and attach fabric in same direction so pattern or weave matches in adjacent panels.

E. Dimensional Tolerances of Finished Panels: Plus or minus 1/16 inch (1.6 mm) for the following:
   1. Thickness.
   2. Edge straightness.
   3. Overall length and width.
   4. Squareness from corner to corner.
   5. Chords, radii, and diameters.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fabric, fabricated panels, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting panel performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panels in locations indicated. Unless otherwise indicated, install panels with vertical surfaces and edges plumb, top edges level and in alignment with other panels, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with manufacturer's written instructions for installation of panels using type of mounting devices indicated. Mount panels securely to supporting substrate.

C. Align fabric pattern and grain with adjacent panels.

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb and Level: Plus or minus 1/16 inch (1.6 mm) in 48 inches (1200 mm), noncumulative.

B. Variation of Joint Width: Not more than 1/32 inch (0.79 mm) wide from hairline in 48 inches (1200 mm), noncumulative.

3.4 CLEANING

A. Clip loose threads; remove pills and extraneous materials.

B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 097723

SECTION 098438 - SOUND-ABSORBING CEILING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes shop-fabricated, acoustical panel units tested for acoustical performance, including the following:
   1. Sound-absorbing ceiling panels.

1.2 DEFINITIONS

A. NRC: Noise Reduction Coefficient.

B. LR: Light Reflectance

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For unit assembly and installation.
   A. Include reflected ceiling plans, elevations, sections, and mounting devices and details.
   B. Include details at joints and corners; and details at ceiling intersections and intersections with walls. Indicate panel edge profile and core materials.

C. Samples for Verification: For the following products:
   A. Panel Edge: 12-inch- (300-mm-) long Sample(s) showing each edge profile, corner, and finish.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   A. Electrical outlets.
   B. Items penetrating or covered by units including the following:
      1. Lighting fixtures.
      2. Air outlets and inlets.
      3. Speakers.
      4. Alarms.
      5. Sprinklers.
      6. Access panels.

B. Product Certificates: For each type of unit.

C. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of unit to include in maintenance manuals. Include fabric manufacturer's written cleaning and stain-removal instructions.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   A. Mounting Devices: Full-size units equal to 5 percent of amount installed, but no fewer than **five** devices.

1.7 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials, fabrication, and installation.
   A. Build mockup of typical ceiling area as shown on Drawings 96 inches (2400 mm) wide by full width of ceiling Include intersection of wall and ceiling, corners, and perimeters.
   B. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   C. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with fabric and unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Lighting: Do not install units until a permanent level of lighting or a lighting level of not less than 50 fc (538 lx) is provided on surfaces to receive the units.

C. Air-Quality Limitations: Protect units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.

D. Field Measurements: Verify unit locations and actual dimensions of openings and penetrations by field measurements before fabrication and indicate them on Shop Drawings.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace units and components that fail in materials or workmanship within specified warranty period.
   A. Failures include, but are not limited to, the following:
      1. Acoustical performance. Verify available warranties and warranty periods for units and components.
      2. Defects in materials and workm
   B. Warranty Period: 30 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain ceiling units specified in this section from a single source from a single manufacture.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: Units shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
   A. Surface-Burning Characteristics: Comply with ASTM E84 (Class A) or UL 723; testing 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.

   B. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 286.

B. UL Classified Noise Reduction Coefficient (NRC): ASTM C423; C20(0.80) Classified with UL Label.

C. Light Reflectance (LR): Natural 75%.

D. Dimensional Stability/Mold Resistance: no significant mold growth when tested by ASTM D3273.

2.3 SOUND-ABSORBING CEILING UNITS. (ACP -01)

A. Basis of Design Product: Subject to compliance with requirements, provide Tectum Direct Attached acoustical ceiling panels as manufactured by Armstrong World Industries, Inc. or products comparable by one of the following:
   1. Tectum Inc.
   2. Sound Management Group
   3. Snowsound USA
   4. The ReWall Company, LLC **As**

B. Panel Shape: Flat

C. Color: Natural

D. Size: 24 inches wide by 48; inches and Custom Sizes, See Reflected Ceiling Plans

E. Edge Profile: Long edge – Bevel; Short Edge – Square,

F. Mounting: Direct attachment to wood furring.
   1. Mounting Method C-20 per Armstrong described installation methods.

2.4 MATERIALS

A. 1 inch thick Wood fiber Tectum Panels

B. 1” x 2” wood furring strips

C. 1 inch thick semi-rigid fiberglass insulation
   A. Provide products from one of the following:
      1. Owens-Corning
      2. CMI Insulation
      3. ATS Acoustics
      4. Carter-Hoffman

D. Fasteners
   1. 1 5/8 inch long #6-18 with #2 drive for tectum panels
   2. 1 ¼ inch power driven concrete nails for wood furring

E. Insulation: 1 inch thick 3 lb. density Fiberglass batt insulation installed between the wood furring.material

2.5 SOUND-ABSORBING CEILING UNITS. (ACP -02)

A. Basis of Design Product: Subject to compliance with requirements, provide Armstrong LYRA PB Direct Applied, 8403PB03CE1 fiberglass acoustical ceiling panels as manufactured by Armstrong World Industries, Inc. or acceptable, comparable and in compliance with requirements.

B. Panel Shape: Flat

C. Color: White

D. Size: 24 inches wide by 72; inches and Custom Sizes, See Reflected Ceiling Plans

E. Edge Profile: Long edge – Square,

F. Mold/Mildew resistant

G. Mounting: Direct attachment to concrete with adhesive as recommended by manufacture.
1. Remove painted surfaces before installing panels.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fabric, fabricated units, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting unit performance.

H. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install units in locations indicated. Unless otherwise indicated, install units with edges in alignment with walls and other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.

C. Align pattern as indicated on Drawings, installing bevel edge against bevel edge and square edge against square edge. Secure panels to wood furring with Philips head screw per manufactures written instructions. Head of screw to be flush with finish of panel and painted to match surface of Tectum panel.

3.3 INSTALLATION TOLERANCES

A. Variation from Alignment with Surfaces: Plus or minus 1/16 inch (1.6 mm) in 48 inches (1200 mm), noncumulative.

B. Variation from Level or Slope: Plus or minus 1/16 inch (1.6 mm)

C. Variation of Joint Width: Not more than 1/16 inch (1.6 mm) from hairline in 48 inches (1200 mm), noncumulative.

3.4. CLEANING

A. Clip loose threads; remove pills and extraneous materials.

B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 098438

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Primers.
   2. Finish coatings.
   3. Floor sealers and paints.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, include preparation requirements and application instructions.
   1. Include printout of current “MPI Approved Products List” for each product category specified.
   2. Indicate VOC content.

B. Samples for verification: For each type of paint system and each color and gloss of topcoat.
   1. Submit Samples on rigid backing 8 inches (200 mm) square.
   2. Apply coats on samples in steps to show each coat required for system.
   3. Label each coat of each sample
   4. Label each sample for location and application area.

C. Product List: Cross reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules, include color designations.

1.3. MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials from the same product run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Paint: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

B. Mockups: Apply mockups of each paint system and each color and finish selected to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Apply mockups for each substrate and finish indicated for application of each paint system.
      a. Vertical and Horizontal Surfaces, provide samples at least 100 sq. ft. (9 sq. m) in surface area. Architect will designate area for Mockup
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4. DELIVERY, STORAGE, AND HANDLING

A. Delivery of materials to project site in manufactures original, unopen packages and containers bearing manufactures name and label and the following information:
   1. Product name or title of material
   2. Product description (generic classification or binder type)
   3. Manufactures stock number and date of manufacture
   4. Contents by volume, for pigment and vehicle constituents
   5. Application instructions
   6. Color name and number
   7. VOC Content

B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.5. FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.6. WARRANTY

A. Warrant installation to be free of defects in material and workmanship for 5 years.

B. Repair or replace defects occurring during warranty period. Defects include but not limited to pinholes, crazing or cracking, loss of adhesion to substrate, deficient thickness, improper material and workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Basis of Design Product: Subject to compliance with requirements, provide Dunn-Edwards corporation products or an approved product from one of the following:
   1. Benjamin Moore
   2. Sherwin-Williams Company

3. Kelly-Moore Paint Company, Inc.
4. Glidden Professional (PPG Professional)

2.2 PAINT PRODUCTS - GENERAL

A. Material Compatibility:
   1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer based on testing and field experience.
   2. For each coat in a paint system, provide products recommended in writing by topcoat manufacturer for use in paint system and on substrate indicated.

B. Colors: As indicated in a color schedule

C. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products List".

2.3. GRAFFITI COATINGS

A. Basis of Design Product; Subject to compliance with requirements, provide Sherwin Williams Company Anti-Graffiti Coating 1K Siloxane products or an approved product from one of the following:
   1. Rainguard International (VandlGuard TEN)
   2. Evonik Corporation (Protectosil Anti-Graffiti)

2.4. SOURCE QUALITY CONTROL;:

A. Testing of Paint Materials: Owner reserves the right to invoke the following Proceedure
   1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken, If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed and certified by testing agency.
   2. Testing agency will perform test for compliance with product requirements.
   3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from project site, pay for testing and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify suitability of substrates, including surface conditions and compatibility, with finishes and primers.

B. Examine substrates and conditions, with applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the work.

C. Maximum Moisture Content of Substrates: When measured with and electronic moisture meter as follows:
   1. Concrete: 12 percent
   2. Fiber Cement Board: 12 percent
   3. Masonry (Clay and CMU): 12 percent
   4. Wood: 15 percent
   5. Gypsum Board: 12 percent
   6. Plaster: 12 percent.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.
   1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems specified in this Section.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer, but not less than the following:
   1. SSPC-SP 7/NACE No. 4.

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Wood Substrates:
   1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
   2. Sand surfaces that will be exposed to view, and remove sanding dust.
   3. Prime edges, ends, faces, undersides, and backsides of wood.
   4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 INSTALLATION

A. Apply paints in accordance with manufacturer's written instructions.

B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

C. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behins permanently fixed equipment or furniture with prim coat only.

D. Do not paint over Labels of independent testing agencies or equipment name, identification, performance rating or nomenclature plates.

3.4 CLEANING AND PROTECTION

A. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

B. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

C. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINTING SCHEDULE

A. Galvanized-Metal Substrates:
   1. Latex System
      a. Prime Coat: Water-based, galvanized-metal primer MPI #134.
         1) Benjamin Moore – Ultra Spec, Acrylic Metal Primer, HP04/FP04, applied at a dry film thickness of not less than 1.7 mils.
         2) Dunn-Edwards – Ultrashield, Interior/Exterior Galv. Metal Primer ULGM00-White, applied at a dry film thickness of not less than 2.0 mils.
         3) Sherwin Williams – Pro-Industrial, Pro-Cryl Prime finish, B66W1310, applied at a dry film thickness of not less than 2.0 mils.
         4) Kelly Moore – 5725 DTM, DTM Acrylic Primer Finish, 5724-100, applied at a dry film thickness of not less than 1.4 mils.
         5) Glidden Professional – Dulux (CA), Weatherguard 100% Acrylic Exterior Primer, 1535, applied at a dry film thickness of not less than 1.4 mils.

      b. Intermediate Coat: Matching topcoat.
      c. Topcoat: Exterior latex paint,
         1) Benjamin Moore - UltraSpec, Waterborne Exterior Gloss, N449/K449, applied at a dry film thickness of not less than 1.-5 mils.
         2) Dunn Edwards – Evershield, Ext./Int. Semi-Gloss Paint, EVSH50-3, applied at a dry film thickness of not less than 1.5 mils.
         3) Kelly Moore – 1298ENVY, Ext. Semi-Gloss Enamel, 1298121, applied at a dry film thickness of not less than 2.4 mils.
         4) Sherwin Williams – A100, Ext. Latex Gloss, A08W00116, applied at a dry film thickness of not less than 1.4 mils.
         5) Glidden Professional – High Endurance Plus Ext. Paint, 9402GP, applied at a dry film thickness of not less than 1.4 mils.

B. Exposed Wood- Substrates:
   1. Latex over Latex Primer System :
      a. Prime Coat: Exterior, latex wood primer.(MPI 6)
         1) Benjamin Moore – Ultra Spec EXT, Latex Primer, N558/K558, applied at a dry film thickness of not less than 1.7 mils.
         2). Dunn Edwards – EZ-Prime premium, Exterior Wood Primer, EZPR00-1, applied at a dry film thickness of not less than 1.7 mils.
         3). Kelly Moore – 255 AcryShield, AcryShield 100% Acrylic Exterior Wood Primer, 255-100, applied at a dry film thickness of not less than 1.7 mils.
         4). Sherwin Williams – Exterior Latex Primer, B42Wo8141, applied at a dry film thickness of not less than 1.7 mils.
         5). Glidden Professional – Dulux, Gripper Int/Ext Universal Acrylic Primer/Sealer, 6000A, applied at a dry film thickness of not less than 1.7 mils.
      b. Intermediate Coat: Matching topcoat.
      c. Topcoat: Exterior latex paint,
         1) Benjamin Moore - UltraSpec, Waterborne Exterior Gloss, N449/K449, applied at a dry film thickness of not less than 1.-5 mils.
         2) Dunn Edwards – Evershield, Ext./Int. Semi-Gloss Paint, EVSH50-3, applied at a dry film thickness of not less than 1.5 mils.

3) Kelly Moore – 1298ENVY, Ext. Semi-Gloss Enamel, 1298121, applied at a dry film thickness of not less than 2.4 mils.
4) Sherwin Williams – A100, Ext. Latex Gloss, A08W00116, applied at a dry film thickness of not less than 1.4 mils.
5) Glidden Professional – High Endurance Plus Ext. Paint, 9402GP, applied at a dry film thickness of not less than 1.4 mils.

C. Portland Cement Plaster Substrates:
1. Latex System
a. Prime Coat: (MPI 15)
1). Benjamin Moore – Ultra Spec EXT, Exterior Satin Finish, N448/K448, applied at a dry film thickness of not less than 1.7 mils.
2). Dunn-Edwards – VERSASATIN, Interior/Exterior Latex Low Sheen Paint, W 6250E, applied at a dry film thickness of not less than 1.5 mils.
3). Kelly Moore – Acryshield, Acryshield 100% Acrylic Exterior Satin Enamel, 1247-121, applied at a dry film thickness of not less than 1.4 mils.
4). Sherwin Williams – Emerald, Exterior Acrylic Latex Satin, K48W00051, applied at a dry film thickness of not less than 2.1 mils.
5). Glidden Professional – Premium Exterior Latex Satin Paint, GL6911 Series, applied at a dry film thickness of not less than 1.4 mils.
b. Intermediate Coat Matching topcoat.
b. Topcoat: Exterior latex paint,
1) Benjamin Moore - UltraSpec, Waterborne Exterior Gloss, N449/K449, applied at a dry film thickness of not less than 1.-5 mils.
2) Dunn Edwards – Evershield, Ext./Int. Semi-Gloss Paint, EVSH50-3, applied at a dry film thickness of not less than 1.5 mils.
3) Kelly Moore – 1298ENVY, Ext. Semi-Gloss Enamel, 1298121, applied at a dry film thickness of not less than 2.4 mils.
4) Sherwin Williams – A100, Ext. Latex Gloss, A08W00116, applied at a dry film thickness of not less than 1.4 mils.
5) Glidden Professional – High Endurance Plus Ext. Paint, 9402GP, applied at a dry film thickness of not less than 1.4 mils.

D. Steel Substrates (Windows)
1. Latex Systems
a. Prime Coat: (MPI 107)
1). Benjamin Moore – Ultra Spec HP, Alkyd Metal Primer, HP04/FKP04, applied at a dry film thickness of not less than 1.7 mils.
2). Dunn Edwards – Enduraprime, Rust Preventative Acrylic Metal Primer, ENPR00, applied at a dry film thickness of not less than 2.0 mils.
3). Kelly Moore – 5725 DTM, Acrylic Primer Finish, 5725-100, applied at a dry film thickness of not less than 1.9 mils.
4). Sherwin Williams – Pro Industrial, Pro-Cryl Universal Primer, B66W01310, applied at a dry film thickness of not less than 1.9 mils.
5). Glidden Professional – High Performance Coatings, Pitt-Tech Int/Ext DTM Industrial Primer, 90-712, applied at a dry film thickness of not less than 2.0 mils.
b. Intermediate Coat Matching topcoat.
c. Topcoat: Exterior latex paint,

1) Benjamin Moore - UltraSpec, Waterborne Exterior Gloss, N449/K449, applied at a dry film thickness of not less than 1.-5 mils.
2) Dunn Edwards – Evershield, Ext./Int. Semi-Gloss Paint, EVSH50-3, applied at a dry film thickness of not less than 1.5 mils.
3) Kelly Moore – 1298ENVY, Ext. Semi-Gloss Enamel, 1298121, applied at a dry film thickness of not less than 2.4 mils.
4) Sherwin Williams – A100, Ext. Latex Gloss, A08W00116, applied at a dry film thickness of not less than 1.4 mils.
5) Glidden Professional – High Endurance Plus Ext. Paint, 9402GP, applied at a dry film thickness of not less than 1.4 mils.

E. Exterior Masonry Substrates:
1. Latex System
a. Prime Coat: (MPI 15)
1). Benjamin Moore – Ultra Spec EXT, Exterior Satin Finish, N448/K448, applied at a dry film thickness of not less than 1.7 mils.
2). Dunn-Edwards – VERSASATIN, Interior/Exterior Latex Low Sheen Paint, W 6250E, applied at a dry film thickness of not less than 1.5 mils.
3). Kelly Moore – Acryshield, Acryshield 100% Acrylic Exterior Satin Enamel, 1247-121, applied at a dry film thickness of not less than 1.4 mils.
4). Sherwin Williams – Emerald, Exterior Acrylic Latex Satin, K48W00051, applied at a dry film thickness of not less than 2.1 mils.
5). Glidden Professional – Premium Exterior Latex Satin Paint, GL6911 Series, applied at a dry film thickness of not less than 1.4 mils.
b. Intermediate Coat Matching topcoat.
b. Topcoat: Exterior latex paint,
1) Benjamin Moore - UltraSpec, Waterborne Exterior Gloss, N449/K449, applied at a dry film thickness of not less than 1.-5 mils.
2) Dunn Edwards – Evershield, Ext./Int. Semi-Gloss Paint, EVSH50-3, applied at a dry film thickness of not less than 1.5 mils.
3) Kelly Moore – 1298ENVY, Ext. Semi-Gloss Enamel, 1298121, applied at a dry film thickness of not less than 2.4 mils.
4) Sherwin Williams – A100, Ext. Latex Gloss, A08W00116, applied at a dry film thickness of not less than 1.4 mils.
5) Glidden Professional – High Endurance Plus Ext. Paint, 9402GP, applied at a dry film thickness of not less than 1.4 mils.
2. Graffiti Coating:
a. 1 coat Anti-Graffiti Coating reduced 10 percent with minimum spirits
b. 1 coat Anti-Graffiti Coating for a minimum dry film thickness of 6.0 mils.

END OF SECTION 099113

SECTION 09 91 23

INTERIOR PAINTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes surface preparation and the application of paint systems on interior substrates

1.02 DEFINITIONS

A. Conform to PDCA Glossary for interpretation of terms used in this Section except as modified below.

B. Exposed Surfaces: Surfaces of products, assemblies, and components visible from any angle after final installation. Includes internal surfaces visible when operable doors, panels or drawers are open, and surfaces visible behind registers, grilles, or louvers.

C. Concealed Surfaces: Surfaces permanently hidden from view in finished construction and which are only visible after removal or disassembly of part or all of product or assembly.

D. Inaccessible Spaces: Spaces not intended for human use.

E. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.

F. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

G. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

H. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.

I. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.MPI Gloss

J. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.

K. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

L. System DFT: Dry film thickness of entire coating system unless otherwise noted.

PART 2 - PRODUCTS

2.01 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.
   1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
   2. Indicate VOC content.

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
   1. Submit Samples on rigid backing, 8 inches (200 mm) square.
   2. Apply coats on Samples in steps to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.

C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

2.02 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Paint: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

2.03 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
      a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
      b. Other Items: Architect will designate items or areas required.
   2. Final approval of color selections will be based on mockups.
      a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

2.04 DELIVERY, STORAGE, AND HANDLING

A. Delivery materials to Project site in manufactures original, unopened packages and containers bearing manufactures name and label and the following information:
   1. Product name or title of material
   2. Product description (generic classification or binder type)
   3. Manufactures stock number and date of manufacture
   4. Contents by Volume, for pigment and vehicle constituents
   5. Application Instructions
   6. Color name and umber

7. VOC Content

B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

2.05 FIELD CONDITIONS

A. Environmental Conditions: Comply with more restrictive of the following or manufactures requirements under which systems can be applied:
   1. Provide continuous ventilation during application of coatings to exhaust hazardous fumes.
   2. Provide heating necessary to maintain surface ambient temperatures within specified limits.
   3. Maintain temperature and humidity conditions for a minimum 24 hours before, during and 48 hours after application of finishes, unless longer times are required by the manufacture.
   4. Do not permit wide variations in ambient temperatures which might result in condensation on freshly coated surfaces.
   5. Provide illumination of not less than 80 footcandles measured mid-height at substrate surface during application of coatings.

B. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

C. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

2.06 WARRANTY

A. Warrant installation to be free of defects in material and workmanship for 5 years.

B. Repair or replace defects occurring during warranty period. (Defects include but are not limited to pinholes, crazing or cracking, loss of adhesion to substrate, deficient thickness, improper material and workmanship)

PART 3 - PRODUCTS

3.01 MANUFACTURERS

A. Basis of Design Products: Subject to compliance with requirements, provide products by Dunn-Edwards Corporation (Colors noted in Finish Schedule) or comparable product from one of the following:
   1. Benjamin Moore and Company
   2. Sherwin-Williams Company
   3. Kelly-Moore Paint Company, Inc.
   4. Glidden Professional

3.02 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Colors: As indicated in a color schedule
1. Ten percent of surface area will be painted with deep tones.

3.03 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from

Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 4 - EXECUTION

4.01 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent.
2. Fiber-Cement Board: 12 percent.
3. Masonry (Clay and CMUs): 12 percent.
4. Wood: 15 percent.
5. Gypsum Board: 12 percent.
6. Plaster: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Plaster Substrates: Verify plaster is fully cured.

E. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

F. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

4.02 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
   1. SSPC-SP 7/NACE No. 4.

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC- PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Wood Substrates:
   1. Scrape and clean knots and apply coat of knot sealer before applying primer.
   2. Sand surfaces that will be exposed to view and dust off.
   3. Prime edges, ends, faces, undersides, and backsides of wood.
   4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

4.03 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
   1. Use applicators and techniques suited for paint and substrate indicated.
   2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
   3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
   4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
   5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
   1. Paint the following work where exposed in equipment rooms:
      a. Equipment, including panelboards and switch gear.
      b. Uninsulated metal piping.
      c. Uninsulated plastic piping.
      d. Pipe hangers and supports.
      e. Metal conduit.
      f. Plastic conduit.
      g. Tanks that do not have factory-applied final finishes.
      h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
   2. Paint the following work where exposed in occupied spaces:
      a. Equipment, including panelboards.
      b. Uninsulated metal piping.
      c. Uninsulated plastic piping.
      d. Pipe hangers and supports.
      e. Metal conduit.
      f. Plastic conduit.
      g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
      h. Other items as directed by Architect.
   3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

4.04 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
   1. Contractor shall touch up and restore painted surfaces damaged by testing.
   2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

4.05 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

4.06 INTERIOR PAINTING SCHEDULE

A. CMU Substrates:
1. Institutional Low-Odor/VOC Latex System:
a. Block Filler: Block filler, latex, interior/exterior**, (**MPI #4).
1) Dunn Edwards - Smooth BLOCFIL Select, Int/Ext, SBSL00-1.
2) Benjamin Moore – Ultra Spec, Hi-Build Masonry Block Fill, 571/K571.
3) Sherwin Williams – PrepRite Interior/Exterior Block Filler, B25W00025.
b. Intermediate Coat: Latex, interior, institutional low odor/VOC, Level 4 matching topcoat (MPI #43).
c. Topcoat: Latex, interior, institutional low odor/VOC (MPI #43).
1) Dunn Edwards – Spartawall, Low Oder Interior Low Sheen SWLL40-1, applied at a dry film thickness of not less than 1.5 mils.
2) Benjamin Moore – Ultra Spec 500, Waterborne Interior Semi Gloss, N539/K539, applied at a dry film thickness of not less than 1.8 mils.
3) Sherwin Williams – ProMar 200, Zero VOC, Int. Latex Low Sheen B24W02651, applied at a dry film thickness of not less than 1.8 mils.
4) Kelly Moore – KM Professional, 1040 Premium Professional Latex Int, Satin Enamel, 1040- 121, applied at a dry film thickness of not le applied at a dry film thickness of not less than
1.5 mils ss than 1.5 mils.
5) Glidden Professional – Premium Interior Latex Satin GLN62XX, applied at a dry film thickness of not less than 1.5 mils.
d. Intermediate Coat: Latex, interior, institutional low odor/VOC, Level 5 matching topcoat (MPI #54).
e. Topcoat: Latex, interior, institutional low odor/VOC (MPI #54).
1) Dunn Edwards – Versaglo, Int/Ext Latex Semi-Gloss Paint, W6160E applied at a dry film thickness of not less than 1.5 mils.
2) Benjamin Moore – Ultra Spec 500 Waterborne Interior Gloss, N540/K540, applied at a dry film thickness of not less than 1.8 mils.
3) Sherwin Williams – ProMar 200, Zero VOC, Interior Latex Semi-Gloss B21W1265, applied at a dry film thickness of not less than 1.5 mils.
4) Kelly Moore – 1050 Premium Professional Latex Interior Semi-Gloss Enamel. 1050121. applied at a dry film thickness of not less than 1.5 mils.
5) Glidden Professional – High Endurance Plus Interior Semi-Gloss Paint, 7902GEP; applied at a dry film thickness of not less than 1.5 mils.

B. Steel Substrates:
1. Institutional Low-Odor/VOC Latex System:
a. Prime Coat: Primer, rust inhibitive, water based MPI #107.
1) Dunn Edwards – Enduraprime Interior/Exterior Acrylic Rust Preventative Metal Primer, ENPR00, applied at a dry film thickness of not less than 2.0 mils.

2) Benjamin Moore – Ultra Spec HP, Acrylic Metal Primer HP04/FP04, applied at a dry film thickness of not less than 1.7 mils.
3) Sherwin Williams – Pro Industrial, Pro-Cryl Universal Primer, B66W01310, applied at a dry film thickness of not less than 1.8 mils.
4) Kelly Moore – 5725 DTM, DTM Acrylic Primer Finish 5725-100.
5) applied at a dry film thickness of not less than 1.5 mils.
6) Glidden Professional – High Hide Interior Primer Sealer 1000-1200, applied at a dry film thickness of not less than 1.2.

b. Intermediate Coat: Latex, interior, institutional low odor/VOC, Level 4 matching topcoat. (MPI #43).
c. Topcoat: Latex, interior, institutional low odor/VOC (MPI #43).
1) Dunn Edwards – Spartawall, Low Oder Interior Low Sheen SWLL40-1, applied at a dry film thickness of not less than 1.5 mils.
2) Benjamin Moore – Ultra Spec 500, Waterborne Interior Semi Gloss, N539/K539, applied at a dry film thickness of not less than 1.8 mils
3) Sherwin Williams – ProMar 200, Zero VOC, Int. Latex Low Sheen B24W02651, applied at a dry film thickness of not less than 1.8 mils.
4) Kelly Moore – KM Professional, 1040 Premium Professional Latex Int, Satin Enamel, 1040- 121, applied at a dry film thickness of not le applied at a dry film thickness of not less than
1.5 mils ss than 1.5 mils
5) Glidden Professional – Premium Interior Latex Satin GLN62XX, applied at a dry film thickness of not less than 1.5 mils

d. Intermediate Coat: Latex, interior, institutional low odor/VOC, Level 5 matching topcoat (MPI #54).
e. Topcoat: Latex, interior, institutional low odor/VOC (MPI #54).
1) Dunn Edwards – Versaglo, Int/Ext Latex Semi-Gloss Paint, W6160E applied at a dry film thickness of not less than 1.5 mils.
2) Benjamin Moore – Ultra Spec 500 Waterborne Interior Gloss, N540/K540, applied at a dry film thickness of not less than 1.8 mils.
3) Sherwin Williams – ProMar 200, Zero VOC, Interior Latex Semi-Gloss B21W1265, applied at a dry film thickness of not less than 1.5 mils.
4) Kelly Moore – 1050 Premium Professional Latex Interior Semi-Gloss Enamel. 1050121. applied at a dry film thickness of not less than 1.5 mils.
5) Glidden Professional – High Endurance Plus Interior Semii-Gloss Paint, 7902GEP; applied at a dry film thickness of not less than 1.5 mils.

C. Galvanized-Metal Substrates:
1. High-Performance Architectural Latex System:
a. Prime Coat: Primer, galvanized, water based, MPI #134.
1) Dunn Edwards – Ultra-Grip Premium Interior/Exterior Multi-Surface Primer, UGPR00-1, applied at a dry film thickness of not less than 2.0 mils.
2) Benjamin Moore – Ultra Spec HP, Acrylic Metal Primer HP04/FP04, applied at a dry film thickness of not less than 1.7 mils.
3) Sherwin Williams – Pro Industrial, Pro-Cryl Universal Primer, B66W01310, applied at a dry film thickness of not less than 1.8 mils.
4) Kelly Moore – 5725 DTM, DTM Acrylic Primer Finish 5725-100 applied at a dry film thickness of not less than 1.5 mils.
5) Glidden Professional (Devoe) – Devflex 4020 PF Water-borne Acrylic applied at a dry film thickness of not less than 2.2 mils.

b. Intermediate Coat: Latex, interior, institutional low odor/VOC, Level 4 matching topcoat. (MPI #43).
c. Topcoat: Latex, interior, institutional low odor/VOC (MPI #43).

1) Dunn Edwards – Spartawall, Low Oder Interior Low Sheen SWLL40-1, applied at a dry film thickness of not less than 1.5 mils.
2) Benjamin Moore – Ultra Spec 500, Waterborne Interior Semi Gloss, N539/K539, applied at a dry film thickness of not less than 1.8 mils.
3) Sherwin Williams – ProMar 200, Zero VOC, Int. Latex Low Sheen B24W02651, applied at a dry film thickness of not less than 1.8 mils.
4) Kelly Moore – KM Professional, 1040 Premium Professional Latex Int, Satin Enamel, 1040- 121, applied at a dry film thickness of not le applied at a dry film thickness of not less than
1.5 mils ss than 1.5 mils.
5) Glidden Professional – Premium Interior Latex Satin GLN62XX, applied at a dry film thickness of not less than 1.5 mils

d. Intermediate Coat: Latex, interior, institutional low odor/VOC, Level 5 matching topcoat (MPI #54).
e. Topcoat: Latex, interior, institutional low odor/VOC (MPI #54).
1) Dunn Edwards – Versaglo, Int/Ext Latex Semi-Gloss Paint, W6160E applied at a dry film thickness of not less than 1.5 mils.
2) Benjamin Moore – Ultra Spec 500 Waterborne Interior Gloss, N540/K540, applied at a dry film thickness of not less than 1.8 mils.
3) Sherwin Williams – ProMar 200, Zero VOC, Interior Latex Semi-Gloss B21W1265, applied at a dry film thickness of not less than 1.5 mils.
4) Kelly Moore – 1050 Premium Professional Latex Interior Semi-Gloss Enamel. 1050121. applied at a dry film thickness of not less than 1.5 mils.
5) Glidden Professional – High Endurance Plus Interior Semii-Gloss Paint, 7902GEP; applied at a dry film thickness of not less than 1.5 mils.

D. Gypsum Board and Plaster (Stucco) Substrates:
1. Institutional Low Oder/VOC Latex System:
a. Prime Coat: Primer sealer, latex, interior**,** MPI #50.
1) Dunn Edwards – Vinylastic Select, Interior/Exterior Multi-Surface Primer, VNSL00-1, applied at a dry film thickness of not less than 2.0 mils.
2) Benjamin Moore – Ultra Spec 500 Interior Latex Primer, K534/K534,
3) applied at a dry film thickness of not less than 1.8 mils.
4) Sherwin Williams – ProMar 200 Zero VOC Interior/Exterior Primer, B28W02600, applied at a dry film thickness of not less than 1.0 mils.
5) Kelly Moore – 971 AcryPlex, Acryplex Interior PVA Primer/Sealer, 971-100, applied at a dry film thickness of not less than 1.4 mils.
6) Glidden Professional – Lifemaster, No VOC, Interior Primer GP 9116, applied at a dry film thickness of not less than 1.4 mils.
2. Institutional Low-Oder/VOC Latex System:
a. Intermediate Coat: Latex, interior, institutional low odor/VOC, Level 4 matching topcoat. (MPI #43)
b. Topcoat: Latex, interior, institutional low odor/VOC (MPI #43).
1) Dunn Edwards – Spartawall, Low Oder Interior Low Sheen SWLL40-1, applied at a dry film thickness of not less than 1.5 mils.
2) Benjamin Moore – Ultra Spec 500, Waterborne Interior Semi Gloss, N539/K539, applied at a dry film thickness of not less than 1.8 mils.
3) Sherwin Williams – ProMar 200, Zero VOC, Int. Latex Low Sheen B24W02651, applied at a dry film thickness of not less than 1.8 mils.

4) Kelly Moore – KM Professional, 1040 Premium Professional Latex Int, Satin Enamel, 1040- 121, applied at a dry film thickness of not le applied at a dry film thickness of not less than
1.5 mils ss than 1.5 mils.

5) Glidden Professional – Premium Interior Latex Satin GLN62XX, applied at a dry film thickness of not less than 1.5 mils.

c. Intermediate Coat: Latex, interior, institutional low odor/VOC, Level 5 matching topcoat (MPI #54).

d. Topcoat: Latex, interior, institutional low odor/VOC (MPI #54).
   1) Dunn Edwards – Versaglo, Int/Ext Latex Semi-Gloss Paint, W6160E applied at a dry film thickness of not less than 1.5 mils.
   2) Benjamin Moore – Ultra Spec 500 Waterborne Interior Gloss, N540/K540, applied at a dry film thickness of not less than 1.8 mils.
   3) Sherwin Williams – ProMar 200, Zero VOC, Interior Latex Semi-Gloss B21W1265, applied at a dry film thickness of not less than 1.5 mils.
   4) Kelly Moore – 1050 Premium Professional Latex Interior Semi-Gloss Enamel. 1050121. applied at a dry film thickness of not less than 1.5 mils.
   5) Glidden Professional – High Endurance Plus Interior Semii-Gloss Paint, 7902GEP; applied at a dry film thickness of not less than 1.5 mils.

E. Concrete Substrate
   1. Institutional Low Oder/VOC Latex System:
      a. Prime Coat: Primer sealer, latex, interior**,** MPI #50.
         1) Benjamin Moore – UltraSpec Int/Ext 100% Acrylic Sealer, o608/K608, applied at a dry film thickness of not less than 1.0 mils.
         2) Dunn Edwards – Eff Stop Premium Int/Ext Masonry Primer/Sealer, ESPR00-1, applied at a dry film thickness of not less than 2.0 mils.
         3) Kelly Moore – 247 AcryShield, Acryshield Acrylic Ext. Masonry Sealer, 247-100, applied at a dry film thickness of not less than 1.2 mils.
         4) Glidden Professional – Dulux (CA), Gripper Int/Ext Universal Acrylic Primer Sealer, 17-921X1 Series, applied at a dry film thickness of not less than 1.6 mils.
         5) Sherwin Williams – Loxon, Loxon Concrete & Masonry Primer, A24W8300/LX02W0050, applied at a dry film thickness of not less than 2.1 mils.
      b. Intermediate Coat: Latex, interior, institutional low odor/VOC, Level 4 matching topcoat. (MPI #153)
      c. Topcoat: Latex, interior, institutional low odor/VOC (MPI #151).
         1) Benjamin Moore – Pre-Catalyzed WB Epoxy Eggshell HP140, applied at a dry film thickness of not less than 1.5 mils.
         2) Dunn Edwards – Enduracoat, Int/Ext Eggshell Industrial Maintenance Coat, ENCT30, applied at a dry film thickness of not less than 1.5 mils.
         3) Kelly Moore – Durapoxy, 1686 Durapoxy Int. Eggshell Enamel, 1686121, applied at a dry film thickness of not less than 1.4 mils.
         4) Glidden Professional – Dulux Diamond (CA), Interior Acrylic Pearl, 14220. applied at a dry film thickness of not less than 1.3 mils.
         5) Sherwin Williams – Pro Industrial, DTM Acrylic Eg-Shell, B66W01251, applied at a dry film thickness of not less than 2.5 mils.

END OF SECTION

SECTION 099600 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of high-performance coating systems.
   1. Exterior Substrates: Steel.

1.2 DEFINITIONS

A. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.

B. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.
   1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

B. Samples: For each type of coating system and in each color and gloss of topcoat indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufactures for MPI Systems: Subject to compliance with requirements, provide products by one of the following:
   1. Benjamin Moore & Co.
   2. Devoe Coatings; Akzo Nobel
   3. PPG Paints
   4. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.
   5. Sherwin-Williams Company (The)

B. Non-MPI Tested Subject to compliance with requirements, provide product listed in the interior High-Performance Coating Schedule for the coating category indicated.

2.2 HIGH PROFORMANCE COATINGS, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:
   1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
   3. Products shall be of same manufacturer for each coat in a coating system.

C. Colors: As indicated in color schedule

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

C. Proceed with coating application only after unsatisfactory conditions have been corrected.
   1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

3.3 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

B. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Steel Substrates:
   1. Pigmented Polyurethane over High-Build Epoxy System MPI EXT 5.1G:
      a. Prime Coat: Primer, epoxy, anti-corrosive, for metal[, MPI #20].
      b. Intermediate Coat: Epoxy, high build, low gloss[, MPI #108].
      c. Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 6), MPI #72.

B. Galvanized-Metal Substrates:
   1. Pigmented Polyurethane over Epoxy Primer System MPI EXT 5.3L:
      a. Prime Coat: Primer, epoxy, anti-corrosive, for metal[, MPI #101].
      b. Intermediate Coat: Polyurethane, two component, pigmented, gloss matching topcoat.
      c. Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 6, MPI #72.

END OF SECTION 099600

SECTION 101423 - PANEL SIGNAGE

1.1 SUMMARY

A. Section Includes: Panel signs.

1.2 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.3 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For panel signs.
   1. Include fabrication and installation details and attachments to other work.
   2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
   3. Show message list, typestyles, graphic elements[, including raised characters and Braille, and layout for each sign at full size.

C. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
   1. Panel Signs: Full-size Sample
   2. Full-size Samples, if approved, will be returned to Contractor for use in Project.

D. Product Schedule: For panel signs. Use same designations indicated on Drawings or specified.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of finishes beyond normal weathering.
      b. Deterioration of embedded graphic image.
      c. Separation or delamination of sheet materials and components.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and] ICC A117.1.

2.2 PANEL SIGNS

A. Panel Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
   1. Solid-Sheet Sign and Returns: Acrylic sheet with finish specified in "Surface Finish and Applied Graphics" Subparagraph and as follows:
      a. Thickness: As indicated on Drawings
      b. Surface-Applied, Flat Graphics: Applied vinyl film.
      c. Surface-Applied, Raised Graphics: Applied polymer characters and Braille
   2. Sign-Panel Perimeter: Finish edges smooth.
      a. Edge Condition Square cut
      b. Corner Condition in Elevation: Square
   3. Frame: To hold changeable sign panel
      a. Material: Acrylic or Aluminum
      b. Material Thickness: Ass indicated on the drawings
      c. Frame Depth: As indicated on Drawings
      d. Profile: Square
      e. Corner Condition in Elevation: Square
      f. Finish and Color: As selected by Architect from manufacturer's full range.
   4. Mounting: Surface mounted to wall with manufacture’s standard method for substrates
   5. Surface Finish and Applied Graphics:
      a. Integral Acrylic Sheet Color: As selected by Architect from full range of industry colors.

6. Text and Typeface: Accessible raised characters and Braille, typeface matching Architect's sample and variable content as scheduled. Finish raised characters to contrast with background color, and finish Braille to match background color.
7. Flatness Tolerance: Sign shall remain flat or uniformly curved under installed conditions as indicated on Drawings and within a tolerance of plus or minus 1/32 inch (0.8 mm) measured diagonally from corner to corner.

2.3 PANEL-SIGN MATERIALS

A. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following unless otherwise indicated:
   1. Use concealed fasteners and anchors unless indicated to be exposed.
   2. Exposed Metal-Fastener Components, General:
      a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
   3. Sign Mounting Fasteners:
      a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly unless otherwise indicated.
      b. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material or screwed into back of sign assembly, unless otherwise indicated.
      c. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, and installed in predrilled holes.
   4. Inserts: Furnish inserts to be set by other installers into concrete or masonry work.

B. Adhesive: As recommended by sign manufacturer.

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
   1. Preassemble signs in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
   2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
   3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
   4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.

5. Internally brace signs for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
6. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

B. Signs with Changeable Message Capability: Fabricate signs to allow insertion of changeable messages as follows:
1. For slide-in changeable inserts, fabricate slot without burrs or constrictions that inhibit function. Furnish initial changeable insert. Subsequent changeable inserts are by Owner,
2. For frame to hold changeable sign panel, fabricate frame without burrs or constrictions that inhibit function. Furnish initial sign panel. Subsequent changeable sign panels are by Owner.

C. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.
1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish color unless otherwise indicated.
2. Stainless-Steel Brackets: Factory finish brackets with No. 4 finish unless otherwise indicated.

2.6 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are 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.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Verify that anchorage devices embedded in permanent construction are correctly sized and located to accommodate signs.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
   1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
   2. Install signs so they do not protrude or obstruct according to the accessibility standard.
   3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
   4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Accessible Signage: Install in locations on walls according to the accessibility standard.

C. Mounting Methods:

   1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
      a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
      b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
   2. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
      a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.
      b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.
   3. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
   4. Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position so that signage is correctly located and aligned.
   5. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility

of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.

6. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.
7. Shim-Plate Mounting: Provide 1/8-inch- (3-mm-) thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other direct mounting methods are impractical. Attach plate with fasteners and anchors suitable for secure attachment to substrate.

D. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101423

SECTION 102113.17 - PHENOLIC-CORE TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Phenolic-core toilet compartments configured as toilet enclosures and urinal screens.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings: For toilet compartments.
1. Include plans, elevations, sections, details, and attachment details.
2. Show locations of cutouts for compartment-mounted toilet accessories.
3. Show locations of centerlines of toilet fixtures.
4. Show locations of floor drains.
5. Show overhead support or bracing locations.

C. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:
1. Each type of material, color, and finish required for toilet compartments, prepared on 6-inch- (152-mm-) square Samples of same thickness and material indicated for Work.
2. Each type of hardware and accessory.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing 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: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in 2010 ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for toilet compartments designated as accessible.

2.2 PHENOLIC-CORE TOILET COMPARMENTS

A. Basis of Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc. 1180 Series or approved comparable product by one of the following:
   1. Accurate Partitions Corp., an ASI Group Company
   2. Bradley Corporation
   3. General Partitions Mfg. Corp

B. Toilet-Enclosure Style: Overhead braced and Floor anchored

C. Urinal-Screen Style: Wall hung and Floor anchored

D. Door, Panel[, Screen, and Pilaster Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges and no-sightline system. Provide minimum 3/4-inch- (19-mm-) thick doors and pilasters and minimum 1/2-inch- (13-mm-) thick panels.

E. Pilaster Shoes: Formed from stainless steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.

F. Brackets (Fittings):
   1. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

G. Phenolic-Panel Finish:
   1. Facing Sheet Finish: One color and pattern in each room.
   2. Color and Pattern: As indicated on the drawings by manufacturer's color designations.

2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories: Manufacturer's heavy-duty operating hardware and accessories.
   1. Hinges: Manufacturer's minimum 0.062-inch- (1.59-mm-) thick stainless steel paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees allowing emergency access by lifting door. Mount with through-bolts.

2. Latch and Keeper: Manufacturer's heavy-duty surface-mounted cast-stainless steel latch unit designed to resist damage due to slamming, with combination rubber-faced door strike and keeper, and with provision for emergency access. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible. Mount with through-bolts.
3. Coat Hook: Manufacturer's heavy-duty combination cast-stainless steel hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories. Mount with through-bolts.
4. Door Bumper: Manufacturer's heavy-duty rubber-tipped cast-stainless steel bumper at out-swinging doors Mount with through-bolts.
5. Door Pull: Manufacturer's heavy-duty cast-stainless steel pull at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Mount with through-bolts.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 MATERIALS

A. Aluminum Extrusions: ASTM B221 (ASTM B221M).

B. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.

C. Stainless Steel Castings: ASTM A743/A743M.

2.5 FABRICATION

A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Door Size and Swings: Unless otherwise indicated, provide 24-inch- (610-mm-) wide in-swinging doors for standard toilet compartments and 36-inch- (914-mm-) wide out-swinging doors with a minimum 32-inch- (813-mm-) wide clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
   1. Confirm location and adequacy of blocking and supports required for installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
   1. Maximum Clearances:
      a. Pilasters and Panels: 1/2 inch (13 mm).
      b. Panels and Walls: 1 inch (25 mm).
   2. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.
      a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
      b. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches (44 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113.17

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY: Section Includes: Public and Private use washroom accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule indicating types, quantities, sizes and installation locations by room

1.3 INFORMATIONAL SUBMITTALS: Sample warranties.

1.4 CLOSEOUT SUBMITTALS: Maintenance data.

1.5 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
   1. Warranty Period:15 years from date of Substantial Completion unless noted otherwise in this Section of the Specifications.
   2. Failures include, but not limited to visible silver spoilage defects.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Design accessories and fasteners to comply with the following requirements:
   1. Grab Bars: Installed units are able to resist 250 lbf (1112 N) concentrated load applied in any direction and at any point.

2.2 WASHROOM ACCESSORIES

A. Toilet Tissue (Roll) Dispenser
   1. Basis of Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc.; No. B-3588 or approved comparable product by one of the following:
      a. American Specialties, Inc.
      b. Bradley Corporation

c. GAMCO Specialty Accessories; a division of Bobrick
2. Description: Double-roll dispenser
3. Mounting: Surface mounted.
4. Operation: Non-control delivery with standard spindle
5. Capacity: Designed for 4-1/2- or 5-inch- (114- or 127-mm-) diameter tissue rolls.
6. Material and Finish: Stainless steel, ASTM A480/A48M No. 4 finish (satin)

B. Paper Towel (Folded) Dispenser
1. Basis of Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc.; No. B-4262 or approved comparable product by one of the following:
   a. American Specialties, Inc.
   b. Bradley Corporation
   c. GAMCO Specialty Accessories; a division of Bobrick
2. Mounting: Surface mounted.
3. Minimum Capacity: 400 or 525 multi-fold towels
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin)
5. Lockset: Tumbler type.

C. Soap Dispenser
1. Basis of Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc.; No. B-2111 or approved comparable product by one of the following:
   a. American Specialties, Inc.
   b. Bradley Corporation
   c. GAMCO Specialty Accessories; a division of Bobrick
2. Description: Designed for manual operation and dispensing soap in liquid form.
3. Mounting: Vertically oriented, surface mounted
4. Capacity: 40 fl.oz.
5. Materials: Stainless steel, ASTM A480/A480M No. 4 finish (satin) and a Corrosion resistant valve.
6. Lockset: Tumbler type.
7. Refill Indicator: Window type.

D. Grab Bar :
1. Basis of Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc.; No. B-6806 or approved comparable product by one of the following:
   a. American Specialties, Inc.
   b. Bradley Corporation
   c. GAMCO Specialty Accessories; a division of Bobrick
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 18 Gauge thick.
   a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin) on ends and slip-resistant texture in grip area.
4. Outside Diameter: 1-1/2 inches (38 mm).
5. Configuration and Length: As indicated on Drawings

E. Sanitary-Napkin Disposal Unit
   1. Basis of Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc.; No. B-254 or approved comparable product by one of the following:
      a. American Specialties, Inc.
      b. Bradley Corporation
      c. GAMCO Specialty Accessories; a division of Bobrick
   2. Mounting: Surface
   3. Self-closing, disposal-opening cover and hinged face panel with tumbler lockset.
   4. Receptacle: Removable.
   5. Material and Finish: 18-8 Type 304 Stainless steel, ASTM A480/A480M No. 4 finish (satin).

F. Seat-Cover Dispenser
   1. Basis of Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc.; No. B-301 or approved comparable product by one of the following:
      a. American Specialties, Inc.
      b. Bradley Corporation
      c. GAMCO Specialty Accessories; a division of Bobrick
   2. Mounting: Recessed
   3. Minimum Capacity: **500** seat covers.
   4. Exposed Material and Finish: 18-8 Type 304 Stainless steel, ASTM A480/A480M No. 4 finish (satin).
   5. Lockset: Tumbler type.

G. Mirror Unit
   1. Basis of Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc.; No. B-2808 or approved comparable product by one of the following:
      a. American Specialties, Inc.
      b. Bradley Corporation
      c. GAMCO Specialty Accessories; a division of Bobrick
   2.
   3. Frame: 18-8 Type 304 Stainless steel angle, ¾ inch (19.05 mm) by ¾ inch (19.05 mm) by 0.05 inch (1.3 mm) thick
      a. Corners: Mitered and Welded and ground smooth.
   4. Size: As indicated on Drawings
   5. Hangers: Manufacturer's standard rigid, tamper and theft resistant.

H. Diaper-Changing Station
   1. Basis of Design Product: Subject to compliance with requirements, provide Koala Kare a division of Bobrick Washroom Equipment, Inc.; No. KB310-SSRE or approved comparable product by one of the following:
      a. Bradley Corporation
      b. Global Industries
   2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
      a. Engineered to support minimum of 250-lb (113-kg) static load when opened

3. Mounting: Semi-recessed, with unit projecting not more than 3 inches (76 mm) from wall when closed.
4. Operation: By pneumatic shock-absorbing mechanism.
5. Material and Finish - Stainless steel, ASTM A480/A480M No. 4 finish (satin), with replaceable insulated polystyrene tray liner and rounded plastic corners
6. Liner Dispenser: Provide built-in dispenser for disposable sanitary liners.
7. Warranty: Five (5) years from date of Substantial Completion

I. Under lavatory Guard
1. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
2. Material and Finish: Antimicrobial, molded plastic, white.

J. Custodial Mop and Broom Holder
1. Basis of Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc.; No. B-239 or approved comparable product by one of the following:
   a. American Specialties, Inc.
   b. Bradley Corporation
   c. GAMCO Specialty Accessories; a division of Bobrick
2. Description: Unit with shelf, hooks, holders, beneath shelf.
3. Length: 34 inches (865 mm).
4. Hooks: Four
5. Mop/Broom Holders: Three spring-loaded, rubber hat, cam type.
6. Material and Finish: 18-8 Type 304 Stainless steel, ASTM A480/A480M No. 4 finish (satin).
   a. Shelf: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel.

2.3 FABRICATION

A. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six (6) keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
1. Remove temporary labels and protective coatings.

B. Grab Bars: Install to comply with specified structural-performance requirements.

END OF SECTION 102800

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Fire-protection cabinets for portable fire extinguishers.

B. Related Requirements: Section 104416 “Fire Extinguishers” for portable, hand carried fire extinguishers accommodated by fire protection cabinets.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Show door hardware, cabinet type, trim style and panel style, identification lettering, include rough-in dimensions and details showing recessed, semi-recessed or surface mounting method and relationship of box and trim to surrounding construction.

B. Shop Drawings: For fire-protection cabinets.

C. Samples: For each type of exposed finish required.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.4 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

2.2 FIRE-PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.
   1. Basis of Design Product: Subject to compliance with requirements, provide JL Industries Ambassador Steel Fire Extinguisher Cabinets, Model 1070 or approved comparable product from one of the following:
      a. Guardian Fire Equipment
      b. Larsens Manufacturing Company
      c. Potter Roemer
      d. Amerex

B. Cabinet Construction: Rated as required by wall designation

C. Cabinet Material: Stainless steel sheet.

D. Recessed Cabinet:
   1. Trimless with Concealed Flange: Surface of surrounding wall finishes flush with exterior finished surface of cabinet frame and door, without overlapping trim attached to cabinet. Provide recessed flange, of same material as box, attached to box, to act as drywall bead.
   2. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).

E. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
   1. Rolled-Edge Trim:2-1/2-inch (64-mm) or 4-inch (102-mm) backbend depth trim depth dependent on wall thickness.

F. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim.

G. Cabinet Trim Material: Fabricate cabinet trim in one piece with corners mitered, welded and ground smooth

H. Door Material: Fabricate doors according to manufacture’s standards, from materials indicated and coordinated with cabinet types and trim styles.

I. Door Style: Vertical duo panel with frame.

J. Door Glazing: Tempered float glass (clear)

K. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

L. Accessories:
   1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.

2. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
3. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle
4. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
    a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER"
        1) Location: Applied to cabinet door
        2) Application Process: Pressure-sensitive vinyl letters.
        3) Lettering Color: Red
        4) Orientation: Vertical

M. Materials:
1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.
    a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
    b. Color: As selected by Architect from manufacturer's full range

2.3 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.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Prepare recesses for recessed and semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

B. Install fire-protection cabinets in locations and at mounting heights indicated (48 inches above finish floor to the top of Fire Extinguisher cabinet.

C. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

D. Identification: Apply vinyl lettering at locations indicated.

E. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

END OF SECTION 104413

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

B. Related Requirements: See Section 104413 “Fire Protection Cabinets”.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.4. CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: **Six** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
   1. Product: Subject to compliance with requirements, provide products from one of the following:
      a. Guardian Fire Equipment
      b. Larsens Manufacturing Company
      c. JL Industries, Inc.
      d. Potter Roemer
      e. Amerex
   2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.
   3. Limitations: Obtain fire extinguishers, fir protection cabinets and accessories from a single source, from a single manufacture.
   4. Valves: Nickel plated polished brass body
   5. Handles and Levers: Stainless Steel.

B. Multipurpose Dry-Chemical Type in steel container UL-3-A:40BC, 5-lb (2.3 kg) nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine fire extinguishers for proper charging and tagging.
   1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
   1. Mounting Brackets: Top of fire extinguisher to be at 42 inches (1067 mm) above finished floor.

C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 107516 - GROUND-SET FLAGPOLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes ground-set flagpoles made from aluminum.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.

B. Shop Drawings: For flagpoles.
   1. Include plans, elevations, and attachment details. Show general arrangement, jointing, fittings, accessories, grounding, anchoring, and support.
   2. Include section, and details of foundation system.

C. Samples for Verification: For each type of exposed finish, in manufacturer's standard sizes.

D. Delegated-Design Submittal: For flagpoles.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain flagpoles as complete units, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design flagpole assemblies.

B. Seismic Performance: Flagpole assemblies shall withstand the effects of earthquake motions determined according to ASCE/SEI 7

C. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand design loads indicated within limits and under conditions indicated.
   1. Wind Loads: Determine according to NAAMM FP 1001. Basic wind speed for Project location, see Structural Documents.
   2. Base flagpole design on nylon flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.
      a. Flag size: 5 feet x 8 feet.

2.3 ALUMINUM FLAGPOLES

A. Aluminum Flagpoles: Cone tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B241/B241M, Alloy 6063, with a minimum wall thickness of 3/16 inch (4.8 mm).

B. Basis of Design Product:: Subject to compliance with requirements, provide Liberty Flagpole Company, Commerical Internal Halyard pole, or an approved comparable equal product.
   1. Height: 30 feet (9 m)

C. Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:
   1. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.
   2. Provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.

D. Metal Foundation Tube: Manufacturer's standard corrugated-steel foundation tube, 0.060-inch (1.52-mm) wall thickness with 3/16-inch (4.8-mm) steel bottom plate and support plate; 3/4-inch- (19-mm-) diameter, steel ground spike; and steel centering wedges welded together. Galvanize foundation tube after assembly. Furnish loose hardwood wedges at top of foundation tube for plumbing pole.
   1. Flashing Collar: Same material and finish as flagpole.
   2. Furnish aluminum base or aluminum flashing collar finished to match flagpole.
   3. Furnish ground spike.

2.4 FITTINGS

A. Finial Ball: Flush-seam ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.
   1. 0.063-inch (1.6-mm) spun aluminum**,** finished with gold anodic finish.

B. Internal Halyard, Winch System: Manually operated winch with control stop device and removable handle, stainless-steel cable halyard, and concealed revolving truck assembly with

plastic-coated counterweight and sling. Furnish flush access door secured with cylinder lock. Finish truck assembly to match flagpole.

1. Halyard Flag Snaps: Bronze swivel snap hooks with neoprene or vinyl covers. Furnish two per halyard.

2.5 MISCELLANEOUS MATERIALS

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M.

B. Drainage Material: Crushed stone, or crushed or uncrushed gravel; coarse aggregate.

C. Elastomeric Joint Sealant: single-component nonsag urethane joint sealant complying with requirements in Section 079200 "Joint Sealants."

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.6 ALUMINUM FINISHES

A. Natural Satin Finish: AA-M32, fine, directional, medium satin polish; buff complying with AA-M20; seal aluminum surfaces with clear, hard-coat wax.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.

B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.

C. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms to prevent displacement during concreting.

D. Foundation Tube: Place foundation tube, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level foundation tube and allow concrete to cure.

E. Sleeves: Locate and secure sleeves in forms by bracing to reinforcement and forms.

F. Place concrete, as specified in Section 033000 "Cast-in-Place Concrete." Compact concrete in place by using vibrators. Moist-cure exposed concrete for no fewer than seven days or use nonstaining curing compound.

G. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.2 FLAGPOLE INSTALLATION

A. General: Install flagpoles where indicated and according to Shop Drawings and manufacturer's written instructions.

B. Foundation Tube: Place flagpole in tube, seated on bottom plate between steel centering wedges, and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch (50-mm) layer of elastomeric joint sealant and cover with flashing collar.

C. Baseplate: Cast anchor bolts in concrete foundation. Install baseplate on washers placed over leveling nuts on anchor bolts and adjust until flagpole is plumb. After flagpole is plumb, tighten retaining nuts and fill space under baseplate solidly with nonshrink, nonmetallic grout. Finish exposed grout surfaces smooth and slope 45 degrees away from edges of baseplate.

END OF SECTION 107516

SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Manually operated roller shades with single rollers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

C. Samples: For each exposed product and for each color and texture specified (shade material)

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Product test reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1.6. DELIVERY, STORAGE AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacture, product name and location of installation using same designation indicated on Drawings

1.7. FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for project when occupied for its intended use.

B. Field Measurements: Where Roller Shades are indicated to fit to other construction, verify dimensions of the other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify architect of installation conditions that vary from drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

A. Basis of Design: Subject to compliance with requirements, provide products by Mechoshade, Urban Manual operable shades with ThermoVeil 1500 Series shadecloth, or approved comparable products by one of the following:
1. Hunter Douglas
2. 1draper Inc.
3. Nyan Solar Control, Inc.

B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
1. Chain-Retainer Type: Chain tensioner, jamb mounted or Chain tensioner, sill mounted.
2. Spring Lift-Assist Mechanisms: Provide for shadebands that weigh more than 10 lb (4.5 kg) or for shades as recommended by manufacturer, whichever criterion is more stringent.

C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
1. Roller Drive-End Location: Right side of interior or As indicated on Drawings >.
2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.

D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

E. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.

F. Shadebands:
1. Shadeband Material: Light-filtering fabric
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

a. Type: Enclosed in sealed pocket of shadeband material.
b. Color and Finish: As selected by Architect from manufacturer's full range

G. Installation Accessories:
1. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.
2. Endcap Covers: To cover exposed endcaps.
3. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with **NFPA 701** Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.
1. Source: Roller shade manufacturer
2. Type: Woven polyester and PVC-coated polyester
3. Weave: Basketweave
4. Thickness: 0.037 inches
5. Weight: 19.05 oz./sq. yd. (646 g/sq. m).
6. Roll Width: 126 inches (3200 mm)
7. Orientation on Shadeband: Up the bolt
8. Openness Factor: 3 percent.
9. Color: As selected by Architect from manufacturer's full range.

2.4 ROLLER SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):
1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch (6 mm) per side or 1/2-inch (13-mm) total, plus or minus 1/8 inch (3.1 mm). Length equal to head-to-sill or -floor dimension of opening
2. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:
1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4 provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
2. Railroaded materials: Railroad material where material roll width is less than the width of shadeband where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll width panel(s) plus, if required, one partial roll width panel located at top of shadeband.

PART 3 - EXECUTION

3.1 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
   1. Opaque Shadebands: Located so shadeband is not closer than 2 inches (51 mm) to interior face of glass. Allow clearances for window operation hardware.

B. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

C. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.

D. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 122413

SECTION 22 05 00 - PLUMBING GENERAL REQUIREMENTS

1. SPECIAL NOTICE

1.1 The Architectural Plans and Specifications, including the GENERAL CONDITIONS, SUPPLEMENTAL GENERAL CONDITIONS, SPECIAL CONDITIONS, including all supplements issued thereto, INSTRUCTIONS TO BIDDERS and other pertinent documents issued by the Architect are a part of these Specifications and the accompanying Plumbing Drawings.

2. CODES, ORDINANCES AND REGULATIONS

2.1 All work of this section including materials and workmanship shall be done in the strict accord with City of Phoenix Building Standards and Review Process Guidelines and all applicable city, county, state and national codes, ordinances, and regulations, and in accord with all local utility company regulations.

3. INDUSTRY STANDARDS

3.1 The following industry standards shall apply, as applicable to the work of this section except that where the requirements of these specifications are more stringent than standards listed, these specifications shall take precedence.

3.1.1	City of Phoenix Building Standards and Review Process Guidelines
.1 AMCA	Air Moving and Conditioning Association
.2 ANSI	American National Standards Institute
.3 ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
.4 ASME	American Society of Mechanical Engineers
.5 ASTM	American Society of Testing Materials
.7 NEC	National Electrical Code
.8 NEMA	National Electrical Manufacturer's Associations
.9 NFPA	National Fire Protection Association
.10 OSHA	Occupational Safety and Health Administration
.11 UL	Underwriters' Laboratories

4. SHOP DRAWINGS

4.1 Shop drawings submittals are required under this Division for the following:

4.1.1 Plumbing Fixtures: Lavs, etc.
4.1.2 Valves and Miscellaneous Accessories
4.1.3 Plumbing piping

5. MATERIALS

5.1 Requirements:

All materials shall be new and of the quality specified, free from defects at the time of installation. Materials or equipment damaged in shipment or otherwise damaged prior to installation shall not be repaired at the jobsite, but shall be replaced with new materials.

6. SPACE AND EQUIPMENT ARRANGEMENT AND ACCESS

6.1 Size and Fit:

The size of plumbing equipment shown on the drawings is based on the dimensions of a particular manufacturer (the first named). While other manufacturers may be acceptable, it is the responsibility of each trade to determine if the equipment he proposes to furnish will fit the allotted space and to obtain prior approval from owner of such substituted equipment prior to ordering.

.2 Service Access:

All equipment shall be installed in a manner to permit access to all surfaces as required by the manufacturer. All valves, motors, drives, lubrication devices, filters and other accessory items shall be installed in a position to allow removal for service without disassembly of another part. This requirement includes equipment installed above ceilings.

7. CONSTRUCTION REQUIREMENTS

7.1 General:

All trades shall be responsible for fitting the material and apparatus into the building and shall carefully layout work at the site to conform to the structural conditions, to provide proper grading of condensate and refrigerant lines, to avoid all obstructions and to conform to the details of the installation supplied by the manufacturer of the equipment to be installed and thereby provide an integrated, satisfactory operating installation, furnishing all necessary pilot lines and control lines.

.2 Piping:

In general, piping shall be run concealed in chases, furrings and above suspended ceilings, unless noted and directed otherwise on plans. All pipe and ductwork shall be square to the building and securely supported. Runs of piping shall be grouped wherever it is feasible to do so, to include grouping with all Mechanical, Plumbing, Fire and Electrical Trades. Piping and Plumbing Systems shown on plans are schematic only and do not specify all turns, offsets or other fittings which will be necessary in the construction of this project. Contractor shall not charge owner, engineer, architect or others for such fittings or offsets and shall visit site prior to construction to include such items in contractor’s fee. Contractor shall coordinate with other trades prior to construction to agree to routing of all improvements with consideration given to the Architect’s intended ceiling height. Contractor shall adjust piping, etc as required to provide required clearance for building structure, ceiling height as specified by architect, and other field conditions.

.3 OWNER FURNISHED ITEMS

Affected trades shall familiarize themselves with all the Owner Furnished items and make proper connection to such items. Contractor shall request of Owner or Architect manufacturer’s cut sheets specifying the connection locations and sizes as necessary to assure a complete and properly functioning installation of Owner Furnished items.

9. ELECTRICAL WIRING OF MOTORS AND EQUIPMENT

9.1 Power and Control Wiring:
Except for such items that are normally wired at their point of manufacture and so delivered and unless specifically noted to the contrary herein, all electric wiring for power is part of the work of DIVISION 26.

.2 Controls Installation:
Installation of all automatic controls, temperature controls, temperature indication and all interconnecting conduit, wiring, and junction boxes for the installation of Plumbing equipment shall be part of the work of DIVISION 22. If plans show specific details of controls hardware or interlocks on electrical plans, such control conduit will only then be the responsibility of DIVISION 26.

10. IDENTIFICATION

10.1 Equipment Nameplates:

All equipment including water heaters shall be identified by the attachment of 3/4" high nameplates, constructed from laminated, phenolic, engraved plastic, 3-ply with black surface and white interior core, at least 1/l6" thick. Letters and numbers shall be used for actual identification and shall be identical to designations used on the Contract Drawings. Engraved letters and numbers shall be 1/2" high, upper case, condensed Gothic. Nameplates shall be permanently attached to equipment/devices by chromium-plated screws. Unit number per plans and space served by the unit shall be stated on nameplate.

.2 Piping:

10.2.1 Requirement:

Each and every piping system shall be identified by means of colored, waterproof, all temperature, self-adhering labels, complete with directional flow arrows. Letters shall be 3/4" high and labels shall be placed near each valve, each branch connection and whenever piping emerges or disappears from view (when viewed from the floor of the space in which it is installed) and labels shall be placed not more than twenty (2O') feet apart on all horizontal piping systems above ceilings.

10.2.2 Color Code:

Color code and identifying descriptions for labeling piping systems shall be as follows:

10.2.2.1	Fire Protection System	Red
.2	120°F. Hot Water Supply	Orange
.3	140°F Hot Water Supply	Yellow
.4	Cold Water-General Use	Gray or Black
.5	Cold Water-Conditioned	Aluminum
.6	Condensate Drain Piping	Green

10.2.3 Letter Code:

Letter Codes for piping system nameplates shall be as follows:

10.2.3.1	Fire Protection	"F"
.2	l20°F Hot Water Supply	"H"
.3	180°F Hot Water Supply	”180 FHW”
.4	Cold Water-General Use	”P"
.5	Cold Water-Conditioned	"C"
.6	Condensate Drain Piping	"D"

10.2.3.2 Alternate:

Piping identification may be accomplished with neatly stenciled lettering, complying with above requirements.

10.3 Valves:

10.3.1 Charts

Furnish three (3) neatly typed valve charts which show the valve letter and number, the valve manufacturer and model number, the valve service and normal position (N.O.) or (N.C.), and the location where the valve may be found and three (3) reduced size photocopies of a blueline print of the system flow diagram on which the identical valve identification designations have been incorporated. One (1) reduced size photocopying of flow diagram shall be neatly framed in black wood frame under glass and screw mounted on wall of maintenance office. The other charts and diagrams shall be delivered to the Engineer for approval. Approval shall be received by the installing trade prior to mounting.

.2 Tags

All valves on each piping system with the exception of those normally found exposed in toilet rooms, shall be identified by color coding the valve handle and attaching a valve tag. Valve tags shall be at least 1-1/2" in diameter and of the same material as specified above for nameplates or brass with stamped black enamel filled letters and numbers. Letters shall be used on each tag to identify the valve. Each tag shall be securely fastened to the valve by means of a brass "S" hook. Color codes valve handles shall have the same color as their companion pipe labeling colors. Pipes shall be labeled with direction arrows at each valve.

11. FINAL INSPECTIONS

11.1 It shall be the duty of each trade to personally make a detailed and careful inspection trip of the entire project, assuring himself that his work on the project is ready for final acceptance prior to informing the General Contractor of same.

END OF SECTION

SECTION 22 05 23 - VALVES

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. All work of this section including materials and workmanship shall be done in the strict accord with City of Phoenix Building Standards and Review Process Guidelines and all applicable city, county, state and national codes, ordinances and regulations, and in accord with all local utility company regulations.

B. Valves shall be utilized on main branches from Risers, at main taps from main horizontal runs. In taps to plumbing groups, at inlet and outlet of all equipment, on runouts to exterior hose bibbs and as needed to prevent shutdown of significant portions of the building for repairs, service or expansion.

1.2 QUALITY ASSURANCE

A. Valve Types: All valves shall be of the same manufacturer unless otherwise specified.

PART 2 DESIGN STANDARD

2.1 GENERAL

A. All valves shall be supplied with stamped brass identification tags supplied by the contractor. All valve ports shall be full size same size as connected piping. Install valves on all hot and cold branch lines. Provide access panel at valves locations.

2.2 DOMESTIC HOT AND COLD WATER SERVICE

A. Valves 2" and Smaller:

1. Ball Valves: Valves shall be rated 150 PSI SWP and 600 PSI non-shock WOG and will have two-piece cast bronze bodies, TFE seats, full port, separate packnut with adjustable stem packing, anti-blowout stems, 316 stainless steel trim and 316 stainless steel ball. Valve ends shall have full depth ANSI threads or extended solder connections and be manufactured to comply with MSS-SP110.

a. Acceptable Valves, Full Port: NIBCO T-585-70-66 or Hammond 8901/8503/8301 (threaded); NIBCO S-585-70-66 or Hammond 8911/8513/8311 (solder).

b. NOTE: Where piping is insulated, ball valves shall be equipped with 2" extended handles of non-thermal conductive material. Also, provide a protective sleeve that allows operation of the valve without breaking the vapor seal or disturbing the insulation. Memory stops, which are fully adjustable after insulation is applied, shall be included.

B. Valves 2-1/2" and Larger:

1. Gate Valves: Valves to be Class 125, malleable iron hand wheel, rising stem, flanged, bolted bonnet, OS&Y, bronze body, bronze trimmed, with body and bonnet conforming to ASTM standards. Packing and gaskets to be non-asbestos.

C. Check Valves:

1. Check valves 2-1/2" and smaller shall be Y-pattern swing-type manufactured in accordance with MSS-SP80, Class 125, bronze ASTM B-62 body with TFE seat disc. Where higher operating pressures approach 150 PSI, Class 150 valves of like construction shall be used. Valve ends may be threaded or solder-type.

   a. Acceptable Valves - Horizontal Installation:

      1) Class 125: NIBCO T-413-Y or Hammond IB904 (threaded); NIBCO S-413-Y or Hammond IB912 (solder).

      2) Class 150: NIBCO T-433-Y or Hammond IB946 (threaded); NIBCO S-433-Y or Hammond IB945 (solder).

   b. Acceptable Valves - Vertical and Horizontal Installation:

      1) Class 125: NIBCO T-480-Y or Hammond 943 (threaded).

2. Check valves 2-1/2" and larger shall either be swing-type, Class 125, flanged bronze body with bronze trim, non-asbestos gasket, or wafer style with stainless steel spring, bronze disc plates, rubber seat, body of bronze for use with Class 125/150 flanges. Spring-actuated valve to be used on pump discharge. Wing check with outside lever and spring to be used on storm drain lines. Sump pump and sewage ejector discharge shall be ball or swing type check valve.

   a. Acceptable Valve Manufacturers:

      1) NIBCO or Hammond

D. Valve Actuators:

1. On valves specified to be provided with actuators furnish compact electric actuators, 115VAC.

END OF SECTION

SECTION 22 05 49 - **PLUMBING & ELECTRICAL INSTALLATION COORDINATION**

PART 1 - GENERAL

1.1 REQUIREMENTS

A. Conform with applicable provisions of the General Conditions, Supplementary Conditions and General Requirements.

1.2 RELATED DIVISIONS AND SECTIONS

A. See Section 22 05 00, for Common Work Results for Plumbing.
B. See Division 26, for Electrical.
C. See Division 28, for building fire alarm.

1.3 SCOPE

A. It is the intention of this section to summarize the coordination of effort defined in the related sections and divisions of this specification.

B. If there is a conflict between this Section and other Sections and Divisions of this specification, this Section shall be the governing and decisive Section.

C. Make all connections to motors and controls for equipment supplied and/or installed under Division 15 according to Table 1 on the following page.

PART 2 - PRODUCTS

A. Not Applicable

PART 3 - EXECUTION

A. INSTALLATION

1. No work shall be performed until the reviewed and marked submittal data have been reissued to the Contractor, unless written permission is obtained from the Architect.

TABLE 1

Item or System	Note	Supplied By (3)	Installed By (3)	Powered By	Control Field Wiring By
Equipment Motors		Div. 22	Div. 22	Div. 26	N/A
Motor Control Center Including Starters, Pilot Lights, Heater, Switches, Auxiliary Contacts, and Internal Control Wiring		Div. 26	Div. 26	Div. 26	Div.23
Stand Alone Motor Starters (outside motor control centers)	(1)	Div. 26	Div. 26	Div. 26	Div. 23
Variable Frequency Drives (VFD's)		Div. 22	Div. 22	Div. 26	Div. 23
Fused and Non-Fused Disconnects	(1)	Div. 26	Div. 26	Div. 26	N/A
Control Relays & Control Transformers	(1)	Div. 22	Div. 22	Div. 26	Div. 23
Boilers & Domestic Water Heaters		Div. 22	Div. 22	Div. 26	Div. 23
Pressure Booster Pump Systems		Div. 22	Div. 22	Div. 26	Div. 23
Water Softeners & Other Process Water Equipment		Div. 22	Div. 22	Div. 22	N/A
Facility Management System (FMS) for Automatic Control and/or Monitoring of Plumbing System & Equipment	(2)	Div. 23	Div. 23	Div. 26	Div. 23
Medical Gas System - Alarm Panels, Sensors, Pressure Switches	(3)	Div. 22	Div. 22	Div. 26	Div. 22

TABLE NOTES:

1. Unless specified to be supplied with the equipment

2. Division 26 shall coordinate with Division 23, FMS Contractor as required to provide 120 VAC power to each mechanical space and the central plant as necessary for the FMS and as shown on the drawings. Any additional power, transformers, and distribution shall be provided by the Section or Division indicated.

3. Division 22 indicates the plumbing contractor or their designated representative including equipment suppliers, sub-contractors, etc.

END OF SECTION

SECTION 22 10 00 - PIPING SYSTEM

PART I - GENERAL

1.1 SCOPE OF WORK

1.1.1 Furnish all labor, materials, services, equipment, and appliances required for piping system work indicated on the drawings and specified and City of Phoenix Building Standards and Review Process Guidelines.

1.2 WORK INCLUDED, BUT NOT INCLUSIVE

1.2.1 Complete potable hot and cold water, sanitary, soil, waste and vent and roof drain piping systems.

.2 All condensate piping from AC units and kitchen equipment to the drain points shown in the drawings.

.3 Installation and connection of equipment furnished by other trades, or the Owner, where indicated on the plans and by the specifications.

1.3 DESIGN AND FABRICATION

1.3.1 All work shall be performed in strict accord with governing codes, as minimum requirements. Should any requirements of the plans and specifications for materials and installation be less than the requirements of the governing codes, the codes shall govern. All costs for conforming to codes shall be part of the base bid. Should drawings and specifications exceed code requirements, then the drawings and specifications shall govern.

1.4 REFERENCE STANDARDS

1.4.1 "Industry Standards" as specified in SECTION 22 05 00.

1.5 TESTING

1.5.1 Perform all test required by governing codes, regulations and ordinances in compete compliance with most stringent requirements.

PART II – PRODUCTS

2.1 Potable Water Piping System

2.1.1 Above Grade Piping

2.1.2.1 Type "L" hard drawn copper tubing, ASTM B88.

.2 Fittings

Wrought copper, sweat solder-joint type.

.3 Fittings - Option:

Soldered wrought copper tee fittings.

.4 Ferrules and Nipples

Best quality red brass.

.5 Fixture and Equipment Connections

Red brass nipples, chrome-plated where exposed to view in finished areas, except Mechanical Rooms, screwed into copper IPS adaptor fittings. Ferrous piping of any kind shall not be used in the various water systems.

.3 Shock Absorbers:

Josam "Absorbotron", Watts, or approval equal.

.4 Valves

Crane, Nibco, Walworth or approved equal, chrome plated Brasscraft at fixtures, full size unless otherwise noted. Ends match pipe jointing.

.5 Solder and Flux

Lead-free “Silvabrite” or Silfos solder or approved equal and suitable non-corrosive flux paste.

2.2 Sanitary Drainage System

2.2.1 Piping and Fittings

See section 22 13 16.

2.5 EQUIPMENT DRAIN AND CONDENSATE DRAIN PIPING SYSTEM

2.5.1 Piping

Type "DWV", copper tubing. Insulate copper tubing and p trap for 10’ from cooling coil connections.

.2 Fittings

Wrought copper, sweat solder-joint type.

.3 Solder

95/5 tin-antimony.

2.8 Plumbing Fixtures

2.8.1 Shall be per Plumbing Fixture Schedule on plans. Equal equipment by other manufacturers may be permissible substitutes with approval of submittals.

PART III – EXECUTION

3.1 GENERAL

3.1.1 Routing and Distribution

Install the various piping systems as shown and/or specified, adhering to the general routing and methods of distribution shown on the drawings. The various installing trades shall familiarize themselves with all the Owner-furnished items in order that proper connections can be made to such items. Include all items as may be required for the satisfactory operation of the various systems.

.2 Workmanship

Install all work in neat and workmanlike manner, employing only mechanics skilled in each respective trade.

.3 Running and Grouping Pipe:

Run piping parallel with or perpendicular to building lines and wherever possible, group together for ease of service and identification. Lines which require definite grade for draining shall take precedence in routing over all other lines. Wherever possible, hold horizontal and vertical lines close as possible to walls, ceilings, struts, members, etc., so as to occupy minimum space, consistent with the proper requirements for insulation, expansion, removal of pipe and access to valves, etc. Concealed work shall finish off within the limit permitted by the vertical or horizontal chases.

.4 Vibration

Connections to rotating equipment shall be made in such a manner as to prevent transmission of vibration into the piping system.

.5 Reaming:

All pipe shall be properly reamed after cutting and threading and shall be cleaned before installation.

.6 Nipples:

Nipples shall be of the same material and composition as the pipe on which they are installed and shall be extra heavy when unthreaded shoulder is less than one (1) inch. No running thread nipples will be permitted.

3.2 Potable Water Piping Systems

3.2.1 General

Various hot and cold water supply running to the various risers, items of equipment and fixtures shall be made up as shown on the drawings. All connections on hot water lines shall be made with adequate provisions for expansion. The line shall be free of traps and shall drain completely by gravity.

.3 Jointing

All piping joints shall be made with solder type fittings. Clean ends of pipe thoroughly inside and out and remove all burrs before soldering. "Sweat" solder joints as recommended by the manufacturer of the tubing and fittings. Surfaces to be soldered shall be cleaned bright. Heat copper tubing larger than 1" with ring torch. Wrap copper tubing with electrical tape whenever tubing touches a dissimilar metal. The use of joints below concrete slab will not be permitted.

.4 Mechanically Formed Copper Connection:

Shall not be allowed

.5 Valves

Valves shall be placed in all main hot and cold water lines as indicted on the drawings and at each branch take-off from the main or elsewhere as required.

.6 Shock Absorbers

Provide shock absorbers on both cold and hot-water supply at each group of fixtures and where quick-acting shut-off valves are used. Shock absorbers shall be located and of the size recommended by the PDI Standard WH-201. Install all shock absorbers above the ceiling.

.7 Pressure

Piping is sized with a pressure of up to 80 psi at the main. Should pressure exceed this, then a pressure reducing valve should be installed at no additional cost to reduce the pressure to maximum of 78 psi.

3.3 SANITARY DRAINAGE SYSTEM

3.3.1 General

Install a complete soil, waste and vent system for all water closets, urinals, lavatories sinks, floor drains, etc., as shown on the drawings and/or as hereinunder specified. Waste and vent piping to fixtures shall be sized as shown on the drawings and in case of location changes, shall be so arranged as to give proper

changes, shall be so arranged as to give proper drainage and venting for each fixture.

.2 Jointing

3.3.2.1 General

.1 Threaded Pipe

Threads use in the assembly of pipe shall conform to ASA dimensional standards B2 and shall be cut true and clean. Pipe ends shall be securely squared and reamed to remove all burrs and made tight with an approved pipe lubricant applied to the male threads only.

.3 Traps

Equip fixtures and each piece of equipment requiring connection to the sanitary drainage system, except fixtures with integral traps, with a trap. Each trap shall be placed as near to the fixture as possible and no fixture shall be double-trapped.

.4 Vents

Provide each vent with an extension piece extending the vent above the roof to the top of the parapet when one exists. Vents shall be properly flashed as detailed on the drawings.

.5 Cleanouts

Provide soil, waste, condensate, and vent piping with cleanouts to make all sections of the system accessible. Install cleanouts on 50 ft. centers and at ends of mains and at points of change in directions of all drains, soil and waster pipe and branches and at the base of each main stack, other points indicated on the plans or where required by governing codes. Cleanouts, except trap and fittings, shall be of same size as pipe up to 4" and 4" for all larger pipe. Should piping installation and building construction conflict so as to prohibit the use of the flush type cleanouts called for, secure the Architect's approval of another type of cleanout. Cleanouts in sanitary mains outside of building shall be a maximum of 50 ft. on center for straight runs.

3.9 KITCHEN PIPING

3.9.1 Rough-In and Connections:

Make all rough-in and final connections to all equipment.

.2 Waste Pipe:

Provide waste pipe as shown on the drawings and in accordance with the section on sanitary drainage system as previously described.

3.10 ISOLATING COUPLINGS

3.10.1 Furnish and install approved isolating couplings at all connections between brass or copper pipe and steel pipe.

3.11 VALVES

3.11.1 Furnish and install valves and cocks where shown on the drawings or as necessary to make all the systems complete, including but not limited to the following.

.2 Valves at inlet and outlet connections of all equipment as close to equipment as possible.

.3 Valves at all by-passes.

.4 Hose end, drain valves at low points in systems to drain all piping systems.

.5 Install valves in a manner consistent with the best workmanship practices, neat in appearance and grouped so that all parts are easily accessible through a minimum of access doors.

.6 All valves shall be installed in accessible locations and pipe shall be so arranged that control valves can be operated through access panels which are furnished and installed by the Contractor.

.7 Set tops of all valve boxes flush with finished grade. Furnish and install suitable box with l2" washed pea gravel.

3.13 EQUIPMENT LEVELING, HANGERS AND SUPPORTS

3.13.1 General:

Each piece of equipment set in place under this Division shall be installed true and level.

.2 Piping

3.13.2.1 General

Pipes throughout the building, both horizontal and vertical, shall be supported with riser clamps sized to fit and adequately support their weight. At the bases of all pipes 4" in size and larger and elsewhere as shown and/or where required for proper support, furnish and install anchor base fittings. Piping systems shall be completely self-supporting without stress to any piece of equipment.

.2 Hanger Shields

Hangers for piping shall be placed around the outside of the insulation and protective shields shall be installed at every hanger location. Shield shall not less than 2/3 the circumference of the insulation and where speed clips are used, the metal shield shall be continuous around the circumference of the pipe insulation. Shields shall be fabricated of the following gauges:

Nominal Pipe Size Metal Gauge

0" - 1-1/2"	20
2" - 3"	16
3-1/2" and up	14

.3 Hanger Spacing

Hangers shall be spaces so as to properly support piping; cast iron pipes and 1/2" copper tubing shall be supported on hangers not more than 5'-0" on centers; hangers for all other copper or steel pipe shall be spaced according to the following schedules:

Pipe Size	Hanger Spacing	Rod Sizes
0 - 1-1/2"	* 7'-0"	1/2"
2" - 3"	*10'-0"	5/8"
4" and up	*12"-0"	3/4"

*Any horizontal run must have a minimum of one (1) hanger.

.4 Coordination with Electrical

The intent of the above ceiling supports is to combine as many pipes, conduit, etc., as is possible within safe structural limits, on each horizontal section of a trapeze hanger. Prior to selecting the horizontal member, all trades, Mechanical and Electrical, shall coordinate actual number of pipes, conduit, etc., such that final selection results in a neatly grouped, disciplined and accessible installation.

3.14 FLOOR, CEILING AND WALL ESCUTCHEONS

3.14.1 Furnish and install chromium plated section escutcheon on each pipe or hanger rod penetrating a wall or ceiling. Escutcheons shall be sized to fit snugly to all lines. Set crews shall be used where needed so that they fit snugly against the finished surface.

3.l5 CLEAN-UP

3.15.1 Upon completion of the work of this section, remove all debris relating to the conduct of this portion of the work form the premises.

END OF SECTION

SECTION 221113 - FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes water-distribution piping and related components outside the building for potable domestic water service and fire service.

B. All work and materials in this specification must meet the guidelines and rules of the City of Phoenix Water Service Department; “Design Standards Manual for Water and Wastewater Systems”, dated 2017.

1.2 ACTION SUBMITTALS

A. Product Data and Shop Drawings approved by the contractor: For each type of product indicated or to be used in the installation of all water lines.

B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

B. Final inspection and approval by City of Phoenix water Service Department.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Comply with ASTM F645 for selection, design, and installation of thermoplastic water piping.

D. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

F. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:

1. Notify Architect, Governing agency, and owner no fewer than 10 days in advance of proposed interruption of service.
2. Do not proceed with interruption of water-distribution service without written permission by all parties.

1.6 COORDINATION

A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

All materials shall meet the requirements of the City of Phoenix Water Service Department; “Design Standards Manual for Water and Wastewater Systems”, dated 2017.

2.1 WATER METERS

A. Water meters will be furnished by utility company.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Flanges, unions, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

3.3 FIELD QUALITY CONTROL

A. Piping Tests: Conduct all testing per government agency standards.

B. Prepare reports of testing activities.

3.4 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping.

END OF SECTION 221113

22 13 16 - SANITARY WASTE AND VENT SYSTEM

PART 1 GENERAL

1.1 SCOPE

A. All work of this section including materials and workmanship shall be done in the strict accord with City of Phoenix Building Standards and Review Process Guidelines and all applicable city, county, state and national codes, ordinances and regulations, and in accord with all local utility company regulations.

B. All waste and vent pipe shall be solid core PVC schedule 40 pipe. Pipe routed in air plenum areas shall be no-hub cast iron marked DWV or where noted on plans. Use approved pattern drainage type cast iron fittings on all waste and vent piping.

PART 2 DESIGN STANDARD

2.1 CI PIPING

No-hub cast iron, shall conform to CISPI #301-04a and ASTM A-888-04a. CI piping shall be marked with collective trademark of the Cast Iron Soil Pipe Institute. Offshore pipe is not acceptable. All pipe shall be manufactured in the USA.

2.2 CI FITTINGS

A. No-hub cast iron drainage pattern fittings, conforming to CISPI #301-04a. Fittings shall be marked with collective trademark of the Cast Iron Soil Pipe Institute. All fittings shall be manufactured in the USA.

B. Threaded cast iron fittings conforming to ANSI B16.4.

C. Threaded malleable iron fittings conforming to ANSI B16.3.

2.3 PIPE HANGERS AND SUPPORTS

A. Vertical and horizontal piping shall be supported per code and per manufacturer.

2.4 CI NEOPRENE GASKETS

A. Ty-Seal neoprene gasket conforming to ASTM C-5.

2.5 NO-HUB COUPLINGS FOR PIPE ABOVE GRADE

A. Stainless steel shield-clamp assembly with neoprene gasket conforming to CISPI 310. Screened stainless steel is not acceptable.

2.6 INSTALLATION

A. Pitch waste and drain lines at a uniform slope of 1/4" per foot minimum unless noted otherwise on the drawings.

B. Install wall cleanouts wherever possible for cleanout of stoppages.

C. Install cleanouts on waste lines at all change of directions, 100'-0" O.C. on straight runs and as required by local plumbing code. Make all cleanouts accessible by either being accessible within 6" of ceiling access panel, extended to floor or grade, or located in wall with removable plate. Provide 24” clearance all around cleanout.

END OF SECTION

SECTION 22 33 00 - DOMESTIC WATER HEATER

PART I – GENERAL

1.2 SCOPE OF WORK

1.1.1 Furnish all labor, materials, services, equipment and appliances required for conventional electric domestic water heater work specified herein. Refer to Plumbing Fixture Schedule.

1.2 WORK INCLUDED, BUT NOT INCLUSIVE

1.2.1 Water heaters.

.2 Temperature - pressure relieve valve and fittings.

1.3 REFERENCE PUBLICATIONS AND STANDARDS

1.3.1 Water heaters shall be manufactured and installed in accordance with local and state ordinances and shall be in compliance with the requirements of the Plumbing Code.

1.4 MANUFACTURER

1.4.1 The drawings were prepared and this specification written on the basis of using the products of a specific manufacturer.

1.5 WARRANTY

1.5.1 Water heaters shall carry a three (3) year tank warranty and one (1) year parts warranty from the date of Substantial Completion.

PART II - PRODUCTS

2.1 GENERAL

2.1.1 Water heaters shall be type vessels as scheduled and installed in accordance with the equipment's listing. The water heater storage and heating recovery capacities shall be as indicated on the drawings.

2.1.2 A listed expansion tank shall be provided and supported directly to structure to serve all tank type water heaters. Expansion tank shall be located on the cold water supply pipe.

2.1.3 Furnish a drain pan beneath tank type water heaters with dedicated drain routed per plans.

2.2 MATERIALS

2.2.1 Tank type water heaters to have ASME temperature and pressure relief valve; factory set high limit control, heavy fiberglass insulation. Water heater support shall be included if required per plans. A drain pan below unit with drain pipe to indirect waste such as floor sink or mop sink shall be provided with gap per code.

PART III - EXECUTION

3.1 INSTALLATION

3.1.1 Install water heaters as indicated by the drawings. The piping arrangement of the heaters shall be as schematically shown on the drawings.

3.2 RELIEF DRAINS

3.2.1 Provide each tank type water heater with a full-sized relief drain line, extending from safety relief valve to floor drain or approved location per plans.

3.3 CLEAN-UP

3.3.1 Upon completion of the work of this section, remove all debris relating to the conduct of this portion of the work from the premises.

END OF SECTION

SECTION 22 40 00 - PLUMBING FIXTURES

PART I - GENERAL

1.1 SCOPE OF WORK

1.1.1 Furnish all labor, materials, services, equipment and appliances required for plumbing fixture work specified herein. All work and materials shall conform to the specifications listed in the City of Phoenix Building Standards and Review Process Guidelines.

1.2 WORK INCLUDED, BUT NOT INCLUSIVE

1.2.1 All plumbing fixtures including seats and miscellaneous parts.

.2 Carriers and hangers.

.3 Flush valves, sink and lavatory trim, faucets, stops, etc.

.4 Traps, tailpieces, wastes, etc.

.5 Escutcheons and miscellaneous trim items.

1.3 MANUFACTURER

1.3.1 The drawings were prepared and this specification written on the basis of using the products and specifications on plans. It is not the intent to limit competitive bidding. Equivalent products with equal construction as manufactured by other manufacturers may be substituted provided submittals are accepted.

PART II - PRODUCTS

2.1 GENERAL

2.1.1 All fixtures shall be new, non-absorbent throughout and free from waves, kiln marks or discoloration. All exposed finished metal parts shall be chromium-plated, rough bodies parts shall be heavily nickel plated. All enameled ironware shall be acid resisting. All wall mounted water closet carriers shall be capable of withstanding a 500lb load and a letter of certification will accompany the submittal for approval.

2.2 MATERIALS

2.2.1 All materials shall be per specifications on plans. All plumbing equipment shall be per Plumbing Equipment Schedule on plans.

PART III - EXECUTION

3.1 PROTECTION

3.1.1 Protect all fixtures with not less than two (2) thicknesses of tough building paper, pasted on and fully covering all surfaces. All fixtures must be turned over to the Owner clean and free from defects.

3.2 INSTALLATION

3.2.1 Install all fixtures, trim, fittings, etc., in complete accordance with manufacturer's written specifications and recommendations for materials used. Connection to fixtures shall be per plans. Sizes are for short branches only; main line sizes are as indicated on the drawings.

3.3 SHUT-OFF VALVES

3.3.1 Provide and install shut-off valves at each fixture.

3.4 CLEAN-UP

3.4.1 Upon completion of the work of this section, remove all debris relating to the conduct of this portion of the work from the premises.

END OF SECTION

SECTION 23 05 00 - HVAC GENERAL REQUIREMENTS

1. SPECIAL NOTICE

1.1 The Architectural Plans and Specifications, including the GENERAL CONDITIONS, SUPPLEMENTAL GENERAL CONDITIONS, SPECIAL CONDITIONS, including all supplements issued thereto, INSTRUCTIONS TO BIDDERS and other pertinent documents issued by the Architect are a part of these Specifications and the accompanying Mechanical Drawings.

2. CODES, ORDINANCES AND REGULATIONS

2.1 All work of this section including materials and workmanship shall be done in the strict accord with all applicable city, county, state and national codes, ordinances and regulations, and in accord with all local utility company regulations.

3. INDUSTRY STANDARDS

3.1 The following industry standards shall apply, as applicable to the work of this section except that where the requirements of these specifications are more stringent than standards listed, these specifications shall take precedence.

3.1.1
- .1 AMCA Air Moving and Conditioning Association
- .2 ANSI American National Standards Institute
- .3 ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers
- .4 ASME American Society of Mechanical Engineers
- .5 ASTM American Society of Testing Materials
- .7 NEC National Electrical Code
- .8 NEMA National Electrical Manufacturer's Associations
- .9 NFPA National Fire Protection Association
- .10 OSHA Occupational Safety and Health Administration
- .11 UL Underwriters' Laboratories
- .12 SMACNA Sheet Metal and Air Conditioning Contractors National Association, Inc.

4. SHOP DRAWINGS

4.1 Shop drawings submittals are required under this Division for the following:

4.1.1 HVAC Units Including: Packaged Units, Air Handlers, Heat Pumps, Split system units, VRF Systems, Electric Heaters, Exhaust Fans, and Relief Fans.
- .2 Valves and Miscellaneous Accessories
- .3 Dampers, Damper Regulators, Damper Actuators
- .4 Grilles, Registers and Diffusers
- .5 Insulation for Ducts and Piping
- .6 HVAC Temperature Control

4.1.2 Submittal Process Specification:

Prior to ordering equipment, submittals reviewed by the engineer are required for all items listed on the mechanical schedules, and as follows:

All submittals and re-submittals: shall use the following format or shall be returned for corrections until formatted as follows:

1. Submitted as a single electronic pdf file identified as a first submittal, or as revised submittal with the corresponding submittal number identified as "resubmittal #"; beginning with "resubmittal 1" and continuing with sequential numbering on any resubmittals.
2. All equipment on the mechanical schedules shall be submitted combined into a single pdf file (partial submittals will be returned).
3. Submittal product data shall be labeled in red boldface text in the top right hand corner of the first page with the equipment identification tag as labeled on plan schedules (unidentified cut sheets and product data will be returned).
4. Required options listed on the construction document schedules shall be clearly identified with each option on the submittal marked with a red box, circle, check, or other similar conspicuous indication that the submitted device's options match the plan schedule notes (generic equipment data that has unidentified options will be returned).
5. Contractor / supplier submittal is a presentation to the engineer that the equipment submitted is equivalent to that specified on the construction documents. Equipment substitutions which include or require deviations from the construction document's requirements shall be clearly identified by the contractor / supplier directly on the first page of the cut sheet with a clear explanation of the reason(s) for non-compliance or equivalence with equipment schedules. Failure of substituted equipment to perform to the level specified in the equipment schedule may require replacement of substituted equipment if deviations are not clearly identified.
6. All resubmittals of equipment or materials previously rejected by the engineer shall be resubmitted as a single electronic pdf file. All resubmittals shall include cut sheets of only the items that have been returned / rejected by the engineer on the first submittal (complete resubmittals of all project equipment will be returned to be reduced down to resubmittal items only).
7. All resubmittals shall include cut sheet and product data updates to show conformance to construction document requirements and as indicated and required by the engineer in the previous submittal reviews.
8. On all resubmittals clearly identify any changes made other than those requested by the engineer in the previously returned/rejected submittal. Provide a statement explaining any changes which were not prompted by the engineer's previous review.

5. MATERIALS

5.1 Requirements:

All materials shall be new and of the quality specified, free from defects at the time of installation. Materials or equipment damaged in shipment or otherwise damaged prior to installation shall not be repaired at the jobsite, but shall be replaced with new materials.

6. SPACE AND EQUIPMENT ARRANGEMENT AND ACCESS

6.1 Size and Fit:

The size of mechanical and plumbing equipment shown on the drawings is based on the dimensions of a particular manufacturer (the first named). While other manufacturers may be acceptable, it is the responsibility of each trade to determine if the equipment that is proposed to be furnish will fit the allotted space and to obtain prior approval from owner of such substituted equipment prior to ordering.

6.2 Service Access:

All equipment shall be installed in a manner to permit access to all surfaces as required by the manufacturer. All valves, motors, drives, lubrication devices, filters and other accessory items shall be installed in a position to allow removal for service without disassembly of another part. This requirement includes equipment installed above ceilings.

7. CONSTRUCTION REQUIREMENTS

7.1 General:

All trades shall be responsible for fitting the material and apparatus into the building and shall carefully layout work at the site to conform to the structural conditions, to provide proper grading of condensate and refrigerant lines, to avoid all obstructions and to conform to the details of the installation supplied by the manufacturer of the equipment to be installed and thereby provide an integrated, satisfactory operating installation, furnishing all necessary pilot lines and control lines. Refrigerant piping plan shall be provided to manufacturer for approval prior to installation to assure the manufacturer's Warrantee for split systems are not voided by an improper installation.

7.2 Piping and Ductwork:

In general, piping and ductwork shall be run concealed in chases, furrings and above suspended ceilings, unless noted and directed otherwise on plans. All pipe and ductwork shall be square to the building and securely supported. Runs of piping shall be grouped wherever it is feasible to do so, to include grouping with all Mechanical, Plumbing, Fire and Electrical Trades. Ductwork and piping shown on plans are schematic only and do not specify all turns, offsets or other fittings which will be necessary in the construction of this project. Contractor shall not charge owner, engineer, architect or others for such fittings or offsets and shall visit site prior to construction to include such items in contractor's fee. Contractor shall coordinate with other trades prior to construction to agree to routing of all improvements with consideration given to the Architect's intended ceiling height. Contractor shall adjust ducts, piping, etc as required to provide required clearance for building structure, ceiling height as specified by architect, and other field conditions.

7.3 OWNER FURNISHED ITEMS

Affected trades shall familiarize themselves with all the Owner Furnished items and make proper connection to such items. Contractor shall request of Owner or Architect manufacturer's cut sheets specifying the connection locations and sizes as necessary to assure a complete and properly functioning installation of Owner Furnished items.

8. ELECTRICAL WIRING OF MOTORS AND EQUIPMENT

8.1 Power and Control Wiring:
Except for such items that are normally wired at their point of manufacture and so delivered and unless specifically noted to the contrary herein, all electric wiring for power is part of the work of DIVISION 26. Connection of power to air conditioning units, fans, motorized dampers, and duct smoke detectors shall be the work of DIVISION 23.

8.2 Controls Installation:
Installation of all automatic controls, temperature controls, temperature indication and all interconnecting conduit, wiring, and junction boxes for the installation of the HVAC, fans, duct smoke detectors, motorized dampers, and exhaust controls systems including interlocks as specified on the mechanical plans shall be part of the work of DIVISION 23.

If plans show specific details of controls hardware or interlocks on electrical plans, such control conduit will only then be the responsibility of DIVISION 26.

9. IDENTIFICATION

9.1 Equipment Nameplates:

All HVAC equipment, exhaust fans, relief fans, all control devices, motor starters, condensing units etc., shall be identified by the attachment of 3/4" high nameplates, constructed from laminated, phenolic, engraved plastic, 3-ply with black surface and white interior core, at least 1/l6" thick. Letters and numbers shall be used for actual identification and shall be identical to designations used on the Contract Drawings. Engraved letters and numbers shall be 1/2" high, upper case, condensed Gothic. Nameplates shall be permanently attached to equipment/devices by chromium-plated screws. Unit number per plans and space served by the unit shall be stated on nameplate.

9.2 Piping:

9.2.1 Requirement:

Each and every piping system shall be identified by means of colored, waterproof, all temperature, self-adhering labels, complete with directional flow arrows. Letters shall be 3/4" high and labels shall be placed near each valve, each branch connection and whenever piping emerges or disappears from view (when viewed from the floor of the space in which it is installed) and labels shall be placed not more than twenty (2O') feet apart on all horizontal piping systems above ceilings.

9.2.2 Color Code:

Color code and identifying descriptions for labeling piping systems shall be as follows:

10.2.2.1	Condensate Drain Piping	Green
.2	Refrigerant Suction	Blue
.3	Refrigerant Liquid	Blue

9.2.3 Letter Code:

Letter Codes for piping system nameplates shall be as follows:

9.2.3.1	Condensate Drain Piping	"D"
.2	Refrigerant Suction	"S"
.3	Refrigerant Liquid	"L"

.4 Alternate:
Piping identification may be accomplished with neatly stenciled lettering, complying with above requirements.

10.3 Valves:

10.3.1 Tags

All valves on each piping system shall be identified by color coding the valve handle and attaching a valve tag. Valve tags shall be at least 1-1/2" in diameter and of the same material as specified above for nameplates or

brass with stamped black enamel filled letters and numbers. Letters shall be used on each tag to identify the valve. Each tag shall be securely fastened to the valve by means of a brass "S" hook. Color codes valve handles shall have the same color as their companion pipe labeling colors. Pipes shall be labeled with direction arrows at each valve.

11. FINAL INSPECTIONS

11.1 It shall be the duty of each trade to personally make a detailed and careful inspection trip of the entire project, assuring himself that his work on the project is ready for final acceptance prior to informing the General Contractor of same.

END OF SECTION

MECHANICAL ACCESSIBILITY / CLEARANCE CHECKLIST									
			Acceptable Access					Observer	
Bldg.	Location	Unit #	Yes	No	Conflict	Date	Action	Owner	Contractor

SECTION 23 05 29 - HANGERS AND SUPPORTS

PART 1 GENERAL

1.1 SUMMARY

A. This section includes hangers and supports for piping systems and equipment.

B. Size all hangers on insulated piping to fit outside covering.

C. All hangers, rods, and fastener materials shall be galvanized or stainless steel.

D. Hanger Rod Sizes:

Pipe Size	Rod Diameter (Inches)
2" and smaller	3/8
2-1/2" and 3"	1/2
4" and 5"	5/8
6"	3/4
8" through 14"	7/8

E. Hanger Rod Spacing (Horizontal Piping):

Pipe	Max. Hanger Spacing (Ft. O.C.)
Steel pipe 3/4" and smaller	6
Steel pipe 1"	8
Steel pipe 1-1/4" through 12"	10
Steel pipe 14" and larger	12
Copper tubing 1-1/4" and smaller	6
Copper tubing 1-1/2" and larger	8
Special piping materials	As recommended by manufacturer

PART 2 DESIGN STANDARD

2.1 HANGER AND SUPPORT INSTALLATION

A. Provide hangers at all offsets, tees, within 12" of all horizontal elbows, and elsewhere as herein described.

B. Sleeve and seal air and watertight all piping passing through exterior walls, through plenum or fire walls above ceilings. All sealers shall be waterproof and fireproof.

C. Insulated Piping: Comply with the following:

1. Thermal-hanger shield inserts shall be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.

2. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

   b. NPS 4: 12 inches long and 0.06 inch thick.

SECTION 23 05 93 - HVAC SYSTEM TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL

1.1 QUALIFICATIONS

A. Agency Qualifications: The independent TAB Agency shall be a current member of the Associated Air Balance Council (AABC) or a National Environmental Balancing Bureau (NEBB) certified contractor.

PART 2 DESIGN STANDARD

2.1 GENERAL

A. The specified systems shall be reviewed and inspected for conformance to design documents. Testing, adjusting and balancing on each identified system shall be performed. The accuracy of measurements shall be in accordance with AABC or NEBB National Standards. Adjustment tolerances shall be within 10% unless otherwise stated.

B. Equipment settings, including manual damper quadrant positions, manual valve indicators, fan speed controls, motorized dampers, and similar controls and devices, shall be marked to show final settings.

C. Submit TAB trade subcontractor's qualifications and equipment certifications prior to awarding contract to TAB. Owner reserves the right to review and require updating or request alternate TAB contractors should qualifications or equipment be found insufficient in the owner's sole discretion.

D. Submit a TAB plan including project specific TAB procedures, forms, and drawings to be used. TAB plan and procedures shall be performed per AABC or NEBB standard protocols.

E. Submit the TAB Preliminary Field Reports to the Engineer for review and approval prior to the Final Report.

2.2 ADDITIONAL TAB AGENCY SERVICES

A. The TAB Agency shall provide the following additional services:

1. Fire and Smoke Testing: The TAB Agency shall test fire/smoke dampers to assure operation, and verify that an access door has been installed for each fire and smoke damper.

2. Life Safety Controls: The TAB Agency shall test and record life safety control operation on the HVAC equipment. The Agency shall verify the installation of required smoke detectors in air handling equipment (AHE), and shall verify operation of the smoke detector by activating the smoke detector and observing air handler shutdown.

END OF SECTION

SECTION 23 08 39 - AIR HANDLING AND AIR DISTRIBUTION SPECIALTIES

PART 1 GENERAL

1.1 SUMMARY

A. Furnish and install all air outlets, dampers, etc., as shown on the drawings and herein specified. Each unit must be designed for the service intended, of the size and capacities indicated and complete with all accessories as noted.

PART 2 DESIGN STANDARD

2.1 GRILLES, REGISTERS, DIFFUSERS

A. All grilles, registers, and diffusers in shall be all aluminum construction.
B. Ceiling Damper Operators: Provide a Young #315 or equal concealed damper operator for all dampers located in inaccessible locations. Provide cover plate at ceiling.

2.2 LOUVERS & ROOF VENTS

A. Furnish and install louvers and or roof vents as indicated on the drawing and herein specified. Louvers and roof vents shall be installed in accordance with the Manufacturer's instructions.

B. Construction:
1. Louvers shall be extruded aluminum construction, frame depth, drainable, expanded, flatted aluminum bird (exhaust and relief) or insect screen (intake) in removable frame on interior face and *equal to that specified on plans*. Finish as directed by the Architect. Provide free area guide with submittal.
2. Roof vents shall be low silhouette constructed of aluminum, internal components may be galvanized. Exhaust and relief vents shall include an aluminum bird screen. Intake vents shall include an insect screen. Roof vents shall include flashing flange, pitched roof curb, curb seal, stainless steel mounting fasteners.

2.3 BACKDRAFT DAMPERS

A. Furnish and install counter-balanced backdraft dampers as indicated on the drawings and herein specified.

B. Construction: Dampers shall be aluminum with .090" thick channel frame and .025" thick blades with extruded vinyl edge seals. Linkage shall be aluminum concealed in the frame and bearings shall be nylon. Leakage shall not exceed 15 CFM per square foot at 1" WG. Damper shall be equal to *as specified on plans.*
C. Operation: Damper shall be capable to operate in the range of 0.01" w.g. to

0.05” w.g. over the entire range of airflow (0.01”w.g. start open to 0.05”w.g. full open *unless specified otherwise on plans*). Dampers that are not capable of operating within this range are not acceptable.

END OF SECTION

SECTION 23 30 00 - HVAC AIR DISTRIBUTION AND DUCTWORK

PART I - GENERAL

1.1 SCOPE OF WORK

1.1.1 Furnish all labor, materials, services, equipment, appliances required for air distribution and ductwork specified herein.

1.2 WORK INCLUDED, BUT NOT INCLUSIVE

1.2.1 All ductwork.

1.2.2 Grilles, registers and diffusers.

1.2.3 Dampers, etc.

1.3 DESIGN AND FABRICATION

1.3.1 Supply air distribution devices shall be designed, installed and adjusted to provide the throw and spread required with no apparent drafts or excessive air movements within the ventilation or air conditioned spaces. Any air distribution accessories required to effect these conditions shall be furnished and installed as a part of the supply unit.

1.3.2 Prepare shop drawings of all ductwork systems prior to installation. See mechanical plans for additional requirements.

1.4 REFERENCE PUBLICATION

1.4.1 All installation shall conform to the latest edition of the Sheet Metal and Air Conditioning Contractor's National Association Manual.

1.5 MANUFACTURER

1.5.1 The drawings were prepared and this specification written on the basis of using the products of specific manufacturers. It is not the intent to limit competitive bidding. Equal products by other manufacturers will be considered when submitted under the conditions outlined in the SUPPLEMENTAL GENERAL CONDITIONS.

PART II - PRODUCTS

2.1 DUCTWORK

2.1.1 Shall be per plans, International Mechanical Code, and SMACNA guidelines. Flexible ductwork shall only be used for branch ends where concealed above ceiling, see plans for maximum allowable length. Exposed ductwork shall be lock form quality steel. Round duct shall be spiral seam. Install ducts with protective plastic cover on duct ends to be removed after installation. Finished ductwork shall be free of oil marks, handprints, or other visual residues. Refer to plans for additional specifications

2.1.2 Lining and Insulation:

2.1.2.1 No Lining shall be installed on round duct on this project. Concealed round air conditioning duct shall be wrapped with foil backed insulation and seams shall be taped.

2.1.2.2 Rectangular return ducts shall be lined or wrapped in accordance with plans.

2.1.2.3.1 Ducts shall be cleaned following installation per ASHRAE or SMACNA recommended practice by a qualified duct cleaning specialist. A duct cleaning report shall be furnished to owner prior to turn over to Owner.

2.1.2.4 Finished Appearance Painting:
Following installation of duct branches, return and supply boots, and volume dampers but prior to the installation or grilles and diffusers, the interior ductwork, plenums, boots, and volume dampers visible through grilles and diffusers will be painted flat black with a direct to metal paint per Architect Requirements. Grilles, Registers, and Diffuser color and paint shall be as directed by the Architect.

2.2 DAMPERS

2 .2.1 Volume Dampers:
See Plan Schedule for Requirements.

2.2.2 Fire Dampers (Where Required):
As manufactured by Greenheck or equal and shall bear the UL label and shall be in accordance with the NFPA bulletin 90A and rated for service per plans.

2.2.3 Instrument Test Ports:
Young Regulator No. 1100 or Vent Fab No. 699 as manufactured by Vent Fabrics, Inc., Chicago, Illinois or approved equal.

2.3 AIR DISTRIBUTION DEVICES

2.3.1 Ceiling Diffusers:
Equal to Titus with neck size as indicated on plans.

2.3.2 Sidewall Supply Registers:
Equal to Titus with boot size to match duct connection per plans.

2.3.3 Return Grilles
Equal to Titus with boot to match return duct per plans.

2.3.4 Exhaust Registers:
Equal to Titus per plans.

PART III – EXECUTION

3.1 DUCTWORK

3.1.1 Locations and Conditions:
Erect all ductwork in the general locations shown on the drawings, but conform to all structural and finish conditions of the building. Before fabricating any ductwork, check the physical conditions at the jobsite and make all necessary changes in cross sections, offsets, etc., whether they are specifically indicated or not. All ductwork is shown as net inside dimensions. Where ductwork is specified on plans to be internally lined, that ductwork must be increased in size to accommodate the insulation.

3.1.2 Installation
Support all horizontal rectangular ducts up to and including 40" in their greater dimensions by means of a 360 degree encircling iron band hanger supported to structure by means of threaded rods. Support rectangular horizontal ducts larger than 40" in their greatest dimension by means of angle iron trapeze hangers. Each section of

duct shall have at least one pair of supports. Support round branch ducts 24" and smaller exposed to occupied areas with 3/8" treaded rods and fender washers on the interior of the duct. Support 26" and greater round ducts and all flat oval ducts from their flanges. All flat oval and round duct greater than 24" shall be flanged construction.

3.2 DAMPERS

3.2.1 Install dampers where shown on the drawings and whenever necessary for complete control of the air flow, including all supply and return branches, "division" in main supply and return ducts, each individual air supply outlet and fresh air ducts. Install fire dampers as required by plans and local and governing codes.

3.3 AIR DISTRIBUTION DEVICES

3.3.1 Install grilles, registers and diffusers as indicated on the Architectural Reflected Ceiling Plan for exact location. Sizes and types shall be indicated and scheduled on the Mechanical Drawings or specified herein.

3.4 ACCESS DOORS

3.4.1 Furnish and install in the ductwork, hinged across doors to provide access to all automatic dampers, etc. Access doors shall be secured by means of a sash lock. Installation to per SMACNA.

3.5 TURNING VANES

3.5.1 Where square elbows are shown or are required for good air flow, provide and install Airfoil Type or double thickness turning vanes per plan details.

3.6 FAN CONNECTORS

3.6.1 Install flange type expansion joint connector at intake to each exhaust fan conveying air. Installation shall be in accordance with fan manufacturer's installation instructions.

3.7 GENERAL

3.7.1 All holes in ducts for damper rods and other necessary devices shall be either drilled or machine punched, not pin punched, and shall not be any larger than necessary. All duct openings shall be provided with sheet metal caps if the openings are to be left unconnected for any length of time. All panels in un-insulated rectangular ducts l2" or larger shall be cross broken. Sheet metal screws shall not be used in duct construction except for round ducts. Installation shall be in accordance with the standards of the SMACNA Manual, latest edition.

3.8 CLEAN-UP

3.8.1 Upon completion of the work of this section, remove all debris relating to the conduct of this portion of the work from the premises.

END OF SECTION

SECTION 23 33 13 - FIRE DAMPERS AND COMBINATION FIRE SMOKE DAMPERS

PART 1 *GENERAL*

1.1 *SUMMARY*

A. Furnish and install combination fire and combination fire/smoke dampers where required by code.

B. Combination fire/smoke dampers shall have AIRFOIL blades meeting the requirements of UL Standards 555 (6th Edition).

PART 2 DESIGN STANDARD

2.1 FIRE/SMOKE DAMPERS

A.

1. Combination Fire Smoke Dampers Model: Greenheck FSD-312 Series combination fire/smoke dampers or approved equal.
2. Fire Dampers Model: Greenheck FD-150 or approved equal.

B. Ratings:

1. Fire Resistance:

a. Dampers shall have a UL 555 fire resistance rating of 1-1/2 hours.
b. Dampers shall have a leakage rating of Class I or II.
c. Dampers shall be rated to a minimum airflow velocity of 2,000 FPM.

C. Actuators:

1. Type:

a. Electric, 120V AC, two-position, fail close.
b. Provide with RL/OCI option / end switch for connection to and monitoring by the Building Automation System (BAS).

2. Mounting: External or internal if required.

3. All shall have external reset and test switches.

D. Source Quality Control:

1. Factory Tests: Factory cycle damper and actuator assemblies to assure proper operation.

END OF SECTION

SECTION 23 80 00 - HVAC EQUIPMENT

PART I - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, services, equipment and appliances required for heating, ventilating and air conditioning equipment work specified herein.

1.02 WORK INCLUDED, BUT NOT INCLUSIVE

A. Roof Top Packaged Heat Pump Units and ducts
B. Ground Mount Packaged Heat Pump Units and ducts
C. VRF Split System Heat Pump Units and ducts
D. Installation of new exhaust fans.
E. Inspection, testing and balancing of HVAC Systems.
F. Instrument test ports.

1.03 RELATED WORK

A. Temperature controls for HVAC equipment (City of Phoenix Approved Niagra Framework System, Space Sensors, and Switches). Reference HVAC CONTROLS as specified on plans and Appendix F of the COP Building Standards.

1.04 INSPECTION, TESTING AND BALANCING

A. General

Equipment shall be adjusted and all systems balanced to perform as specified and as required to give satisfactory operation to the complete satisfaction of the Architect. Balancing agency shall be certified by NEBB or AABC approved balancing agency. Agency shall be an Arizona licensed and based company.

B. Temperature Control:

Thermostat/zone sensors shall be programed, adjusted, and placed in operation by the installing trade per plan specifications.

C. Balancing Air Distribution Systems:

Balanced to air quantities indicated on the drawings. Air quantities at each grille or outlet shall be recorded. Instruments and procedure shall be in accord with the grille manufacturer's recommendations and as set forth in the latest edition of the Sheet Metal and Air Conditioning contractor's National Association Manual. Air balancing shall be performed on forms furnished by the Owner completed and approved by the Owner's representative before the system will be accepted.

D. Rotating Parts:

All systems shall be calibrated and all fans and other rotating parts shall be properly lubricated, checked for correct alignment, proper belt tensions, etc.

E. Reports and Records:

Prior to acceptance, submit written report stating that all safety devices have been checked and are operating properly; that all equipment has been installed, checked and is operating per the manufacturer's recommendations; that temperature controls have been calibrated, programmed,

and are operating properly. Submit record of air balance with report including all items listed on the air balance forms.

1.05 MANUFACTURER

The drawings were prepared and this specification written on the basis of using the products of specific manufacturers.

1.06 WARRANTY (HEATING/COOLING EQUIPMENT)

Minimum warranties are listed below. Refer to specific warranty requirements which may exceed those listed below.

A. Parts:

One (1) year warranty, including free labor for installing parts and one (1) year warranty on replacement of refrigerant, including labor, all from the date of Substantial Completion.

B. Refrigerant Circuit:

Manufacturer's full one (1) year warranty on refrigeration machine and Manufacturer's extended four (5) year warranty on the compressor, all from the date of Substantial Completion.

PART II - PRODUCTS

2.01 HEATING/COOLING UNITS

A. Requirements:

Units shall be packaged heat pumps or split system VRF heat pumps as specified on the plans complete with all necessary controls and dampers as specified on plans and specifications. Minimum efficiency and staging requirements for equipment shall be as scheduled on the plans.

All DX units shall be configured for use with R-410A refrigerants.

B. Units:

1. HVAC Equipment

Units as specified on plans.

2. Approved Alternate

Submit data to engineer for equal alternative manufacturers.

C. REFRIGERANT PIPING SYSTEM

Piping shall be Air Conditioning and Refrigeration Tube (ACR) or type "L", “HARD” copper tube. Fittings shall be wrought copper, sweat solder joint type centering with ANSI Bl622. Solder to be 95/5 Tin-Antimony or Silfos conforming with ASTM B32. Do not use soft bendable copper which can have excessive dips and sags and can trap oil, reduce equipment performance, and reduce equipment life. See manufacturer’s installation requirements and provide hard copper to suit. Where these specifications, or the manufacturer’s instructions have alternate requirements, the more stringent requirements shall apply.

D. Filters:

Furnish each unit with two sets of new MERV 8 pleated throw away filters which shall remain installed until after final clean and prior to test and balance and occupancy. After final clean and before test and balance and occupancy the temporary air filters shall be removed and replaced with new MERV 8 pleated filters.

2.02 EXHAUST FANS

A. Furnished by the Contractor and installed under this SECTION.

PART III - EXECUTION

3.01 COORDINATION AND INSTALLATION

A. REFRIGERANT PIPING SYSTEM: All refrigerant piping shall be sized and installed in strict accordance with the manufacturer's recommendations.

B. Exhaust Fans: Install all equipment in accordance with manufacturer’s instructions and connect to ductwork.

3.02 VIBRATION ISOLATION FOR EXHAUST FANS

A. Furnish, mount and install all equipment on approved vibration isolators which are appropriate to the type of installation.

B. Connections to rotating equipment shall be made in such a manner as to prevent transmission of vibration into duct and piping systems. Provide flex connections at unit inlet and outlet connections, see plans for specific requirements.

3.03 CLEAN-UP

A. Upon completion of the work of this section, remove from the premises all debris relating to the conduct of this portion of the work.

END OF SECTION

SECTION 26 05 10

GENERAL PROVISIONS

PART 1 GENERAL

1.1 SUMMARY

A. The drawings and specifications do not specify exact installation means and methods or Contractor safety procedures. Installation means and methods and safety procedures are, and shall remain, the responsibility of the Contractor. No instruction or statement made on the drawings, specifications, future addenda, or change orders shall be interpreted to shift this responsibility away from the Contractor.

B. These specifications contain statements which are more definitive or more restrictive than those contained in the General Conditions. Where these statements occur, they shall take precedence over the General Conditions. Where the word "provide" or "provision" is used, it shall be definitely interpreted as "furnishing and installing complete in operating condition." Where the words "as indicated" or "as shown" are used, they shall mean “as shown on contract drawings." Where items are specified in the singular, this Division shall provide the quantity as shown on the drawings, plus any spares or extras mentioned on drawings or in specifications. All specified and supplied equipment shall be new.

1.2 CODES, PERMITS AND FEES

A. Comply with all applicable laws, ordinances, rules, regulations, codes or rulings of governmental units having jurisdiction, as well as standards of the National Fire Protection Association and serving utility requirements.

B. Obtain and pay for permits, fees, inspections, meters, utility connections and extensions and the like associated with work in each section of this Division.

C. Installation procedures, methods, and conditions shall comply with the latest requirements of the Federal Occupational Safety and Health Act (OSHA).

1.3 STANDARDS

A. The following standard publications of the latest editions and supplements thereto shall form a part of these specifications. All electrical work shall, at a minimum, be in accordance with the applicable sections of these standards.

National Fire Protection Association Standards (NFPA).

Underwriters' Laboratories, Inc. (UL).

Certified Ballast Manufacturers Association (CBM).

National Electrical Manufacturers Association (NEMA).

Institute of Electrical and Electronic Engineers (IEEE).

American Society for Testing and Materials (ASTM).

National Board of Fire Underwriters (NBFU).

American National Standards Institute (ANSI).

National Electrical Testing Association (NETA).

Insulated Power Cable Engineers Association (IPCEA).

Maricopa Association of Governments Uniform Standard Specifications for Public Works Construction (MAG).

Electrical Testing Laboratories (ETL).

Local Building Codes.

1.4 WORK AND MATERIALS

A. All electrical materials and equipment shall be new and of the type and quality specified, and shall be listed by UL and bear their label where standards have been established, in compliance with the applicable standards of NEC (NFPA 70), NFPA, ANSI, IEEE, IPCEA and NEMA. Replace or repair any nonconforming, damaged, or defective items at no extra cost to the Owner.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Alcan Products Corporation; Alcan Cable Division.

2. Houston Wire and Cable
3. Belden Inc.
4. Encore Wire Corporation.

5. General Cable Technologies Corporation.
6. Southwire Incorporated.

C. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

D. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2, Type XHHW-2, Type UF, Type USE, and Type SO.

E. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for armored cable, Type AC, metal-clad cable, Type MC, mineral-insulated, metal-sheathed cable, Type MI, Type SO and Type USE with ground wire.

F. Metal-clad (MC) cable shall be steel corrugated interlocking type and shall include an equipment ground conductor, AFC, AmerCable, or as accepted. Metal-clad (MC) cable shall not be permitted to be used in this project unless indicated on the drawings or as noted in PART 3 of this Section. Non-metallic, residential wire (such as Romex) are not acceptable.

G. Mineral insulated cable shall be AmerCable, M.I. Cable Company (MICC), or as accepted.

H. Armor-clad (AC) cable shall not be permitted to be used in this project.

2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. AFC Cable Systems, Inc.
2. Gardner Bender.
3. Hubbell Power Systems, Inc.
4. Ideal Industries, Inc.
5. Ilsco; a branch of Bardes Corporation.
6. NSi Industries LLC.
7. O-Z/Gedney; a brand of the EGS Electrical Group.
8. 3M; Electrical Markets Division.
9. Tyco Electronics.

C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper for feeders rated smaller than 100A; copper or aluminum (where specifically indicated on plans) for feeders rated 100A and larger. Stranded for all sizes.

B. Branch Circuits: Copper. Solid for No. 14 AWG and smaller; stranded for No. 12 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW-2, single conductors in raceway.

B. Exposed Feeders: Type XHHW-2, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type XHHW-2, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

E. Feeders Installed below Raised Flooring: Type THHN-2-THWN-2, single conductors in raceway.

F. Feeders in Cable Tray: Type XHHW-2, single conductors larger than No. 1/0 AWG.

G. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-2-THWN-2, single conductors in raceway for #6 and smaller, type XHHW-2 for sizes #4 and larger.

H. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway for #6 and smaller, type XHHW-2 for sizes #4 and larger.

I. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway for #6 and smaller, type XHHW-2 for sizes #4 and larger.

J. Branch Circuits Installed below Raised Flooring: Type THHN-2-THWN-2, single conductors in raceway for #6 and smaller, type XHHW-2 for sizes #4 and larger.

K. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

Wire Pulling Lubricant: Richards "Gel Lube 7/5"; American Polywater A, C, G&J; Quelcor "Quelube"; American Colloid "Slip X-300"; Thomas/Jet Line "Slipry Loob"; Ideal "Wire Lube"; Mac "Wirepull"; Minerallac "Wire-Wax"; or Electro "Y-er Eas."

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables per NEC.

G. Complete cable tray systems installation prior to installing conductors and cables.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B. Record values in the field.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 **inches** of slack.

D. Terminations at Circuit Breakers and Switches:

1. #10 and #8 AWG wire, locking tongue lug, Buchanan "Termend," or as accepted.
2. #6 AWG and larger wire, round flange solderless lug, Burndy "Quick-Lug" type QDA, or as accepted.

E. Fixture Connections: Pressure-type solderless connectors, Buchanan, Scotchlok, Wing Nut, or accepted equal.

F. Motor Connections: Solderless lug with RayChem GelCap, or as accepted.

G. Wire Splices:

1. Joints in Wire: #8 AWG and smaller wire, pressure-type solderless connectors, Buchanan, Scotchlok, Wing Nut, or as accepted. #6 AWG and larger wire, irreversible compression type, Burndy, Ilsco, or as accepted.
2. Wire Taps: Solderless lug, solderless compression lug, each with Raychem Gtap, Ilsco GTA, or GTT with insulating cover, or as accepted.
3. Exterior Below Grade Joints in Wire: Solderless lug, solderless compression lug, each with Raychem GelCap or as accepted.

H. Applied Insulation: Insulating materials shall be listed for the application. Voltage rating shall be equal to or greater than the factory-applied wire insulation. Raychem, 3M, Ilsco, or as accepted.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables.

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

C. Markers and Tags: Plastic Wire Markers: T&B or Brady.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors and conductors feeding the following critical equipment and services for compliance with requirements.

    a. All emergency feeders.

    b. All normal powered feeders rated 100A and larger.

c. 10% of branch circuits and feeders rated 60 – 100A.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 2 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.

   a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
   b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
   c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

D. Test and Inspection Reports: Prepare a written report to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

E. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes grounding and bonding systems and equipment.

B. Section includes grounding and bonding systems and equipment, plus the following special applications:

1. Underground distribution grounding.
2. Ground bonding common with lightning protection system.
3. Copper building ground.
4. Foundation steel electrodes.
5. Signal Reference Grid

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

A. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:

1. Test wells.
2. Ground rods.
3. Ground rings.
4. Ground bus bars.
5. Grounding arrangements and connections for separately derived systems.

B. Qualification Data: For testing agency and testing agency's field supervisor.

C. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1. Include the following:

a. Instructions for periodic testing and inspection of grounding features at test wells ground rings based on NETA MTS.

1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
2) Include recommended testing intervals.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

B. 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.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Burndy; Part of Hubbell Electrical Systems.
2. Dossert; AFL Telecommunications LLC.
3. ERICO International Corporation.
4. Fushi Copperweld Inc.
5. Galvan Industries, Inc.; Electrical Products Division, LLC.
6. Harger Lightning and Grounding.
7. ILSCO.
8. O-Z/Gedney; A Brand of the EGS Electrical Group.
9. Robbins Lightning, Inc.
10. Siemens Power Transmission & Distribution, Inc.

2.2 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.3 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (24" U.N.O.) in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless irreversible compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 5/8 by 96 inches.

B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.

1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches long.
2. Backfill Material: Electrode manufacturer's recommended material.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, #4/0 AWG minimum.

1. Bury at least 24 inches below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

E. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING SEPARATELY DERIVED SYSTEMS

A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

3.4 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.5 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
9. X-Ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

G. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

H. Metallic Fences: Comply with requirements of IEEE C2.

1. Grounding Conductor: Bare copper, not less than No. 8 AWG.
2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.
3. Barbed Wire: Strands shall be bonded to the grounding conductor.

3.6 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 26 05 43 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches deep, with cover.

1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

F. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

I. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.

1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
2. Bury ground ring not less than 24 inches from building's foundation.

J. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.

1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

K. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; using electrically conductive coated steel reinforcing bars or rods, at least 20 feet long. If reinforcing is in multiple pieces, connect together by the usual steel tie wires or exothermic welding to create the required length.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

E. Grounding system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.

6. Manhole Grounds: 10 ohms.

H. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

B. Provide and install concrete pads for all pad mounted electrical equipment.

C. Provide and install all supports for wall mounted and ceiling hung electrical equipment.

1.2 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. 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 times the applied force.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.
2. Nonmetallic slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.
2. Steel slotted channel systems. Include Product Data for components.
3. Nonmetallic slotted channel systems. Include Product Data for components.
4. Equipment supports.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

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:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.

c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut; Tyco International, Ltd.
g. Wesanco, Inc.

3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
6. Channel Dimensions: Selected for applicable load criteria.

B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- diameter holes at a maximum of 8 inches o.c., in at least 1 surface.

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:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. Fabco Plastics Wholesale Limited.
d. Seasafe, Inc.

3. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
4. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
5. Rated Strength: Selected to suit applicable load criteria.

C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

    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:
    b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Hilti Inc.
        2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
        3) MKT Fastening, LLC.
        4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

    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:
    b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Cooper B-Line, Inc.; a division of Cooper Industries.
        2) Empire Tool and Manufacturing Co., Inc.
        3) Hilti Inc.
        4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
        5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slottedsupport system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete.

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 26 05 33

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

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. (Including floor boxes for concrete and raised floor installations)
7. Handholes and boxes for exterior underground cabling.

1.2 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid steel conduit.

C. IMC: Intermediate metal conduit.

1.3 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.

C. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit.
3. Anamet Electrical, Inc.
4. Electri-Flex Company.
5. O-Z/Gedney.
6. Picoma Industries.
7. Republic Conduit.
8. Robroy Industries.
9. Southwire Company.
10. Thomas & Betts Corporation.
11. Western Tube and Conduit Corporation.
12. Wheatland Tube Company.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. ARC: Comply with ANSI C80.5 and UL 6A.

E. IMC: Comply with ANSI C80.6 and UL 1242.

F. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch, minimum.

G. EMT: Comply with ANSI C80.3 and UL 797.

H. FMC: Comply with UL 1; zinc-coated steel or aluminum.

I. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

J. 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. Fittings for EMT:

a. Material: Steel or die cast.
b. Type: compression.

3. 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.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

K. 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.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

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. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.
3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corporation.
6. Condux International, Inc.
7. Electri-Flex Company.

8. Kraloy.

9. Lamson & Sessions; Carlon Electrical Products.

10. Niedax-Kleinhuis USA, Inc.

11. RACO; Hubbell.

12. Thomas & Betts Corporation.

B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

D. LFNC: Comply with UL 1660.

E. Rigid HDPE: Comply with UL 651A.

F. Continuous HDPE: Comply with UL 651B.

G. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.

H. RTRC: Comply with UL 1684A and NEMA TC 14.

I. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

J. Fittings for LFNC: Comply with UL 514B.

K. 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).

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Cooper B-Line, Inc.

2. Hoffman.

3. Mono-Systems, Inc.

4. 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.

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.

2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

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. Allied Moulded Products, Inc.
2. Hoffman.
3. Lamson & Sessions; Carlon Electrical Products.
4. Niedax-Kleinhuis USA, Inc.

B. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. 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.

D. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.

E. 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.

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).

2.5 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. Mono-Systems, Inc.

   b. Panduit Corp.

   c. Wiremold / Legrand, ALA4800 Series

C. Surface Nonmetallic Raceways: 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.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Hubbell Incorporated.

   b. Mono-Systems, Inc.

   c. Panduit Corp.

   d. Wiremold / Legrand, G4000 Series

D. Tele-Power Poles:

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. Mono-Systems, Inc.

   b. Panduit Corp.

   c. Wiremold / Legrand.

2. Material: Aluminum with clear anodized finish.
3. Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.

2.6 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Adalet.

2. Cooper Technologies Company; Cooper Crouse-Hinds.

3. EGS/Appleton Electric.

4. Erickson Electrical Equipment Company.

5. FSR Inc.

6. Hoffman.

7. Hubbell Incorporated.

8. Kraloy.

9. Milbank Manufacturing Co.

10. Mono-Systems, Inc.

11. O-Z/Gedney.

12. RACO; Hubbell.

13. Robroy Industries.

14. Spring City Electrical Manufacturing Company.

15. Stahlin Non-Metallic Enclosures.

16. Thomas & Betts Corporation.

17. Wiremold / Legrand.

18. Panduit.

B. General Requirements for Boxes, Enclosures, and Cabinets: 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.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, 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. Material: Cast metal or sheet metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. 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. Floor boxes for installation in raised floors, suitable for plenum use, with power and data terminations, Panduit Panzone.

H. Nonmetallic Floor Boxes: Nonadjustable, rectangular.

1. Listing and Labeling: 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.

I. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

J. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.

1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

K. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

L. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

M. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

N. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

O. Gangable boxes are prohibited.

P. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 12 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Fiberglass.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

Q. Cabinets:

1. NEMA 250, Type 12 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.

2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. Armorcast Products Company.

   b. Carson Industries LLC.

   c. NewBasis.

   d. Oldcastle Precast, Inc.

   e. Quazite: Hubbell Power System, Inc.

   f. Synertech Moulded Products.

3. Standard: Comply with SCTE 77.
4. Configuration: Designed for flush burial with closed bottom unless otherwise indicated.
5. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
6. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
7. Cover Legend: Molded lettering, "ELECTRIC.".
8. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
9. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of polymer concrete.

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. Armorcast Products Company.

   b. Carson Industries LLC.

   c. Nordic Fiberglass, Inc.

   d. Oldcastle Precast, Inc; Christy Concrete Products.

   e. Quazite: Hubbell Power System, Inc; Hubbell Power Systems.

f. Synertech Moulded Products.

3. Standard: Comply with SCTE 77.
4. Color of Frame and Cover: Gray.
5. Configuration: Designed for flush burial with closed bottom unless otherwise indicated.
6. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
7. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
8. Cover Legend: Molded lettering, "ELECTRIC.".
9. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
10. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.8 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit (Subject to physical damage): GRC, IMC.

2. Exposed Conduit, Not Subject to Physical Damage: EMT (with weatherproof compression fittings)
3. Concealed Conduit, Aboveground: GRC, IMC, EMT.
4. Underground Conduit: RNC, schedule 40 minimum, concrete encased (as applicable).
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
6. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Encased in concrete decks: RNC, schedule 40 minimum, concrete encased

2. Exposed, (Subject to Physical Damage): GRC, IMC.
3. Exposed, (Not Subject to Severe Physical Damage): EMT.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT. MC cable shall be permitted for final drops to wiring devices within furred out walls.

5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: IMC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 nonmetallic in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use compression, cast-metal fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

G. Install surface raceways only where indicated on Drawings.

H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches of enclosures to which attached.

I. Raceways 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 raceways to reinforcement at maximum 10-footintervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways 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.

J. 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.

K. 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.

L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

P. 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.

Q. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

S. Surface Raceways:

1. Install surface raceway with a minimum 2-inchradius control at bend points.

2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

T. 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. Install raceway sealing fittings according to NFPA 70.

U. 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.

V. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

W. 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 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 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 temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.

3. 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.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

X. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

Y. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

Z. 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 box and cover plate or supported equipment and box.

AA. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

BB. Locate boxes so that cover or plate will not span different building finishes.

CC. 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.

DD. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

EE. Set metal floor boxes level and flush with finished floor surface.

FF. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 31 20 00 "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 31 20 00 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 31 20 00 "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits but a minimum of 6 inches below grade. Align planks along centerline of conduit.
7. Underground Warning Tape: Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

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, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

E. Field-cut openings for conduits 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.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 84 00 "Penetration Firestopping."

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 05 36

CABLE TRAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ladder cable trays. **(Basket style tray shall be considered an acceptable material for low voltage cabling on the project.)**
2. Single-rail cable trays.
3. Trough cable trays.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data indicating dimensions and finishes for each type of cable tray indicated.

B. Shop Drawings: For each type of cable tray.

1. Show fabrication and installation details of cable trays, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.

C. Delegated-Design Submittal: For seismic restraints.

1. Seismic-Restraint Details: Signed and sealed by a qualified professional engineer, licensed in the state where Project is located, who is responsible for their preparation.
2. Design Calculations: Calculate requirements for selecting seismic restraints.
3. Detail fabrication, including anchorages and attachments to structure and to supported cable trays.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans and sections, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:.

1. Include scaled cable tray layout and relationships between components and adjacent structural, electrical, and mechanical elements.
2. Vertical and horizontal offsets and transitions.
3. Clearances for access above and to side of cable trays.
4. Vertical elevation of cable trays above the floor or below bottom of ceiling structure.

B. Seismic Qualification Certificates: For cable trays, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR CABLE TRAYS

A. Cable Trays and Accessories: Identified as defined in NFPA 70 and marked for intended location, application, and grounding.

1. Source Limitations: Obtain cable trays and components from single manufacturer.

B. Sizes and Configurations: See the Cable Tray Schedule on Drawings for specific requirements for types, materials, sizes, and configurations.

C. Structural Performance: See articles on individual cable tray types for specific values for the following parameters:

1. Uniform Load Distribution: Capable of supporting a uniformly distributed load on the indicated support span when supported as a simple span and tested according to NEMA VE 1.
2. Concentrated Load: A load applied at midpoint of span and centerline of tray.
3. Load and Safety Factors: Applicable to both side rails and rung capacities.

2.2 LADDER CABLE TRAYS

A. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Cooper B-Line, Inc.
2. Walker
3. P-W Industries

C. Description:

1. Configuration: Two I-beam side rails with transverse rungs welded to side rails.

2. Rung Spacing: 6 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 a200-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: 18 inches unless otherwise indicated on Drawings.
10. Fitting Minimum Radius: 36 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.

2.3 SINGLE-RAIL CABLE TRAYS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Cooper B-Line, Inc.
2. Walker
3. P-W Industries

C. Description:

1. Configuration: Center rail with extruded-aluminum rungs arranged symmetrically about the center rail.
2. Construction: Aluminum rungs mechanically connected to aluminum center rail in at least two places, with ends finished to protect installers and cables.
3. Rung Spacing: 6 inches o.c.
4. Radius-Fitting Rung Spacing: 9 inches at center of tray's width.
5. Straight Section Lengths: 10 feet except where shorter lengths are required to facilitate tray assembly.
6. Width: 18 inches unless otherwise indicated on Drawings.
7. Support Point: Splice fittings shall be hanger support point.
8. Support Spacing: Support each section at midpoint. Support wall-mounted sections a maximum of one-sixth of the section length from each end.
9. Loading Depth: 4 inches.
10. Maximum Loads: 25 lb/ft..

11. Splicing Assemblies: Bolted type using serrated flange locknuts.
12. Splicing Assembly Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.
13. Hardware and Fasteners: Steel, zinc plated according to ASTM B 633.

14. Splices and Connectors: Protect cables from edges of center rail and do not intrude into cable fill area.

2.4 MATERIALS AND FINISHES

A. Steel:

1. Straight Section and Fitting Side Rails and Rungs: Steel complies with the minimum mechanical properties of ASTM A 1011/A 1011M, SS, Grade 33.
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: Mill galvanized before fabrication.

    a. Standard: Comply with ASTM A 653/A 653M, G90.
    b. Hardware: Galvanized, ASTM B 633.

5. Finish: Electrogalvanized before fabrication.

    a. Standard: Comply with ASTM B 633.
    b. Hardware: Galvanized, ASTM B 633.

6. Finish: Hot-dip galvanized after fabrication.

    a. Standard: Comply with ASTM A123/A123 M, Class B2.
    b. Hardware: Chromium-zinc plated, ASTM F 1136.

7. Finish: Epoxy-resin paint.

    a. Powder-Coat Enamel: Cable tray manufacturer's recommended primer and corrosion-inhibiting treatment, with factory-applied powder-coat paint.
    b. Epoxy-Resin Prime Coat: Cold-curing epoxy primer, MPI# 101.
    c. Epoxy-Resin Topcoat: Epoxy, cold-cured, gloss, MPI# 77.
    d. Hardware: Chromium-zinc plated. ASTM F 1136.

8. Finish: Factory-standard primer, ready for field painting, with chromium-zinc-plated hardware according to ASTM F 1136.
9. Finish: Black oxide finish for support accessories and miscellaneous hardware according to ASTM D 769.

B. Aluminum:

1. Materials: Alloy 6063-T6 according to ANSI H35.1/H 35.1M for extruded components, and Alloy 5052-H32 or Alloy 6061-T6 according to ANSI H35.1/H 35.1M for fabricated parts.
2. Hardware: Chromium-zinc-plated steel, ASTM F 1136.
3. Hardware for Aluminum Cable Tray Used Outdoors: Stainless steel, Type 316, ASTM F 593 and ASTM F 594.

C. Stainless Steel:

1. Materials: Low-carbon, passivated, stainless steel, Type 304L or Type 316L, ASTM F 593 and ASTM F 594.
2. Hardware for Stainless-Steel Cable Tray Used Outdoors: Stainless steel, Type 316, ASTM F 593 and ASTM F 594.

2.5 CABLE TRAY ACCESSORIES

A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.

B. Covers: Solid type made of same materials and with same finishes as cable tray.

C. Barrier Strips: Same materials and finishes as for cable tray.

D. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

2.6 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."

2.7 SOURCE QUALITY CONTROL

A. Testing: Test and inspect cable trays according to NEMA FG 1 NEMA VE 1.

PART 3 - EXECUTION

3.1 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. Install cable trays so that the tray is accessible for cable installation and all splices are accessible for inspection and adjustment.

D. Remove burrs and sharp edges from cable trays.

E. Join aluminum cable tray with splice plates; use four square-neck carriage bolts and locknuts.

F. Fasten cable tray supports to building structure.

G. Design fasteners and supports to carry cable tray, the cables, and a concentrated load of 200 lb. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems."

H. Place supports so that spans do not exceed maximum spans on schedules and provide clearances shown on Drawings. Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.

I. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.

J. Support bus assembly to prevent twisting from eccentric loading.

K. Install center-hung supports for single-rail trays designed for 60 versus 40 percent eccentric loading condition, with a safety factor of 3.

L. Locate and install supports according to NEMA VE 2. Do not install more than one cable tray splice between supports.

M. 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.

N. 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.

O. Make changes in direction and elevation using manufacturer's recommended fittings.

P. Make cable tray connections using manufacturer's recommended fittings.

Q. Seal penetrations through fire and smoke barriers. Comply with requirements in Section 07 84 00 "Penetration Firestopping."

R. Install capped metal sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.

S. Install cable trays with enough workspace to permit access for installing cables.

T. 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.

U. Install permanent covers, if used, after installing cable. Install cover clamps according to NEMA VE 2.

V. Clamp covers on cable trays installed outdoors with heavy-duty clamps.

W. Install warning signs in visible locations on or near cable trays after cable tray installation.

3.2 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 electrical power conductors shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.

C. Cable trays with single-conductor power conductors shall be bonded together with a grounding conductor run in the tray along with the power conductors and bonded to the tray at 72-inch intervals. The grounding conductor shall be sized according to NFPA 70, Article 250.122, "Size of Equipment Grounding Conductors," and Article 392, "Cable Trays."

D. When using epoxy- or powder-coat painted cable trays as a grounding conductor, completely remove coating at all splice contact points or ground connector attachment. After completing splice-to-grounding-bolt attachment, repair the coated surfaces with coating materials recommended by cable tray manufacturer.

E. 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."

3.3 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. Install cable ties with a tool that includes an automatic pressure-limiting device.

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. Tie MI cables down every 36 inches where required to provide a 2-hour fire rating and every 72 inches elsewhere.

F. In existing construction, remove inactive or dead cables from cable trays.

3.4 CONNECTIONS

A. Remove paint from all connection points before making connections. Repair paint after the connections are completed.

B. Connect raceways to cable trays according to requirements in NEMA VE 2 and NEMA FG 1.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

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 improperly sized or installed bonding jumpers.
8. Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
9. 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.

3.6 PROTECTION

A. Protect installed cable trays and cables.

1. Install temporary protection for cables in open trays to safeguard exposed cables against falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials and shall remain in place until the risk of damage is over.
2. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.
3. Repair damage to paint finishes with matching touchup coating recommended by cable tray manufacturer.

END OF SECTION

SECTION 26 05 44

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:
1. Product Data for Credit EQ 4.1: For sealants, documentation including printed statement of VOC content.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:
1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:
1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:
a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
a. Advance Products & Systems, Inc.
b. CALPICO, Inc.
c. Metraflex Company (The).
d. Pipeline Seal and Insulator, Inc.
e. Proco Products, Inc.
3. Sealing Elements: EPDM Nitrile (Buna N) rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
4. Pressure Plates: Carbon steel.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, Stainless steel of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
a. Presealed Systems.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 07 92 00 "Joint Sealants."
b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
1. Use circular metal sleeves unless penetration arrangement requires rectangular opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION

SECTION 26 05 48

VIBRATION CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Spring isolators.
3. Restrained spring isolators.
4. Channel support systems.
5. Restraint cables.
6. Hanger rod stiffeners.
7. Anchorage bushings and washers.

1.2 DEFINITIONS

A. The IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

3. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.

4. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.
5. Field-fabricated supports.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

B. Qualification Data: For professional engineer and testing agency.

C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

E. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

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:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. California Dynamics Corporation.
4. Isolation Technology, Inc.
5. Kinetics Noise Control.
6. Mason Industries.
7. Vibration Eliminator Co., Inc.
8. Vibration Isolation.
9. Vibration Mountings & Controls, Inc.

D. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

E. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Seismic or limit-stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.2 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment and Hanger Restraints:

1. Install restrained isolators on electrical equipment.
2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.

B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

D. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust isolators after isolated equipment is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 26 05 48

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification for conduit and 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 nameplates.
8. Labels
9. Lockout Devices
10. Miscellaneous identification products.

1.2 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Samples: For each type of label and sign submit (2) samples to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.

D. Manufacturer’s installation instructions: Indicate installation instructions, special procedures, and installation.

1.3 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

F. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

G. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum 3 years experience.

H. Installer: Company specializing in performing Work of this section with minimum 3 years experience.

I. Delivery, Storage, and Handling: Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

J. Delivery, Storage, and Handling: Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.4 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER AND CONTROL CONDUIT AND 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. Colors for Raceways Carrying Circuits at 600 V or Less:
   1. Legend: Indicate voltage and system or service type including,
      a. Normal source: black letters on white contrasting background color
      b. Emergency source: red letters on white contrasting background color
      c. High Voltage Systems (above 600V): black letters on yellow contrasting background color.
      d. Communication Systems: black letters on orange contrasting background color.
      e. UPS source: blue letters on white
   2. Conduits shall be color coded according to service. The color coding scheme (basis of design is as follows) shall be approved prior to installation or purchase of materials.
      a. Normal power (208V and 480V): standard conduit
      b. Fire alarm system: red
      c. Emergency power (generator): yellow
      d. UPS power (208V and 480V): blue
      e. Data, A/V: orange

C. Colors for Raceways Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING."

D. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

E. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

G. Tape and Stencil for Raceways Carrying Circuits More Than 600 V: 4-inch- wide black stripes on 10-inch centers diagonally over orange background that extends full length of raceway or duct and is 12 inches wide. Stop stripes at legends.

H. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

I. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 ARMORED AND METAL-CLAD 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. Colors for Cables Carrying Circuits at 600 V and Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Colors for Cables Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER HIGH VOLTAGE WIRING."

D. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

E. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

F. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around cable it identifies. Full shrink recovery at a maximum of 200 deg F. Comply with UL 224.

2.3 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. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

C. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil- thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-resistant, self-laminating, protective shield over the legend. Labels sized to fit the cable diameter such that the clear shield overlaps the entire printed legend.

D. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around cable it identifies. Full shrink recovery at a maximum of 200 deg F. Comply with UL 224.

E. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

F. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

G. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of cable it identifies and to stay in place by gripping action.

H. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of cable it identifies and to stay in place by gripping action.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil- thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-resistant, self-laminating, protective shield over the legend. Labels sized to fit the conductor diameter such that the clear shield overlaps the entire printed legend.

C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of conductor it identifies and to stay in place by gripping action.

D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve with diameter sized to suit diameter of conductor it identifies and to stay in place by gripping action.

E. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around conductor it identifies. Full shrink recovery at a maximum of 200 deg F. Comply with UL 224.

F. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

G. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Labels for Tags: Self-adhesive label, machine-printed with permanent, waterproof, black ink recommended by printer manufacturer, sized for attachment to tag.

H. Power and Lighting Circuits: Branch circuit or feeder number as indicated on Drawings.

I. Control Circuits: Control wire number as indicated on schematic and interconnection diagrams.

2.5 FLOOR MARKING TAPE

A. 2-inch- wide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

2.6 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. 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. Inscriptions for Red-Colored Tapes:
   a. ELECTRIC LINE
   b. HIGH VOLTAGE
3. Inscriptions for Orange-Colored Tapes:
   a. TELEPHONE CABLE
   b. CATV CABLE
   c. COMMUNICATIONS CABLE

d. OPTICAL FIBER CABLE

C. Tag: Type I:

1. Pigmented polyolefin, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Thickness: 4 mils.
3. Weight: 18.5 lb/1000 sq. ft..
4. 3-Inch Tensile According to ASTM D 882: 30 lbf, and 2500 psi.

D. Tag: Type II:

1. Multilayer laminate consisting of high-density polyethylene scrim coated with pigmented polyolefin, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Thickness: 12 mils.
3. Weight: 36.1 lb/1000 sq. ft..
4. 3-Inch Tensile According to ASTM D 882: 400 lbf, and 11,500 psi.

E. Tag: Type ID:

1. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Overall Thickness: 5 mils.
3. Foil Core Thickness: 0.35 mil.
4. Weight: 28 lb/1000 sq. ft..
5. 3-Inch Tensile According to ASTM D 882: 70 lbf, and 4600 psi.

F. Tag: Type IID:

1. Reinforced, detectable three-layer laminate, consisting of a printed pigmented woven scrim, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Overall Thickness: 8 mils.
3. Foil Core Thickness: 0.35 mil.
4. Weight: 34 lb/1000 sq. ft..
5. 3-InchTensile According to ASTM D 882: 300 lbf, and 12,500 psi.

2.7 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 grommets in corners for mounting.

3. Nominal size, 7 by 10 inches.

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.

3. Nominal size, 10 by 14 inches.

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.8 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch 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.

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. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.9 EQUIPMENT IDENTIFICATION NAMEPLATES

A. Product Description: Laminated three-layer plastic with engraved letters on contrasting background color.
1. Normal Systems: black letters on white contrasting background color.
2. Emergency Systems: red letters on white contrasting background color.
3. High Voltage Systems (above 600V): black letters on yellow contrasting background color.
4. Communication Systems: black letters on orange contrasting background color.

B. Letter Size:
1. 1/4inch high letters for identifying individual equipment and loads.
2. 1/4inch high letters for identifying grouped equipment and loads.

C. Minimum nameplate thickness: 1/8”.

2.10 LABELS

A. Adhesive Film Label (Plastic adhesive tape): Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/16 inch.
   1. Normal Systems: black letters on white contrasting background color.
   2. Emergency Systems: red letters on white contrasting background color.
   3. High Voltage Systems (above 600V): black letters on yellow contrasting background color.
   4. Communication Systems: black letters on orange contrasting background color.

B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/16 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

C. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.11 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.

   1. Minimum Width: 3/16 inch.
   2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
   3. Temperature Range: Minus 40 to plus 185 deg F.
   4. Color: Black except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.

   1. Minimum Width: 3/16 inch.
   2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
   3. Temperature Range: Minus 40 to plus 185 deg F.
   4. Color: Black.

C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.

   1. Minimum Width: 3/16 inch.
   2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
   3. UL 94 Flame Rating: 94V-0.
   4. Temperature Range: Minus 50 to plus 284 deg F.
   5. Color: Black.

2.12 LOCKOUT DEVICES

A. Lockout hasps: Anodized aluminum hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

2.13 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Identify branch circuit assignment on all wiring device cover plates using adhesive labels, black on clear or black on white labels.

C. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

D. Apply identification devices to surfaces that require finish after completing finish work.

E. Install labels and nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

F. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

G. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

H. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape with adhesive appropriate to the location and substrate.

I. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

J. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

K. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

L. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

M. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil 4-inch- wide black stripes on 10-inch centers over orange background that extends full length of raceway or duct and is 12 inches wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- high black letters on 20-inch centers. Stop stripes at legends. Apply to the following finished surfaces:

1. Floor surface directly above conduits running beneath and within 12 inches of a floor that is in contact with earth or is framed above unexcavated space.
2. Wall surfaces directly external to raceways concealed within wall.
3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

B. Underground conduit (power and telecomm) stub ups or penetrations within manholes and buildings (other than within gear) including stub ups within TRs and electrical rooms fed from within facility: Install brass tag each end identifying location fed from.

C. Accessible Raceways, Armored and Metal-Clad Cables, More Than 600 V: Self-adhesive vinyl labels. Install labels at 20-foot maximum intervals.

D. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl label. Install labels at 20-foot maximum intervals.

E. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Normal source
2. Emergency source
3. UPS source

F. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.

   a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
   b. Colors for 208/120-V Circuits:

      1) Phase A: Black.
      2) Phase B: Red.

3) Phase C: Blue.

c. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: 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 bands to avoid obscuring factory cable markings.

G. Power-Circuit Conductor Identification, More than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic plastic tag holder with adhesive-backed phase tags, and a separate tag with the circuit designation.

H. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

I. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive, self-laminating polyester labels with the conductor or cable designation, origin, and destination.

J. Control-Circuit Conductor Termination Identification: For identification at terminations provide heat-shrink preprinted tubes with the conductor designation.

K. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

L. Data wiring identification:
1. Mark data cabling at each end. Install additional marking at accessible locations along the cable run.
2. Install labels at data outlets identifying patch panel and port designation as indicated on drawings.

M. Auxiliary Electrical 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 designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

N. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

O. 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.

P. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

    a. Power transfer switches.
    b. Controls with external control power connections.

Q. Operating Instruction Signs: Install instruction signs to facilitate 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.

R. 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.

S. Nameplate Installation:
1. Install nameplate parallel to equipment lines.
2. Install nameplate for each electrical distribution and control equipment enclosure located inside with corrosive-resistant mechanical fasteners or adhesive.
3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners or adhesive.
4. Secure nameplate to equipment with screws or adhesive (indoors only).
5. Secure nameplate to inside surface of door on recessed panelboard in finished locations.

T. Label Installation:
1. Install label parallel to equipment lines.
2. Install label on each control station and wiring device with panel and circuit assignment including,
    a. Receptacles (per 262726.3.3.B)
    b. Wall switches (including light switches, shade controls, and similar control devices)

U. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

    a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
    b. Outdoor Equipment: Stenciled legend 4 inches high.

c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label.
b. Enclosures and electrical cabinets.
c. Access doors and panels for concealed electrical items.
d. Service disconnects – DISC
e. Automatic transfer switches - ATS
f. Switchgear.
g. Switchboards / Distribution Boards - DP.
h. Transformers - TX: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
i. Emergency system boxes and enclosures.
j. Motor-control centers - MCC.
k. Enclosed switches.
l. Enclosed circuit breakers.
m. Enclosed controllers.
n. Variable-speed controllers.
o. Push-button stations.
p. UPS systems.

END OF SECTION

SECTION 26 05 73.16

OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes computer-based, overcurrent protective device coordination studies to determine overcurrent protective devices and to determine overcurrent protective device settings for selective tripping.

1. Study results shall be used to determine coordination of series-rated devices.

1.2 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. SCCR: Short-circuit current rating.

E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.3 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: Submit the following after the approval of system protective devices submittals. Submittals shall be in digital form.

1. Coordination-study input data, including completed computer program input data sheets.
2. Study and equipment evaluation reports.
3. Overcurrent protective device coordination study report; signed, dated, and sealed by a qualified professional engineer.

a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal

of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Coordination Study Specialist.

B. Product Certificates: For overcurrent protective device coordination study software, certifying compliance with IEEE 399.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For the overcurrent protective devices to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:

a. The following parts from the Protective Device Coordination Study Report:

1) One-line diagram.
2) Protective device coordination study.
3) Time-current coordination curves.

b. Power system data.

1.6 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. Coordination Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

C. Coordination Study Specialist Qualifications: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

D. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and 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.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Software Developers: Subject to compliance with requirements, provide software by the following:

1. ESA Inc.
2. Operation Technology, Inc.
3. Power Analytics, Corporation.
4. SKM Systems Analysis, Inc.

B. Comply with IEEE 242 and IEEE 399.

C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

D. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

1. Optional Features:

a. Arcing faults.
b. Simultaneous faults.
c. Explicit negative sequence.
d. Mutual coupling in zero sequence.

2.2 PROTECTIVE DEVICE COORDINATION STUDY REPORT CONTENTS

A. Executive summary.

B. Study descriptions, purpose, basis and scope. Include case descriptions, definition of terms and guide for interpretation of the computer printout.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Cable size and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.

4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations.

D. Study Input Data: As described in "Power System Data" Article.

E. Short-Circuit Study:

1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

    a. Voltage.
    b. Calculated fault-current magnitude and angle.
    c. Fault-point X/R ratio.
    d. Equivalent impedance.

2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

    a. Voltage.
    b. Calculated symmetrical fault-current magnitude and angle.
    c. Fault-point X/R ratio.
    d. Calculated asymmetrical fault currents:

        1) Based on fault-point X/R ratio.
        2) Based on calculated symmetrical value multiplied by 1.6.
        3) Based on calculated symmetrical value multiplied by 2.7.

3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

    a. Voltage.
    b. Calculated symmetrical fault-current magnitude and angle.
    c. Fault-point X/R ratio.
    d. No AC Decrement (NACD) ratio.
    e. Equivalent impedance.
    f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
    g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

F. Protective Device Coordination Study:

1. Report recommended settings of protective devices, ready to be applied in the field. Use manufacturer's data sheets for recording the recommended setting of overcurrent protective devices when available.

    a. Phase and Ground Relays:

        1) Device tag.

2) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
3) Recommendations on improved relaying systems, if applicable.

b. Circuit Breakers:

1) Adjustable pickups and time delays (long time, short time, ground).
2) Adjustable time-current characteristic.
3) Adjustable instantaneous pickup.
4) Recommendations on improved trip systems, if applicable.

c. Fuses: Show current rating, voltage, and class.

G. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

1. Device tag and title, one-line diagram with legend identifying the portion of the system covered.
2. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
3. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
4. Plot the following listed characteristic curves, as applicable:

a. Power utility's overcurrent protective device.
b. Medium-voltage equipment overcurrent relays.
c. Medium- and low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
d. Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
e. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
f. Cables and conductors damage curves.
g. Ground-fault protective devices.
h. Motor-starting characteristics and motor damage points.
i. Generator short-circuit decrement curve and generator damage point.
j. The largest feeder circuit breaker in each motor-control center and panelboard.

5. Series rating on equipment allows the application of two series interrupting devices for a condition where the available fault current is greater than the interrupting rating of the downstream equipment. Both devices share in the interruption of the fault and selectivity is sacrificed at high fault levels. Maintain selectivity for tripping currents caused by overloads.
6. Provide adequate time margins between device characteristics such that selective operation is achieved.
7. Comments and recommendations for system improvements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.

1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.2 PROTECTIVE DEVICE COORDINATION STUDY

A. Comply with IEEE 242 for calculating short-circuit currents and determining coordination time intervals.

B. Comply with IEEE 399 for general study procedures.

C. The study shall be based on the device characteristics supplied by device manufacturer.

D. The extent of the electrical power system to be studied is indicated on Drawings.

E. Begin analysis at the service, extending down to the system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.
2. Exclude equipment rated 240-V ac or less when supplied by a single transformer rated less than 125 kVA.

F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. Transformer Primary Overcurrent Protective Devices:

1. Device shall not operate in response to the following:

a. Inrush current when first energized.
b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.

2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

H. Motor Protection:

1. Select protection for low-voltage motors according to IEEE 242 and NFPA 70.
2. Select protection for motors served at voltages more than 600 V according to IEEE 620.

I. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

J. Generator Protection: Select protection according to manufacturer's written recommendations and to IEEE 242.

K. The calculations shall include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and shall apply to low- and medium-voltage, three-phase ac systems. The calculations shall also account for the fault-current dc decrement, to address the asymmetrical requirements of the interrupting equipment.

1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

L. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and single line-to-ground fault at each of the following:

1. Electric utility's supply termination point.
2. Switchgear.
3. Unit substation primary and secondary terminals.
4. Low-voltage switchgear.
5. Motor-control centers.
6. Standby generators and automatic transfer switches.
7. Branch circuit panelboards.

M. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short-circuit ratings.
2. Adequacy of switchgear, motor-control centers, and panelboard bus bars to withstand short-circuit stresses.
3. Any application of series-rated devices shall be recertified, complying with requirements in NFPA 70.

3.3 POWER SYSTEM DATA

A. Obtain all data necessary for the conduct of the overcurrent protective device study.

1. Verify completeness of data supplied in the one-line diagram on Drawings. Call discrepancies to the attention of Architect.
2. For new equipment, use characteristics submitted under the provisions of action submittals and information submittals for this Project.

3. For existing equipment, whether or not relocated obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. The qualifications of technicians and engineers shall be qualified as defined by NFPA 70E.

B. Gather and tabulate the following input data to support coordination study. The list below is a guide. Comply with recommendations in IEEE 241 and IEEE 551 for the amount of detail required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Electrical power utility impedance at the service.
3. Power sources and ties.
4. Short-circuit current at each system bus, three phase and line-to-ground.
5. Full-load current of all loads.
6. Voltage level at each bus.
7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
8. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
12. Maximum demands from service meters.
13. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
14. Motor horsepower and NEMA MG 1 code letter designation.
15. Low-voltage cable sizes, lengths, number, conductor material, and conduit material (magnetic or nonmagnetic).
16. Medium-voltage cable sizes, lengths, conductor material, and cable construction and metallic shield performance parameters.
17. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:

    a. Special load considerations, including starting inrush currents and frequent starting and stopping.
    b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.

c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
d. Generator thermal-damage curve.
e. Ratings, types, and settings of utility company's overcurrent protective devices.
f. Special overcurrent protective device settings or types stipulated by utility company.
g. Time-current-characteristic curves of devices indicated to be coordinated.
h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
j. Panelboards, switchboards, motor-control center ampacity, and SCCR in amperes rms symmetrical.
k. Identify series-rated interrupting devices for a condition where the available fault current is greater than the interrupting rating of the downstream equipment. Obtain device data details to allow verification that series application of these devices complies with NFPA 70 and UL 489 requirements.

3.4 FIELD ADJUSTING

A. Adjust relay and protective device settings according to the recommended settings provided by the coordination study. Field adjustments shall be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

B. Make minor modifications to equipment as required to accomplish compliance withprotective device coordination studies.

C. Testing and adjusting shall be by a full-time employee of the Field Adjusting Agency, who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters. Perform NETA tests and inspections for all adjustable overcurrent protective devices.

END OF SECTION 26 05 73.16

SECTION 26 05 73.19

OVERCURRENT PROTECTIVE DEVICE ARC-FLASH STUDY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

1.2 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. SCCR: Short-circuit current rating.

E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.3 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals shall be in digital form.

1. Arc-flash study input data, including completed computer program input data sheets.
2. Arc-flash study report; signed, dated, and sealed by a qualified professional engineer.

    a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Arc-Flash Study Specialist.

B. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance procedures according to requirements in NFPA 70E shall be provided in the equipment manuals.

B. Operation and Maintenance Procedures: In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," provide maintenance procedures for use by Owner's personnel that comply with requirements in NFPA 70E.

1.6 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. Arc-Flash Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

C. Arc-Flash Study Specialist Qualifications: Professional engineer in charge of performing the study, analyzing the arc flash, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

D. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and 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.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Software Developers: Subject to compliance with requirements, provide software by one of the following:

1. ESA Inc.
2. Operation Technology, Inc.
3. Power Analytics, Corporation.
4. SKM Systems Analysis, Inc.

B. Comply with IEEE 1584 and NFPA 70E.

C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

2.2 SHORT-CIRCUIT STUDY REPORT CONTENT

A. Executive summary.

B. Study descriptions, purpose, basis and scope.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Cable size and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center and panelboard designations.

D. Study Input Data: As described in "Power System Data" Article.

E. Short-Circuit Study Output:

1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. Voltage.
b. Calculated symmetrical fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. No AC Decrement (NACD) ratio.
e. Equivalent impedance.
f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

F. Incident Energy and Flash Protection Boundary Calculations:

1. Arcing fault magnitude.
2. Protective device clearing time.
3. Duration of arc.
4. Arc-flash boundary.
5. Working distance.
6. Incident energy.
7. Hazard risk category.
8. Recommendations for arc-flash energy reduction.

G. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of the computer printout.

2.3 ARC-FLASH WARNING LABELS

A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems." Produce a 3.5-by-5-inch (76-by-127-mm) thermal transfer label of high-adhesion polyester for each work location included in the analysis.

B. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:

1. Location designation.
2. Nominal voltage.
3. Flash protection boundary.
4. Hazard risk category.
5. Incident energy.
6. Working distance.
7. Engineering report number, revision number, and issue date.

C. Labels shall be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.2 SHORT-CIRCUIT STUDY

A. Perform study following the general study procedures contained in IEEE 399.

B. Calculate short-circuit currents according to IEEE 551.

C. Base study on the device characteristics supplied by device manufacturer.

D. The extent of the electrical power system to be studied is indicated on Drawings.

E. Begin analysis at the service, extending down to the system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.
2. Exclude equipment rated 240-V ac or less when supplied by a single transformer rated less than 125 kVA.

F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. The calculations shall include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and shall apply to low- and medium-voltage, three-phase ac systems.

H. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and single line-to-ground fault at each of the following:

1. Electric utility's supply termination point.
2. Switchgear.
3. Unit substation primary and secondary terminals.
4. Low-voltage switchgear.
5. Motor-control centers.
6. Standby generators and automatic transfer switches.
7. Branch circuit panelboards.

3.3 ARC-FLASH HAZARD ANALYSIS

A. Comply with NFPA 70E and its Annex D for hazard analysis study.

B. Use the short-circuit study output and the field-verified settings of the overcurrent devices.

C. Calculate maximum and minimum contributions of fault-current size.

1. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume no motor load.
2. The maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.

D. Calculate the arc-flash protection boundary and incident energy at locations in the electrical distribution system where personnel could perform work on energized parts.

E. Include medium- and low-voltage equipment locations, except 240-V ac and 208-V ac systems fed from transformers less than 125 kVA.

F. Safe working distances shall be specified for calculated fault locations based on the calculated arc-flash boundary, considering incident energy of 1.2 cal/sq.cm.

G. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented as follows:

1. Fault contribution from induction motors should not be considered beyond three to five cycles.
2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g., contributions from permanent magnet generators will typically decay from 10 per unit to three per unit after 10 cycles).

H. Arc-flash computation shall include both line and load side of a circuit breaker as follows:

1. When the circuit breaker is in a separate enclosure.
2. When the line terminals of the circuit breaker are separate from the work location.

I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.4 POWER SYSTEM DATA

A. Obtain all data necessary for the conduct of the arc-flash hazard analysis.

1. Verify completeness of data supplied on the one-line diagram on Drawings. Call discrepancies to the attention of Architect.
2. For new equipment, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
3. For existing equipment, whether or not relocated, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers.

B. Gather and tabulate the following input data to support coordination study. Comply with recommendations in IEEE 1584 and NFPA 70E as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.

2. Obtain electrical power utility impedance at the service.
3. Power sources and ties.
4. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in per cent, and phase shift.
5. For reactors, provide manufacturer and model designation, voltage rating and impedance.
6. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
7. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
8. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
9. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
10. Motor horsepower and NEMA MG 1 code letter designation.
11. Low-voltage cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
12. Medium-voltage cable sizes, lengths, conductor material, and cable construction and metallic shield performance parameters.

3.5 LABELING

A. Apply one arc-flash label for 600-V ac, 480-V ac, and applicable 208-V ac panelboards and disconnects and for each of the following locations:

1. Motor-control center.
2. Low-voltage switchboard.
3. Switchgear.
4. Medium-voltage switch.
5. Control panel.

3.6 APPLICATION OF WARNING LABELS

A. Install the arc-fault warning labels under the direct supervision and control of the Arc-Flash Study Specialist.

3.7 DEMONSTRATION

A. Engage the Arc-Flash Study Specialist to train Owner's maintenance personnel in the potential arc-flash hazards associated with working on energized equipment and the significance of the arc-flash warning labels.

END OF SECTION 26 05 73.19

SECTION 26 09 36

LIGHTING CONTROLS

PART 1 - GENERAL

SUMMARY

A. The work covered in this section is subject to all of the requirements in the General Conditions of the specifications.

B. Contractor shall coordinate all of the work in this section with all of the trades covered in other sections of the specification to provide a complete and operable system. Provide a complete central lighting system including interconnecting data cabling, power supplies, remote switches, relay panels, sensors, photosensors, addressable devices, wired and wireless devices, to accomplish the proposed sequence of operations as indicated on the plans.

C. Section Includes:
   1. Lighting control system and associated devices.

REFERENCES

A. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE) (www.ansi.org and www.ieee.org)

B. ASTM International (ASTM) (www.astm.org)
   1. D4674 -02a Standard Test Method for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Fluorescent Lighting and Window-Filtered Daylight.

C. Canadian Standards Association (CSA) (www.csa.ca)
   1. CSA C22.2 # 14 Industrial Control Equipment
   2. CSA C22.2 # 184 Solid-State Lighting Controls
   3. CSA C22.2 # 156 Solid-State Speed Controls

D. International Electrotechnical Commission (www.iec.ch)
   1. (IEC) 801-2 Electrostatic Discharge Testing Standard.
   2. IEC/EN 60669-2-1 Switches for household and similar fixed electrical installations - electronic switches.

E. International Organization for Standardization (ISO)
   1. 9001:2000 – Quality Management Systems.

F. National Electrical Manufacturers Association (NEMA)
   1. WD1 (R2005) - General Color Requirements for Wiring Devices.

G. Underwriters Laboratories, Inc. (UL)www.ul.com
   1. 489 (2002) - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
   2. 508 (1999) - Standard for Industrial Control Equipment.
   3. 1472 (1996) - Solid-State Dimming Controls.

4. 924 (2003) - Emergency Lighting and Power Equipment

H. Federal Communications Commission (FCC) rules – Part 15 (Class B): Radio Frequency Devices

SYSTEM DESCRIPTION

A. The lighting control system shall be a distributed system containing communication gateways on each building floor and interconnected to form a complete system including software and licenses. All local devices shall connect to the control system via bridges and control wiring. Extent of lighting control system work is indicated by drawings and by the requirements of this section. It is defined to include, but not by way of limitation:
   1. Low voltage switching system with lighting automation relay panels/controllers and associated low voltage switches.
   2. Low voltage lighting automation relay panels and controllers.
   3. Low voltage wall stations, control interfaces, and sensors.
   4. Panel Master ON/OFF control capability.
   5. Programmable lighting controls for complete system via software with graphic interface specific to the project.

B. The lighting control system supplier shall provide fully trained field personnel (based local to the project) to facilitate the programming and coordination with the BAS system integrator.

C. Requirements are indicated elsewhere in these specifications for work including, but not limited to, raceways and electrical boxes and fitting required for installation on control equipment and wiring. Not work of this section.

D. Conduit stubouts from switches and other devices shall be required to accessible ceilings. Where no ceilings are utilized, conduit must be routed back to the relay panel. Where applicable, wiring and devices shall be plenum rated.

SUBMITTALS (INCLUDING CLOSEOUT SUBMITTALS)

A. Shop Drawings; include:
   1. Sequence of Operation: Submit the project specific sequence of operation, control functions and setpoints for each type of space or control strategy.
   2. Load schedule indicating actual connected load, load type, and voltage per circuit, circuits and their respective control zones, circuits that are on emergency, and capacity, phase, and corresponding circuit numbers, room names and numbers.
   3. Schematic of system.
   4. Submit dimensioned drawings (1/8" = 1'-0" AutoCAD Version 2012) of all lighting control system components and accessories with project name and address.
   5. Typical Wiring Diagrams: Submit typical wiring diagrams for all components including, but not limited to, relay panels, relays, low voltage switches, programmable panel master switches, programmable system switch panels, telephone override cards, global switching/annunciation and wire. Clearly delineate line voltage wiring connections.
   6. Submit interior photosensor locations in accordance with S.P.O.T.
   7. Cut sheet of gateways, bridges, wiring devices, and relay panels.

B. Product Data: Catalog cut sheets with performance specifications demonstrating compliance

with specified requirements.

C. Include all conduit requirements within the submittal. Where conduits are indicated on the Division 26 drawings, the quantity and size shall be a minimum. The vendor shall confirm all quantities and sizes on the submittal.

D. Provide Operation and Maintenance Manuals:
   1. Including:
      a. Warranty Information
      b. System Start-up Information
      c. Installation Guide
      d. Set-up and Programming Guide
   2. Electronic format to be available on Lighting Control System manufacturer website.

E. Sustainable Design Closeout Documentation
   1. Lighting Control System Manufacturer to provide Enhanced Start-up documentation that details the start-up procedure being performed including a process to follow, details on tests performed and an area that documents any test results.

F. Submit commissioning plan per NEC Art. 708.8

QUALITY ASSURANCE

A. Manufacturer: Minimum 10 years experience in manufacture of architectural lighting controls.

B. Manufacturer's Quality System: Registered to ISO 9001:2000 Quality Standard, including in-house engineering for product design activities.

C. System Checkout: Factory-trained technicians shall be based locally and shall be available to functionally test each component in a programmable system after installation to verify proper operation and confirm that the panel wiring and addressing conform to the wiring documentation.

D. Distributed lighting control system:
   1. Listed by UL specifically for the required loads. Provide evidence of compliance upon request.

PROJECT CONDITIONS

E. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
   1. Ambient temperature: 0 degrees to 40 degrees C (32 degrees to 104 degrees F).
   2. Relative humidity: Maximum 90 percent, non-condensing.
   3. Lighting control system must be protected from dust during installation.

WARRANTY

A. Provide Manufacturer's 5 Year Limited Parts Warranty and 2 Year Labor Coverage:
   1. 5-year limited parts warranty for the replacement of defective Lighting System Components from the date of system startup completion and 2-year 100 percent labor coverage from

the date of the system startup completion.

MAINTENANCE MATERIAL SUBMITTALS

A. Make ordering of new equipment for expansions, replacements, and spare parts available to end user.

B. Make new replacement parts available for minimum of 10 years from date of manufacture.

PART 2 – PRODUCTS

MANUFACTURERS

A. Basis of design product: subject to compliance and prior approval with specified requirements of this section, one of the following:
   1. Sensorswitch nLight
   2. Lutron QS
   3. Dynalite
   4. Encellium

B. Substitutions:
   1. All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by the design professional a minimum of 10 working days prior to the bid date and must be made available to all bidders. Proposed substitutes must be accompanied by a review of the specification noting compliance on a line-by-line basis.
   2. By using pre-approved substitutions, the contractor accepts responsibility and associated costs for all required modifications to circuitry, devices, and wiring. The contractor shall provide complete engineered shop drawings (including power wiring) with deviations for the original design highlighted in an alternate color to the engineer for review and approval prior to rough-in.

GENERAL

A. Provide system hardware that is designed, tested, manufactured, and warranted by a single manufacturer.

B. Architectural Lighting Controls: Ten-year operational life while operating continually at any temperature in an ambient temperature range of 0 degrees C (32 degrees F) to 40 degrees C (104 degrees F) and 90 percent non-condensing relative humidity.

C. Products: As scheduled on plans.

D. Wiring devices: White device body, stainless steel faceplate unless noted otherwise.

PART 3 - EXECUTION

INSTALLATION

A. Install equipment in accordance with manufacturer’s installation instructions.

B. Provide complete installation of system in accordance with Contract Documents.

C. Define each dimmer's load type, shade settings, and set control functions.

D. Provide equipment at locations and in quantities indicated on Drawings. Provide any additional equipment required to provide control intent.

E. Mount exterior daylight sensors to point due north with constant view of daylight.

F. Ensure that daylight sensor placement minimizes sensors view of electric light sources; ceiling mounted and fixture-mounted daylight sensors shall not have direct view of luminaries.

G. Systems Integration:
   1. Equipment Integration Meeting Visit
      a. Facility Representative to coordinate meeting between Facility Representative, Lighting Control System Manufacturer and other related equipment manufacturers to discuss equipment and integration procedures.

STARTUP AND PROGRAMMING

A. Provide factory-certified field service engineer to a site visit to ensure proper system installation and operation under following parameters:
   1. Qualifications for factory-certified field service engineer:
      a. Minimum experience of 2 years training in the electrical/electronic field.
      b. Certified by the equipment manufacturer on the system installed.
   2. Make visits (minimum 1, and as necessary) upon completion of installation of lighting control system:
      a. Verify connection of power feeds and load circuits.
      b. Verify connection and location of controls.
      c. Program system data.
      d. Verify proper connection of digital control link.
      e. Verify proper operation of manufacturers interfacing equipment.
      f. Obtain sign-off on system functions.
      g. User to be trained on system operation.

B. After Hours Start-up
   1. Provide factory certified Field Service Engineer to perform manufacturer’s start-up procedures outside normal working hours (Monday through Friday, 7a.m. to 5 p.m.)

C. Tech Support
   1. Provide factory direct technical support hotline 24 hours per day, 7 days per week.
   2. Comply with NEC Art. 708.8 for Commissioning plan.

FIELD QUALITY CONTROL

D. [Manufacturer Services
   1. Aim and Focus Visit
      a. Facility Representative to coordinate on-site meeting with Lighting Control System Manufacturer and Lighting Design Consultant to make required lighting adjustments to

the system for conformance with the Lighting Design Consultant's original design intent.]

CLOSEOUT ACTIVITIES

E. Training Visit
   1. Lighting Control System Manufacturer to provide 2 day additional on-site system training to site personnel.

F. On-site Walkthrough
   1. Lighting Control System Manufacturer to provide a factory certified Field Service Engineer to demonstrate system functionality to the Commissioning Agent.

MAINTENANCE

A. Capable of providing on-site service support within 24 hours anywhere in continental United States and within 72 hours worldwide except where special visas are required.

B. 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 startup.

C. System Optimization Visit
   1. Lighting Control System Manufacturer to visit site 6 months after system start-up to evaluate system usage and discuss opportunities to make efficiency improvements that will fit with the current use of the facility.

END OF SECTION

SECTION 26 24 13

SWITCHBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Service and distribution switchboards rated 600 V and less.
2. Transient voltage suppression devices.
3. Disconnecting and overcurrent protective devices.
4. Instrumentation.
5. Control power.
6. Accessory components and features.
7. Identification.
8. Mimic bus.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Switchboards shall withstand the effects of earthquake motions determined according to.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of switchboard, overcurrent protective device, transient voltage suppression device, ground-fault protector, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

B. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
5. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.
6. Detail utility company's metering provisions with indication of approval by utility company.
7. Include evidence of NRTL listing for series rating of installed devices.

8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
9. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
10. Include diagram and details of proposed mimic bus.
11. Include schematic and wiring diagrams for power, signal, and control wiring.

C. Samples: Representative portion of mimic bus with specified material and finish, for color selection.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Seismic Qualification Certificates: Submit certification that switchboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:

1. Routine maintenance requirements for switchboards and all installed components.
2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
3. Time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. 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: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
2. Control-Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
3. Fuses and Fusible Devices for Fused Circuit Breakers: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
4. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
5. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
6. Indicating Lights: Equal to 10 percent of quantity installed for each size and type, but no fewer than one of each size and type.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.

B. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

C. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Comply with NEMA PB 2.

G. Comply with NFPA 70.

H. Comply with UL 891.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.

B. Remove loose packing and flammable materials from inside switchboards and [install temporary electric heating (250 W per section)] [connect factory-installed space heaters to temporary electrical service] to prevent condensation.

C. Handle and prepare switchboards for installation according to NEMA PB 2.1.

1.9 PROJECT CONDITIONS

A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.

B. Environmental Limitations:

1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding 104 deg F.
b. Altitude: Not exceeding 6600 feet.

C. Service Conditions: NEMA PB 2, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

D. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Construction Manager no fewer than days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Construction Manager's written permission.
4. Comply with NFPA 70E.

1.10 COORDINATION

A. Coordinate layout and installation of switchboards 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.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Square D; a brand of Schneider Electric.
2. Eaton
3. GE
4. Siemens

C. Front-Connected, Front-Accessible Switchboards:

1. Main Devices: Fixed, individually mounted.
2. Branch Devices: Panel mounted.
3. Sections front and rear aligned.

D. Front- and Side-Accessible Switchboards:

1. Main Devices: Fixed, individually mounted.
2. Branch Devices: Panel mounted.
3. Sections front and rear aligned.

E. Front- and Rear-Accessible Switchboards:

1. Main Devices: Drawout mounted.
2. Branch Devices: Individually compartmented and drawout mounted.
3. Sections front and rear aligned.

F. Nominal System Voltage: 480Y/277 V, 208Y/120 V.

G. Main-Bus Continuous: A indicated on plans.

H. Seismic Requirements: Fabricate and test switchboards according to IEEE 344 to withstand seismic forces defined in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

I. Indoor Enclosures: Steel, NEMA 250, Type 1.

J. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

K. Outdoor Enclosures: Type 3R.

1. Finish: Factory-applied finish in manufacturer's standard color; undersurfaces treated with corrosion-resistant undercoating.
2. Enclosure: Flat roof; for each section, with provisions for padlocking.
3. Doors: Personnel door at each end of aisle, minimum width of 30 inches; opening outwards; with panic hardware and provisions for padlocking.
4. Accessories: Fluorescent lighting fixtures, ceiling mounted; wired to a three-way light switch at each end of aisle; ground-fault circuit interrupter (GFCI) duplex receptacle; emergency battery pack lighting fixture installed on wall of aisle midway between personnel doors.
5. Walk-in Aisle Heating and Ventilating:

    a. Factory-installed electric unit heater(s), wall or ceiling mounted, with integral thermostat and disconnect and with capacities to maintain switchboard interior temperature of 40 deg F with outside design temperature of.
    b. Factory-installed exhaust fan with capacities to maintain switchboard interior temperature of 100 deg F with outside design temperature of 23 deg F.
    c. Ventilating openings.
    d. Thermostat: Single stage; wired to control heat and exhaust fan.

6. Power for Space Heaters, Ventilation, Lighting, and Receptacle: Include a control-power transformer within the switchboard. Supply voltage shall be 120-V ac.
7. Power for space heaters, ventilation, lighting, and receptacle provided by a remote source.

L. Barriers: Between adjacent switchboard sections.

M. Insulation and isolation for main bus of main section and main and vertical buses of feeder sections.

N. Cubical Space Heaters: Factory-installed electric space heaters of sufficient wattage in each vertical section to maintain enclosure temperature above expected dew point.

1. Space-Heater Control: Thermostats to maintain temperature of each section above expected dew point.
2. Space-Heater Power Source: Transformer, factory installed in switchboard.

O. Utility Metering Compartment: Fabricated, barrier compartment and section complying with utility company's requirements; hinged sealed door; buses provisioned for mounting utility company's current transformers and potential transformers or potential taps as required by utility company. If separate vertical section is required for utility metering, match and align with basic switchboard. Provide service entrance label and necessary applicable service entrance features.

P. Customer Metering Compartment: A separate customer metering compartment and section with front hinged door, for indicated metering, and current transformers for each meter. Current transformer secondary wiring shall be terminated on shorting-type terminal blocks. Include potential transformers having primary and secondary fuses with disconnecting means and secondary wiring terminated on terminal blocks.

Q. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

R. Removable, Hinged Rear Doors and Compartment Covers: Secured by standard bolts, for access to rear interior of switchboard.

S. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.

T. Pull Box on Top of Switchboard:

1. Adequate ventilation to maintain temperature in pull box within same limits as switchboard.
2. Set back from front to clear circuit-breaker removal mechanism.
3. Removable covers shall form top, front, and sides. Top covers at rear shall be easily removable for drilling and cutting.
4. Bottom shall be insulating, fire-resistive material with separate holes for cable drops into switchboard.
5. Cable supports shall be arranged to facilitate cabling and adequate to support cables indicated, including those for future installation.

U. Buses and Connections: Three phase, four wire unless otherwise indicated.

1. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity,with tin-plated aluminum or copper feeder circuit-breaker line connections.
2. Phase- and Neutral-Bus Material: Tin-plated, high-strength, electrical-grade aluminum alloy with tin-plated aluminum circuit-breaker line connections.
3. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity or tin-plated, high-strength, electrical-grade aluminum alloy.
4. Load Terminals: Insulated, rigidly braced, runback bus extensions, of same material as through buses, equipped with mechanical connectors for outgoing circuit conductors. Provide load terminals for future circuit-breaker positions at full-ampere rating of circuit-breaker position.
5. Ground Bus: 1/4-by-2-inch- hard-drawn copper of 98 percent conductivity, equipped with mechanical connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.
6. Main Phase Buses and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
7. Neutral Buses: 50 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
8. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
9. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.

V. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

W. Bus-Bar Insulation: Factory-applied, flame-retardant, tape wrapping of individual bus bars or flame-retardant, spray-applied insulation. Minimum insulation temperature rating of .

X. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components including instruments and instrument transformers.

2.2 SURGE PROTECTION DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Square D; a brand of Schneider Electric.
   b. Eaton
   c. GE
   d. Siemens

C. Surge Protection Device Description: IEEE C62.41-compliant, integrally mounted, wired-in, solid-state, parallel-connected, modular (with field-replaceable modules) type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the switchboard short-circuit rating, and with the following features and accessories:

   1. Fuses, rated at 200-kA interrupting capacity.
   2. Fabrication using bolted compression lugs for internal wiring.
   3. Integral disconnect switch.
   4. Redundant suppression circuits.
   5. Redundant replaceable modules.
   6. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
   7. LED indicator lights for power and protection status.
   8. Audible alarm, with silencing switch, to indicate when protection has failed.
   9. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
   10. Six-digit, transient-event counter set to totalize transient surges.

D. Peak Single-Impulse Surge Current Rating: [160 kA per mode/320 kA per phase] [120 kA per mode/240 kA per phase] [80 kA per mode/160 kA per phase].

E. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.

F. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277-V, three-phase, four-wire circuits shall be as follows:

   1. Line to Neutral: 800 V for 480Y/277.
   2. Line to Ground: 800 V for 480Y/277.
   3. Neutral to Ground: 800 V for 480Y/277.

G. Protection modes and UL 1449 SVR for 240/120-V, three-phase, four-wire circuits with high leg shall be as follows:

   1. Line to Neutral: 400 V, 800 V from high leg.
   2. Line to Ground: 400 V.

3. Neutral to Ground: 400 V.

H. Protection modes and UL 1449 SVR for 240-, 480-, or 600-V, three-phase, three-wire, delta circuits shall be as follows:

1. Line to Line: 2000 V for 480 V.
2. Line to Ground: 1500 V for 480 V.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
    d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
6. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
7. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    e. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
    f. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system specified in Section 26 09 13 "Electrical Power Monitoring and Control."

g. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at [**55**] [**75**] percent of rated voltage.
h. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
i. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
j. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

B. Insulated-Case Circuit Breaker (ICCB): 100 percent rated, sealed, insulated-case power circuit breaker with interrupting capacity rating to meet available fault current.

1. Fixed circuit-breaker mounting.
2. Two-step, stored-energy closing.
3. Full-function, microprocessor-based trip units with interchangeable rating plug, trip indicators, and the following field-adjustable settings:

a. Instantaneous trip.
b. Long- and short-time time adjustments.
c. Ground-fault pickup level, time delay, and I^2t response.

4. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
5. Remote trip indication and control.
6. Communication Capability: Integral communication module with functions and features compatible with power monitoring and control system specified in Section 26 09 13 "Electrical Power Monitoring and Control."
7. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
8. Control Voltage: 120-V ac.

C. Bolted-Pressure Contact Switch: Operating mechanism uses rotary-mechanical-bolting action to produce and maintain high clamping pressure on the switch blade after it engages the stationary contacts.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Square D; a brand of Schneider Electric.
b. Eaton
c. GE
d. Siemens

2. Main-Contact Interrupting Capability: Minimum of 12 times the switch current rating.
3. Operating Mechanism: Manual handle operation to close switch; stores energy in mechanism for opening and closing.

a. Electrical Trip: Operation of lever or push-button trip switch, or trip signal from ground-fault relay or remote-control device, causes switch to open.
b. Mechanical Trip: Operation of mechanical lever, push button, or other device causes switch to open.

4. Auxiliary Switches: Factory installed, single pole, double throw, with leads connected to terminal block, and including one set more than quantity required for functional performance indicated.

5. Service-Rated Switches: Labeled for use as service equipment.
6. Ground-Fault Relay: Comply with UL 1053; self-powered type with mechanical ground-fault indicator, test function, tripping relay with internal memory, and three-phase current transformer/sensor.

    a. Configuration: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    b. Internal Memory: Integrates the cumulative value of intermittent arcing ground-fault currents and uses the effect to initiate tripping.
    c. No-Trip Relay Test: Permits ground-fault simulation test without tripping switch.
    d. Test Control: Simulates ground fault to test relay and switch (or relay only if "no-trip" mode is selected).

7. Open-Fuse Trip Device: Arranged to trip switch open if a phase fuse opens.

D. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

E. Fuses are specified in Section 26 28 13 "Fuses."

2.4 INSTRUMENTATION

A. Instrument Transformers: IEEE C57.13, NEMA EI 21.1, and the following:

1. Potential Transformers: IEEE C57.13; 120 V, 60 Hz, single secondary; disconnecting type with integral fuse mountings. Burden and accuracy shall be consistent with connected metering and relay devices.
2. Current Transformers: IEEE C57.13; 5 A, 60 Hz, secondary; wound type; [**double**] secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
3. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kVA.
4. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondary wiring to ground overcurrent relays, via shorting terminals, to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker, ground-fault protection.

B. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:

1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:

    a. Phase Currents, Each Phase: Plus or minus 1 percent.
    b. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
    c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
    d. Megawatts: Plus or minus 2 percent.
    e. Megavars: Plus or minus 2 percent.
    f. Power Factor: Plus or minus 2 percent.
    g. Frequency: Plus or minus 0.5 percent.
    h. Accumulated Energy, Megawatt Hours: Plus or minus 2 percent; accumulated values unaffected by power outages up to 72 hours.

i. Megawatt Demand: Plus or minus 2 percent; demand interval programmable from five to 60 minutes.
j. Contact devices to operate remote impulse-totalizing demand meter.

2. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.

C. Ammeters, Voltmeters, and Power-Factor Meters: ANSI C39.1.

1. Meters: 4-inch diameter or 6 inches square, flush or semiflush, with antiparallax 250-degree scales and external zero adjustment.
2. Voltmeters: Cover an expanded-scale range of nominal voltage plus 10 percent.

D. Instrument Switches: Rotary type with off position.

1. Voltmeter Switches: Permit reading of all phase-to-phase voltages and, where a neutral is indicated, phase-to-neutral voltages.
2. Ammeter Switches: Permit reading of current in each phase and maintain current-transformer secondaries in a closed-circuit condition at all times.

E. Feeder Ammeters: 2-1/2-inch minimum size with 90- or 120-degree scale. Meter and transfer device with off position, located on overcurrent device door for indicated feeder circuits only.

F. Watt-Hour Meters and Wattmeters:

1. Comply with ANSI C12.1.
2. Three-phase induction type with two stators, each with current and potential coil, rated 5 A, 120 V, 60 Hz.
3. Suitable for connection to three- and four-wire circuits.
4. Potential indicating lamps.
5. Adjustments for light and full load, phase balance, and power factor.
6. Four-dial clock register.
7. Integral demand indicator.
8. Contact devices to operate remote impulse-totalizing demand meter.
9. Ratchets to prevent reverse rotation.
10. Removable meter with drawout test plug.
11. Semiflush mounted case with matching cover.
12. Appropriate multiplier tag.

G. Impulse-Totalizing Demand Meter:

1. Comply with ANSI C12.1.
2. Suitable for use with switchboard watt-hour meter, including two-circuit totalizing relay.
3. Cyclometer.
4. Four-dial, totalizing kilowatt-hour register.
5. Positive chart drive mechanism.
6. Capillary pen holding a minimum of one month's ink supply.
7. Roll chart with minimum 31-day capacity; appropriate multiplier tag.
8. Capable of indicating and recording [**five**] [**15**] [**30**] <**Insert time period**>-minute integrated demand of totalized system.

2.5 CONTROL POWER

A. Control Circuits: 120-V ac, supplied through secondary disconnecting devices from control-power transformer.

B. Control Circuits: 120-V ac, supplied from remote branch circuit.

C. Electrically Interlocked Main and Tie Circuit Breakers: Two control-power transformers in separate compartments, with interlocking relays, connected to the primary side of each control-power transformer at the line side of the associated main circuit breaker. 120-V secondaries connected through automatic transfer relays to ensure a fail-safe automatic transfer scheme.

D. Control-Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.

E. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

2.6 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from switchboard. Include relay and meter test plugs suitable for testing switchboard meters and switchboard class relays.

C. Portable Circuit-Breaker Lifting Device: Floor-supported, roller-based, elevating carriage arranged for movement of circuit breakers in and out of compartments for present and future circuit breakers.

D. Overhead Circuit-Breaker Lifting Device: Mounted at top front of switchboard, with hoist and lifting yokes matching each drawout circuit breaker.

E. Spare-Fuse Cabinet: Suitably identified, wall-mounted, lockable, compartmented steel box or cabinet. Arrange for wall mounting.

2.7 IDENTIFICATION

A. Mimic Bus: Entire single-line switchboard bus work, as depicted on factory record drawing, on a photoengraved nameplate.

1. Nameplate: At least 0.032-inch- thick anodized aluminum, located at eye level on front cover of the switchboard incoming service section.

B. Mimic Bus: Entire single-line switchboard bus work, as depicted on factory record drawing, on an engraved laminated-plastic (Gravoply) nameplate.

1. Nameplate: At least 0.0625-inch- thick laminated plastic (Gravoply), located at eye level on front cover of the switchboard incoming service section.

C. Mimic Bus: Continuously integrated mimic bus factory applied to front of switchboard. Arrange in single-line diagram format, using symbols and letter designations consistent with final mimic-bus diagram.

D. Coordinate mimic-bus segments with devices in switchboard sections to which they are applied. Produce a concise visual presentation of principal switchboard components and connections.

E. Presentation Media: Painted graphics in color contrasting with background color to represent bus and components, complete with lettered designations.

F. Service Equipment Label: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store switchboards according to NEMA PB 2.1.

B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.

C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install switchboards and accessories according to NEMA PB 2.1.

B. Equipment Mounting: Install switchboards on concrete base, 4-inch nominal thickness. Comply with requirements for concrete base specified in Section 03 30 00 "Cast-in-Place Concrete." Section 03 30 53 "Miscellaneous Cast-in-Place Concrete."

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 switchboards.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

D. Comply with mounting and anchoring requirements specified in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

E. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.

F. Install filler plates in unused spaces of panel-mounted sections.

G. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.

1. Set field-adjustable switches and circuit-breaker trip ranges.

H. Install spare-fuse cabinet.

I. Comply with NECA 1.

3.3 CONNECTIONS

A. Comply with requirements for terminating feeder bus specified in Section 26 25 00 "Enclosed Bus Assemblies." Drawings indicate general arrangement of bus, fittings, and specialties.

B. Comply with requirements for terminating cable trays specified in Section 26 05 36 "Cable Trays for Electrical Systems." Drawings indicate general arrangement of cable trays, fittings, and specialties.

3.4 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. 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. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchboard. Remove front panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchboard 11 months after date of Substantial Completion.
c. Instruments and Equipment:

1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Switchboard will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges [as indicated.] [as specified in Section 26 05 73.16 "Overcurrent Protective Device Coordination Study."]

3.7 PROTECTION

A. Temporary Heating: Apply temporary heat, to maintain temperature according to manufacturer's written instructions, until switchboard is ready to be energized and placed into service.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories, and to use and reprogram microprocessor-based trip, monitoring, and communication units.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.
3. Load centers.
4. Electronic-grade panelboards.

1.2 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. SPD: Surge Protective Device

1.3 ACTION SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

D. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.6 MAINTENANCE MATERIAL SUBMITTALS

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.
2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.
3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. 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.

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.9 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Construction Manager's written permission.
3. Comply with NFPA 70E.

1.10 COORDINATION

A. Coordinate layout and installation of panelboards 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.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces.

B. Enclosures: Flush- and surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Outdoor Locations: NEMA 250, Type 3R.
c. Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.

3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
6. Finishes:

    a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    b. Back Boxes: Galvanized steel.
    c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.

7. Directory Card: Inside panelboard door, mounted in transparent card holder.

C. Incoming Mains Location: Top and bottom.

D. Phase, Neutral, and Ground Buses:

1. Material: Tin-plated aluminum.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
5. Split Bus: Vertical buses divided into individual vertical sections.

E. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Tin-plated aluminum.
2. Main and Neutral Lugs: Mechanical type.
3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
6. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
7. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

H. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, listed and labeled for series-connected short-circuit rating by an NRTL.

I. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

B. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1.

2.3 DISTRIBUTION PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Square D; a brand of Schneider Electric.
2. Eaton
3. GE
4. Siemens

5.

C. Panelboards: NEMA PB 1, power and feeder distribution type.

D. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

E. Mains: As indicated on plans.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

G. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

H. Branch Overcurrent Protective Devices: Fused switches.

I. Contactors in Main Bus: NEMA ICS 2, Class A, electrically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.

1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
2. External Control-Power Source: 120-V branch circuit.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Square D; a brand of Schneider Electric.
2. Eaton
3. GE
4. Siemens

C. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

D. Mains: As indicated on plans.

E. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

F. Contactors in Main Bus: NEMA ICS 2, Class A, electrically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.

1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
2. External Control-Power Source: 120-V branch circuit.

G. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

H. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Square D; a brand of Schneider Electric.

2. Eaton
3. GE
4. Siemens

C. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
    d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    e. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system specified in Section 26 09 13 "Electrical Power Monitoring and Control."
    f. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
    g. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
    h. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
    i. Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
    j. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
    k. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.

l. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
m. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
n. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

D. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

1. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in Section 26 28 13 "Fuses."
2. Fused Switch Features and Accessories: Standard ampere ratings and number of poles.
3. Auxiliary Contacts: One normally open and normally closed contact(s) that operate with switch handle operation.

2.6 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Equipment Mounting: Install panelboards on concrete bases, 4-inch nominal thickness. Comply with requirements for concrete base specified in Section 03 30 00 "Cast-in-Place Concrete." Section 03 30 53 "Miscellaneous Cast-in-Place Concrete."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of base.
2. For panelboards, 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 panelboards.
5. Attach panelboard to the vertical finished or structural surface behind the panelboard.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

D. Comply with mounting and anchoring requirements specified in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

E. Mount top of trim 90 inches above finished floor unless otherwise indicated.

F. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

G. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

H. Install filler plates in unused spaces.

I. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

J. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

K. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 26 05 53 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. 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. Perform the following infrared scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
    c. Instruments and Equipment:

        1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

F. Panelboards will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as provided by Engineer of Supplier's time-current coordination study approved by the Engineer.

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Receptacles with integral surge-suppression units.
4. Isolated-ground receptacles.
5. Hospital-grade receptacles.
6. Tamper-resistant receptacles.
7. Weather-resistant receptacles.
8. Snap switches and wall-box dimmers.
9. Solid-state fan speed controls.
10. Wall-switch and exterior occupancy sensors.
11. Communications outlets.
12. Pendant cord-connector devices.
13. Cord and plug sets.
14. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.2 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Service/Power Poles: One for every 10, but no fewer than one.
2. Floor Service-Outlet Assemblies: One for every 10, but no fewer than one.
3. Poke-Through, Fire-Rated Closure Plugs: One for every five floor service outlets installed, but no fewer than two.
4. TVSS Receptacles: One for every 10 of each type installed, but no fewer than two of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).

2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).

3. Leviton Mfg. Company Inc. (Leviton).

4. Pass & Seymour/Legrand (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 5351 (single), CR5362 (duplex).

b. Hubbell; HBL5351 (single), HBL5352 (duplex).

c. Leviton; 5891 (single), 5352 (duplex).

d. Pass & Seymour; 5361 (single), 5362 (duplex).

B. Hospital-Grade, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 8310 (single), 8300 (duplex).

b. Hubbell; HBL8310 (single), HBL8300 (duplex).

c. Leviton; 8310 (single), 8300 (duplex).

d. Pass & Seymour; 8301 (single), 8300H (duplex).

2. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.

C. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; IG5362RN.

b. Hubbell; IG5362.

c. Leviton; 5362-IG.

d. Pass & Seymour; IG5362.

2. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

D. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; TR8300.

b. Hubbell; HBL8300SGA.

c. Leviton; 8300-SGG.

d. Pass & Seymour; TR63H.

2.4 GFCI RECEPTACLES

A. General Description:

1. Straight blade, feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; VGF20.

b. Hubbell; GFR5352L.

c. Pass & Seymour; 2095.

d. Leviton; 7590.

C. Tamper-Resistant GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; GFTR20.

b. Pass & Seymour; 2095TR.

D. Hospital-Grade, Duplex GFCI Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; VGFH20.

b. Hubbell; HFR8300HL.

c. Leviton; 7899-HG.

d. Pass & Seymour; 2095HG.

2.5 TVSS RECEPTACLES

A. General Description: Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 1449, and FS W-C-596, with integral TVSS in line to ground, line to neutral, and neutral to ground.

1. TVSS Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 V and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
2. Active TVSS Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."

B. Duplex TVSS Convenience Receptacles:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 5362BLS.

b. Hubbell; HBL5362SA.

c. Leviton; 5380.

d. Pass & Seymour; 5362BLSP.

2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 Configuration 5-20R.

C. Isolated-Ground, Duplex Convenience Receptacles:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; IG5362BLS.

b. Hubbell; IG5362SA.

c. Leviton; 5380-IG.

d. Pass & Seymour; IG5362BLSP.

2. Description:

   a. Straight blade, 125 V, 20 A; NEMA WD 6 Configuration 5-20R.
   b. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

D. Hospital-Grade, Duplex Convenience Receptacles: Comply with UL 498 Supplement sd.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Cooper; 8300BLS.

   b. Hubbell; HBL8362SA.

   c. Leviton; 8380.

   d. Pass & Seymour; 8300BLSP.

2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 Configuration 5-20R.
3. 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.
4. Comply with NFPA 70.

E. Isolated-Ground, Hospital-Grade, Duplex Convenience Receptacles:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Cooper; IG8300HGBLS.

   b. Hubbell; IG8362SA.

   c. Leviton; 8380-IG.

   d. Pass & Seymour; IG8300BLSP.

2. Description:

   a. Straight blade, 125 V, 20 A; NEMA WD 6 Configuration 5-20R.
   b. Comply with UL 498 Supplement sd.
   c. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.6 HAZARDOUS (CLASSIFIED) LOCATION RECEPTACLES

A. Wiring Devices for Hazardous (Classified) Locations: Comply with NEMA FB 11 and UL 1010.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. Cooper Crouse-Hinds.

   b. EGS/Appleton Electric.

   c. Killark; Division of Hubbell Inc.

2.7 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; CWL520R.

   b. Hubbell; HBL2310.

   c. Leviton; 2310.

   d. Pass & Seymour; L520-R.

B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Cooper; IGL520R.

   b. Hubbell; IG2310.

   c. Leviton; 2310-IG.

   d. Pass & Seymour; IG4700.

2. Description:

   a. Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.
   b. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.8 PENDANT CORD-CONNECTOR DEVICES

A. Description:

1. Matching, locking-type plug and receptacle body connector.

2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
4. 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.

2.9 CORD AND PLUG SETS

A. Description:

1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.10 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

1) Single Pole:

Cooper; AH1221.
Hubbell; HBL1221.

Leviton; 1221-2.

Pass & Seymour; CSB20AC1.

2) Two Pole:

Cooper; AH1222.
Hubbell; HBL1222.

Leviton; 1222-2.

Pass & Seymour; CSB20AC2.

3) Three Way:

Cooper; AH1223.
Hubbell; HBL1223.

Leviton; 1223-2.

Pass & Seymour; CSB20AC3.

4) Four Way:

Cooper; AH1224.
Hubbell; HBL1224.

Leviton; 1224-2.

Pass & Seymour; CSB20AC4.

C. Pilot-Light Switches, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Cooper; AH1221PL for 120 and 277 V.

   b. Hubbell; HBL1201PL for 120 and 277 V.

   c. Leviton; 1221-LH1.

   d. Pass & Seymour; PS20AC1RPL for 120 V, PS20AC1RPL7 for 277 V.

2. Description: Single pole, with neon-lighted handle, illuminated when switch is "off."

D. Key-Operated Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Cooper; AH1221L.

   b. Hubbell; HBL1221L.

   c. Leviton; 1221-2L.

   d. Pass & Seymour; PS20AC1-L.

2. Description: Single pole, with factory-supplied key in lieu of switch handle.

E. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Cooper; 1995.

   b. Hubbell; HBL1557.

   c. Leviton; 1257.

   d. Pass & Seymour; 1251.

F. Key-Operated, Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Cooper; 1995L.

   b. Hubbell; HBL1557L.

   c. Leviton; 1257L.

   d. Pass & Seymour; 1251L.

2.11 DECORATOR-STYLE DEVICES

A. Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Cooper; 6252.

   b. Hubbell; DR15.

   c. Leviton; 16252.

   d. Pass & Seymour; 26252.

B. Tamper-Resistant Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Cooper; TR6252.

   b. Hubbell; DR15TR.

   c. Pass & Seymour; TR26252.

2. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section.

C. Tamper-Resistant and Weather-Resistant Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Cooper; TWRBR15.

   b. Hubbell; DR15TR.

   c. LevitonTRW15.

   d. Pass & Seymour; TRW26252.

2. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section, when installed in wet and damp locations.

D. GFCI, Feed-Through Type, Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, UL 498, and UL 943 Class A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; VGF15.

b. Hubbell; GF15LA.

c. Leviton; 8599.

d. Pass & Seymour; 1594.

E. GFCI, Tamper-Resistant and Weather-Resistant Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, UL 498, and UL 943 Class A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; TWRVGF15.

b. Hubbell; GFTR15.

c. Pass & Seymour; 1594TRWR.

2. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section.

F. Toggle Switches, Square Face, 120/277 V, 15 A: Comply with NEMA WD 1, UL 20, and FS W-S-896.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 7621 (single pole), 7623 (three way).

b. Hubbell; DS115 (single pole), DS315 (three way).

c. Leviton; 5621-2 (single pole), 5623-2 (three way).

d. Pass & Seymour; 2621 (single pole), 2623 (three way).

G. Lighted Toggle Switches, Square Face, 120 V, 15 A: Comply with NEMA WD 1 and UL 20.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 7631 (single pole), 7633 (three way).

b. Hubbell; DS120IL (single pole), DS320 (three way).

c. Leviton; 5631-2 (single pole), 5633-2 (three way).

d. Pass & Seymour; 2625 (single pole), 2626 (three way).

2. Description: With neon-lighted handle, illuminated when switch is "off."

2.12 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch- thick, satin-finished, Type 302 stainless steel.
3. Material for Unfinished Spaces: Smooth, high-impact thermoplastic.
4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.13 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular, solid brass with satin finish.

D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.

E. Voice and Data Communication Outlet: Blank cover with bushed cable opening

2.14 POKE-THROUGH ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Hubbell Incorporated; Wiring Device-Kellems.

2. Pass & Seymour/Legrand.

3. Square D/Schneider Electric.

4. Thomas & Betts Corporation.

5. Wiremold/Legrand.

C. Description:

1. Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
2. Comply with UL 514 scrub water exclusion requirements.
3. Service-Outlet Assembly: Pedestal type with services indicated complying with requirements in Section 27 15 00 "Communications Horizontal Cabling."
4. Size: Selected to fit nominal 3-inch cored holes in floor and matched to floor thickness.
5. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
6. Closure Plug: Arranged to close unused 3-inch cored openings and reestablish fire rating of floor.
7. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of four, four-pair cables that comply with requirements in Section 27 15 00 "Communications Horizontal Cabling."

2.15 PREFABRICATED MULTIOUTLET ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Universal Electric Corp. (Starline)

2. Mono-Systems SWA4800 Series 2 Compartment Aluminum Raceway, 6” x 2.3”

3. Hubbell Incorporated; Wiring Device-Kellems.

4. Wiremold/Legrand G3000 Series.

C. Description:

1. Two-piece surface metal raceway, with factory-wired multioutlet harness.
2. Components shall be products from single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

D. Raceway Material: Metal, with manufacturer's standard finish.

E. Multioutlet Harness:

1. Receptacles: 15-A, 125-V, NEMA WD 6 Configuration 5-15R receptacles complying with NEMA WD 1, UL 498, and FS W-C-596.
2. Receptacle Spacing: 18 inches.
3. Wiring: No. 12 AWG solid, Type THHN copper, single circuit.

2.16 SERVICE POLES

A. Description:

1. Factory-assembled and -wired units to extend power and voice and data communication from distribution wiring concealed in ceiling to devices or outlets in pole near floor.
2. Poles: Nominal 2.5-inch- square cross section, with height adequate to extend from floor to at least 6 inches above ceiling, and with separate channels for power wiring and voice and data communication cabling.
3. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment.
4. Finishes: Manufacturer's standard painted finish and trim combination.
5. Wiring: Sized for minimum of five No. 12 AWG power and ground conductors and a minimum of four, four-pair, Category 3 or Category 5 voice and data communication cables.
6. Power Receptacles: Two duplex, 20-A, straight-blade receptacles complying with requirements in this Section.
7. Voice and Data Communication Outlets: Blank insert with bushed cable opening complying with requirements in Section 27 15 00 "Communications Horizontal Cabling."

2.17 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.
3. TVSS Devices: Blue.
4. Isolated-Ground Receptacles: Orange.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.

2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the left.
2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.

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. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Identify each receptacle with panelboard identification and circuit number. Use machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
2. Test Instruments: Use instruments that comply with UL 1436.
3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Test straight-blade convenience outlets in patient-care areas for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz..

D. Wiring device will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION

SECTION 26 28 13

FUSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600-V ac and less for use in enclosed switches, enclosed controllers, and motor-control centers.
2. Plug fuses rated 125-V ac and less for use in plug-fuse-type enclosed switches fuseholders and panelboards.
3. Plug-fuse adapters for use in Edison-base, plug-fuse sockets.
4. Spare-fuse cabinets.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

    a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
    b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
3. Current-limitation curves for fuses with current-limiting characteristics.
4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
5. Coordination charts and tables and related data.
6. Fuse sizes for elevator feeders and elevator disconnect switches.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. Include the following:

1. Ambient temperature adjustment information.
2. Current-limitation curves for fuses with current-limiting characteristics.

3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
4. Coordination charts and tables and related data.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

B. 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.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Comply with UL 248-11 for plug fuses.

1.6 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.7 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Bussmann, Inc.

2. Edison Fuse, Inc.

3. Ferraz Shawmut, Inc.

4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

2.3 PLUG FUSES

A. Characteristics: UL 248-11, nonrenewable plug fuses; 125-V ac.

2.4 PLUG-FUSE ADAPTERS

A. Characteristics: Adapters for using Type S, rejection-base plug fuses in Edison-base fuseholders or sockets; ampere ratings matching fuse ratings; irremovable once installed.

2.5 SPARE-FUSE CABINET

A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.

1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
2. Finish: Gray, baked enamel.
3. Identification: "SPARE FUSES" in 1-1/2-inch- high letters on exterior of door.
4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:

1. Service Entrance: Class RK1, time delay.
2. Feeders: Class RK1, time delay.
3. Motor Branch Circuits: Class RK5, time delay.
4. Other Branch Circuits: Class RK5, time delay.
5. Control Circuits: Class CC, fast acting.

B. Plug Fuses:

1. Motor Branch Circuits: Edison-base type, dual-element time delay.
2. Other Branch Circuits: Edison-base type, dual-element time delay.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install plug-fuse adapters in Edison-base fuseholders and sockets. Ensure that adapters are irremovable once installed.

C. Install spare-fuse cabinet(s).

3.4 IDENTIFICATION

A. Install labels and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION

SECTION 26 28 16

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Receptacle switches.
4. Shunt trip switches.
5. Molded-case circuit breakers (MCCBs).
6. Molded-case switches.
7. Enclosures.

1.2 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of NRTL listing for series rating of installed devices.

5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

D. Manufacturer's field service report.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. Include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Fuse Pullers: Two for each size and type.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. 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.

E. Comply with NFPA 70.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Construction Manager no fewer than seven days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Construction Manager's written permission.
4. Comply with NFPA 70E.

1.10 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit. (Basis of Design)

2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Siemens Energy & Automation, Inc.

4. Square D; a brand of Schneider Electric.

C. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Type HD, Heavy Duty, Six Pole, Single Throw, 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

E. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

F. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
6. Hookstick Handle: Allows use of a hookstick to operate the handle.
7. Lugs: Mechanical type, suitable for number, size, and conductor material.
8. Service-Rated Switches: Labeled for use as service equipment.

2.2 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit. (Basis of Design)
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

C. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Type HD, Heavy Duty, Six Pole, Single Throw, 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

E. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

F. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
5. Hookstick Handle: Allows use of a hookstick to operate the handle.
6. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 RECEPTACLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

C. Type HD, Heavy-Duty, Single-Throw Fusible Switch: 600-V ac, 30 60 100 A; UL 98 and NEMA KS 1; horsepower rated, with clips or bolt pads to accommodate specified fuses; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

D. Type HD, Heavy-Duty, Single-Throw Nonfusible Switch: 600-V ac, 30 60 100 A; UL 98 and NEMA KS 1; horsepower rated, lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

E. Interlocking Linkage: Provided between the receptacle and switch mechanism to prevent inserting or removing plug while switch is in the on position, inserting any plug other than specified, and turning switch on if an incorrect plug is inserted or correct plug has not been fully inserted into the receptacle.

F. Receptacle: Polarized, three-phase, four-wire receptacle (fourth wire connected to enclosure ground lug).

2.4 SHUNT TRIP SWITCHES

A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Cooper Bussmann, Inc.
2. Ferraz Shawmut, Inc.
3. Littelfuse, Inc.

C. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class J fuses.

D. Switches: Three-pole, horsepower rated, with integral shunt trip mechanism and Class J fuse block; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

E. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, with a control power transformer of enough capacity to operate shunt trip, connected pilot, and indicating and control devices.

F. Accessories:

1. Oiltight key switch for key-to-test function.
2. Oiltight green ON pilot light.
3. Isolated neutral lug; 100 percent rating.
4. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
5. Form C alarm contacts that change state when switch is tripped.
6. Three-pole, double-throw, fire-safety and alarm relay; 120-V ac coil voltage.
7. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.

2.5 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Siemens Energy & Automation, Inc.

4. Square D; a brand of Schneider Electric.

C. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

D. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

E. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

F. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I^2t response.

G. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

H. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.

I. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

J. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

K. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system, specified in Section 26 09 13 "Electrical Power Monitoring and Control."
6. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
7. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
8. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
9. Alarm Switch: One NO NC contact that operates only when circuit breaker has tripped.
10. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
11. Zone-Selective Interlocking: Integral with electronic ground-fault trip unit; for interlocking ground-fault protection function.
12. Electrical Operator: Provide remote control for on, off, and reset operations.
13. Accessory Control Power Voltage: Integrally mounted, self-powered;.

2.6 MOLDED-CASE SWITCHES

A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Siemens Energy & Automation, Inc.

4. Square D; a brand of Schneider Electric.

C. General Requirements: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.

D. Features and Accessories:

1. Standard frame sizes and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
6. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.
7. Alarm Switch: One NO contact that operates only when switch has tripped.
8. Key Interlock Kit: Externally mounted to prohibit switch operation; key shall be removable only when switch is in off position.
9. Zone-Selective Interlocking: Integral with ground-fault shunt trip unit; for interlocking ground-fault protection function.
10. Electrical Operator: Provide remote control for on, off, and reset operations.
11. Accessory Control Power Voltage: Integrally mounted, self-powered;.

2.7 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
6. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7 Type 9.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements 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 metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. 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. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.

c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges[as specified in Section 26 05 73.16 "Overcurrent Protective Device Coordination Study."]

END OF SECTION

SECTION 26 51 00

LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.

1.2 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color-rendering index.

C. LER: Luminaire efficacy rating.

D. Lumen: Measured output of lamp and luminaire, or both.

E. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. Ballast, including BF.
4. Energy-efficiency data.
5. Air and Thermal Performance Data: For air-handling lighting fixtures.
6. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
7. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

    a. Testing Agency Certified Data: For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.

b. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

C. Samples: For each lighting fixture indicated in the Interior Lighting Fixture Schedule. Each Sample shall include the following:

1. Lamps and ballasts, installed.
2. Cords and plugs.
3. Pendant support system.

D. Installation instructions.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Lighting fixtures.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extends to within 12 inches of the plane of the luminaires.
4. Ceiling-mounted projectors.
5. Structural members to which suspension systems for lighting fixtures will be attached.
6. Other items in finished ceiling including the following:

a. Air outlets and inlets.
b. Speakers.
c. Sprinklers.
d. Smoke and fire detectors.
e. Occupancy sensors.
f. Access panels.

7. Perimeter moldings.

B. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

C. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.

D. Field quality-control reports.

E. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Plastic Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Ballasts: One for every 100 of each type and rating installed. Furnish at least one of each type.
4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.7 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910, complying with the IESNA Lighting Measurements Testing & Calculation Guides.

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.

D. Comply with NFPA 70.

E. FM Global Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

F. Mockups: Provide interior lighting fixtures for room or module mockups, complete with power and control connections.

1. Obtain Architect's approval of fixtures for mockups before starting installations.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
3. Approved fixtures in mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.9 WARRANTY

A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
2. Warranty Period for Emergency Fluorescent Ballast and Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Metal Parts: Free of burrs and sharp corners and edges.

C. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

D. 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.

E. Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
b. UV stabilized.

2. Glass: Annealed crystal glass unless otherwise indicated.

F. Air-Handling Fixtures: For use with plenum ceiling for air return and heat extraction and for attaching an air-diffuser-boot assembly.

1. Air-Supply Units: Slots in one or both side trims join with air-diffuser-boot assemblies.
2. Heat-Removal Units: Air path leads through lamp cavity.
3. Combination Heat-Removal and Air-Supply Unit: Heat is removed through lamp cavity at both ends of the fixture door with air supply same as for air-supply units.
4. Dampers: Operable from outside fixture for control of return-air volume.
5. Static Fixture: Air-supply slots are blanked off, and fixture appearance matches active units.

2.3 EMERGENCY POWER UNIT

A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.

B. External Type: Self-contained, modular, battery-inverter unit, remote mounted from lighting fixture. Comply with UL 924.

2.4 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:
1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

a. Battery: Sealed, maintenance-free.
b. Charger: Fully automatic, solid-state type with sealed transfer relay.
c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

3. Master/Remote Sign Configurations:

a. Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in LED power supply for power connection to remote unit.
b. Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery, and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.

C. Self-Luminous Signs: Powered by tritium gas, with universal bracket for flush-ceiling, wall, or end mounting. Signs shall be guaranteed by manufacturer to maintain the minimum brightness requirements in UL 924 for 20 years.

D. Self-Luminous Signs: Using strontium oxide aluminate compound to store ambient light and release the stored energy when the light is removed. Provide with universal bracket for flush-ceiling, wall, or end mounting.

2.5 EMERGENCY LIGHTING UNITS

A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
7. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.
8. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
9. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.6 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Section 26 05 29 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.

F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures:

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
2. Install lamps in each luminaire.

B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

C. Remote Mounting of Ballasts: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.

D. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.

1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches from lighting fixture corners.
2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

E. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

F. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.

3.2 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Verify that self-luminous exit signs are installed according to their listing and the requirements in NFPA 101.

C. 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.

3.3 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.

1. Adjust aimable luminaires in the presence of Architect.

END OF SECTION

SECTION 28 31 00

FIRE DETECTION AND ALARM

PART 1 GENERAL

1.1 SCOPE

A. This specification provides the requirements for the installation, programming and configuration of a complete Addressable Intelligent Life Safety System Network. The system shall include, but not limited to: Automatic and Manually activated alarm Initiating and Indicating Peripheral Devices and Appliances, conduit, wire and accessories required to furnish a complete and operational Life Safety System as shown on the drawings, as specified, and as directed by the Architect/Engineer.

B. The work covered by this section of the specification is to be coordinated with the related work as specified elsewhere under the project specifications.

C. The Fire Alarm System shall consist of all necessary hardware equipment and software programming to perform the following functions:

1. Provide all fire alarm devices, conduit, wire, boosters, initiating, and notification devices as indicated and as required by the AHJ as part of the deferred fire alarm submittal.

1.1 REFERENCES

A. The equipment and installation shall comply with the current provisions of the following standards:

National Electric Code, Article 760.
National Fire Protection Association Standards:
NFPA72 National Fire Alarm Code
NFPA101 Life Safety Code
Local and State Building Codes.
Local Authorities Having Jurisdiction.
Underwriters Laboratories Inc.

The system and all components shall be listed by Underwriters Laboratories Inc. for use in fire protective signaling system under the following standards as applicable:

UL 864/UOJZ, APOU Control Units for Fire Protective Signaling Systems.
UL 268 Smoke Detectors for Fire Protective Signaling Systems.
UL 217 Smoke Detectors Single Station.
UL 521 Heat Detectors for Fire Protective Signaling Systems.
UL 228 Door Holders for Fire Protective Signaling Systems.

UL 464 Audible Signaling Appliances.
UL 1638 Visual Signaling Appliances.
UL 38 Manually Activated Signaling Boxes.
UL 346 Waterflow Indicators for Fire Protective Signaling Systems.
UL 1971 Standard for Signaling Devices for the Hearing Impaired
UL 1481 Power Supplies for Fire Protective Signaling Systems.
UL 1711 Amplifiers for Fire Protective Signaling Systems.

Americans with Disabilities Act (ADA)

International Standards Organization (ISO)
ISO-9000
ISO-9001

1.2 SYSTEM DESCRIPTION

A. The Fire Alarm / Life Safety System supplied under this specification shall be a microprocessor-based network system. All Control Panel Assemblies and connected Field Appliances shall be both designed and manufactured by the same company, and shall be tested and cross-listed as compatible to ensure that a fully functioning Life Safety System is designed and installed.

1.3 QUALITY ASSURANCE

Qualifications

1. The installing ESD shall provide proof of their qualifications as Factory Authorization and Factory Training for the product(s) specified herein. These qualification credentials shall not be more than two years old, to ensure up-to-date product and application knowledge on the part of the installing ESD.

Warranty

2. Warranty all materials, installation and workmanship for three (3) years from date of acceptance, unless otherwise specified.
3. A copy of the manufacturers' warranty shall be provided with close-out documentation and included with the operation and installation manuals.

1.4 SYSTEM STARTUP, OWNERS' INSTRUCTIONS, COMMISSIONING SYSTEM

A. Startup shall be performed by a Factory Trained and Authorized Engineered Systems Distributor.

B. Certain functions of the Systems Startup Procedure may be performed by a contractor under the direction of the Factory Trained and Authorized Engineered Systems Distributor.

C. Owners' Instructions and Operation Manuals, specific for this project, shall be supplied to the Building Operations Staff by the Factory Trained and Authorized Engineered Systems Distributor. A "Generic" or "Typical" Owners' Instruction and Operation Manual shall not be acceptable to fulfill this requirement.

D. Commissioning of the installed system shall be performed by the Factory Trained and Authorized Engineered Systems Distributor in the presence of the Local AHJ, the Building Owners' Representative, and a Representative of the General Contractor, if deemed appropriate.

E. A System Generated device map, which will serve as an "as-built" drawing shall be provided to the Local AHJ and the Building Owners' Representative.

PART 2 DESIGN STANDARDS

2.1 This Life Safety System Specification must be conformed to in its entirety to ensure that the installed and programmed Life Safety System will accommodate all of the future requirements and operations required by the building owner. Any specified item or operational feature not specifically addressed prior to bid date will be required to be met without exception.

2.2 Submission of product purported to be equal to those specified herein will be considered as possible substitutes only when all of the following requirements have been met:

2.3 Any deviation from the equipment, operations, methods, design or other criteria specified herein must be submitted in detail to the Specifying Architect or Engineer a minimum of 10 working days prior to the scheduled submission of bids. Each deviation from the operation detailed in these specifications must be documented in detail, including Page Number and Section Number that lists the system function for which the substitution is being proposed.

2.4 A complete list of such substituted products, with three (3) copies of working drawings for each, shall be submitted to and be approved by the architect and/or consulting engineer, not less than ten (15) calendar days prior to the scheduled date for opening bids.

2.5 The contractor or substitute bidder shall functionally demonstrate that the proposed substituted products are, in fact, equal in quality and performance to those specified herein. Because the decision to specify the Life Safety System(s) and Equipment detailed herein was made by an Architect and/or Consulting Engineer on behalf of their client(s) (the Building Owners), such evidence of the applicability of any substitute materials must be submitted to, and accepted by, the Architect and/or Consulting Engineer, not less than ten (15) calendar days prior to the scheduled date for opening bids for this project. Substitute equipment will be accepted only on the discretion of the Architect and/or Consulting Engineer on behalf of the Building Owner.

2.6 EQUIPMENT AND MATERIAL GENERAL REQUIREMENTS

A. All equipment furnished for this project shall be new and unused. All components and systems shall be designed for uninterrupted duty. All equipment, materials, accessories, devices, and other facilities covered by this specification or noted on contract drawings and installation specifications shall be the best suited for the intended use and shall be provided by a single manufacturer. If any of the equipment provided under this Specification is provided by different manufacturers, then that equipment shall be recognized as compatible by both manufacturers, and “Listed” as such by Underwriters’ Laboratories.

B. System installation and operations shall be verified by the manufacturer’s representative and a verification certificate presented upon completion. The manufacturer’s representative shall be responsible for an on-site demonstration of the operation of the system and initial staff training as required by the Architect and/or Consulting Engineer.

C. The system shall be capable of detecting the electrical location of each Signature intelligent device including new and existing devices. It shall be possible to display the intelligent device map on the laptop PC.

D. If a device map cannot be generated by the Control Panel, the contractor must include a minimum of (3) days to verify location of all wire runs while in the presence of the Architect/Engineer or Building Owners Representative to verify all conduit and wire runs.

E. In addition, “As-Built” riser and wiring diagrams reflecting all T-Taps, each programmed device characteristic including detector type, base type, serial number, sensitivity setting and wire configurations will be provided to the Architect/Engineer, based on the information gathered during the verification process described above.

F. It shall be possible for authorized service personnel using a Program/Service Tool or laptop PC to change the personality/function of a Signature Series Device to meet changes in building layout or environment. System changes shall be verified by the manufacturer’s representative and a verification certificate presented upon completion.

2.7 MANUFACTURERS

A. Equipment and materials shall be provided to ensure proper Specification Adherence, final connection, test, turnover, warranty compliance, and service.

B. Service availability: The supplier shall have sufficient stock on hand and have a fully equipped service organization capable of guaranteeing response time within 8 hours of service calls, 24 hours a day, 7 days a week to service completed systems.

C. The Engineered Systems Distributor of the Fire Alarm / Life Safety Equipment specified herein shall provide a copy of their certificate of successful completion of an authorized Training Course given by the Manufacturer of the Fire Alarm / Life Safety Equipment.

2.8 EQUIPMENT

A. The Life Safety System shall be a Multi-Processor Based Network System designed specifically for Fire, Audio Evacuation and Security applications. The Life Safety System shall be a Model EST3, and shall be UL listed under Standards 864 (Control Units for Fire-Protective Signaling Systems) under categories UOJZ and APOU, and ULC listed under standard CAN/ULC-S527. The specified modules shall also be listed under UL 1076 (Proprietary Burglar Alarm Units and Systems) under category APOU.

B. The Life Safety System shall include all required hardware and system programming to provide a complete and operational system, capable of providing the protected premises with the following functions and operations:

1. Modular systems design, with a layered application design concept, including an “Operational Layer” and a “Human Interface Layer”, to allow maximum flexibility of the system with a minimum physical size requirement.
2. All System operational software is to be stored in FLASH memory. Control Panel disassembly, and replacement of electronic components of any kind shall not be required in order to upgrade the operations of the installed system to conform to future application code and operating system changes.
3. Up to 128 Service Groups must be definable within the system program to allow the testing of the installed system based on the physical layout of the system, not on the wiring of the field circuits connected to the Fire Alarm Control Panel.
4. Advanced Windows-based System Definition Utility with Program Version Reporting to document any and all changes made during system start-up or system commissioning. Time and Date Stamps of all modifications made to the program must be included to allow full retention of all previous program version data.
5. System response to any alarm condition must occur within 3 seconds, regardless of the size and the complexity of the installed system.
6. One amplifier shall be supplied per speaker circuit to enhance system survivability.
7. HVAC Status LED Illumination shall be controlled by the activation of the output device. A “Flash”, followed by a “Steady” illumination will verify operation without the need for a “sail” switch in each air handling unit.
8. System Common Control Functions shall be automatically routed to any node of the system as a function of the time of day and date.

2.9 THE LIFE SAFETY SYSTEM

A. Life Safety System Mechanical and Overall Feature Summary - The Life Safety System shall include the following features and shall support the following operations in each installed cabinet or node of the system:

1. Up to 10 Signature Series Intelligent Device loops.
2. Up to 125 Intelligent Smoke Detectors and 125 Intelligent Modules per SDC.
3. Up to 120 Hardwired input/output Circuits.
4. Up to 342 Manual Control (Input) Switches

5. Up to 456 LED Annunciation Points
6. Up to 63 Remote Display Units.
7. Multi-Priority, token passing, peer-to-peer network connection of up to 64 system nodes wired as Class A (Style 7).
8. Ground fault detection by panel, by Signature Data Circuit, and by device module.
9. Ability to download all system applications programs and “firmware” from a computer through a single
10. point in the system.
11. True Distributed Intelligence, including microprocessor-based Detectors and Modules.
12. AC Power Trouble Delay adjustable from 4 Hours to 10 Hours.
13. Removable, Interlocked terminal blocks for the connection of the field wiring to the Fire Alarm Control Panel.
14. Electronic Addressing of Field Devices.
15. Advanced Power Management
16. Dead Front Construction.

B. Life Safety System Human Interface System Common Controls and Emergency User Interface

1. The Fire Alarm / Life Safety System shall include an Emergency Operators’ Interface Panel that shall include the following system annunciation and control functions:
2. System Annunciation and Control Functions:
    a. Hands Free Emergency Operation. The first and last highest priority event on the system shall be displayed automatically and simultaneously.
    b. Control Panel Internal Audible Signal shall have four programmable signal patterns, to allow for the easy differentiation between Alarm, Supervisory, Trouble and Monitor conditions within the installed system.
3. Discreet “System Status” LEDs:
    a. Power Status LED - Green LED shall illuminate when AC power is present.
    b. Test Status LED - Yellow LED shall illuminate when any portion of the system is in the test mode. A programmable timer shall cause the system to automatically exit the test mode after a period of system inactivity. This Test LED shall function in a local or in a group mode.
    c. CPU Fail Status LED - Yellow LED shall illuminate when the panel controller has an internal failure.
    d. Ground Fault Status LED - Yellow LED shall illuminate when ungrounded wiring connected to the cabinets’ power supply has continuity to ground. This feature shall function in either a local or group mode.
    e. Disable Status LED - Yellow LED shall illuminate whenever any point or zone in the installed system is manually disabled.
4. Discreet Common Control Switches with Associated Status LEDs:
    a. Reset: Depression of the Reset Switch starts the system reset operation. The associated Yellow LED shall have three flash rates during this operation to inform the user of the progress status of the reset cycle. The LED shall flash fast during the smoke detector power down sequence, then it shall flash slowly during the restart phase, and shall illuminate steadily or the restoral phase. The LED shall go out completely when the system is back to normal mode.

Each phase, as well the overall reset cycle shall be programmable to perform other functions.

b. Alarm Silence: Depression of the Alarm Silence Switch shall turn off all (audible and/or visible) Notification Appliance Circuits. The associated yellow LED illuminates when the Alarm Silence function is active, whether by the Alarm Silence Switch, or by an integral software timer. Subsequent activation of the Alarm Silence Switch shall resound the signals. Activation of the Alarm Silence switch shall be programmable to perform other functions.

c. Panel Silence: Depression of the Panel Silence Switch shall turn off the systems' internal audible signal when configured as a 'local' system. The associated yellow LED illuminates when the panel silence feature is activated.

d. Drill Switch / LED: Depressing the DRILL switch activates the fire drill function. Yellow LED indicates that the fire drill function is active. The Drill Switch shall also be programmable to perform system functions other than the Drill Function.

5. Other Operator Control Switches:

a. Previous Message Switch: Pressing the Previous Message Switch shall scroll the display to show the preceding message in the selected queue. Holding the Previous Message Switch and pressing any queue select switch moves to the top of the respective queue event list. Scrolling through event messages may be done by the operator at any time.

b. Next Message Switch: Pressing the Next Message Switch shall scroll the display to show the following message in the selected queue. Holding the Previous Message Switch and pressing any queue select switch moves to the bottom of the respective queue event list. Scrolling through event messages may be done by the operator at any time.

c. More Details Switch: Pressing the More Details Switch shall show the address and 42 character location message of the active device on display. If a zone is active, pressing the switch displays the address and message of active devices within the zone. When multiple devices are active, the "Previous/Next" message switch may be used to scroll through the messages.

6. The System Main Liquid Crystal Display:

a. The Liquid Crystal display shall provide the means to inform the System Operator with detailed information about the off-normal status of the installed Fire Alarm / Life Safety System. The Main Display shall automatically respond to the status of the system, and shall display that status on a 8 line by 21 character backlit alpha-numeric Graphical Liquid Crystal Display.

7. Automatic Functions:

1. The following status functions shall be annunciated by the Main Liquid Crystal Display:

2. When the Fire Alarm / Life Safety System is in the "Normal" Mode, the LCD displays:

a. The current Date and Time.

b. A Custom System Title (2 lines X 21 characters).

c. A summary total of the Alarm History of the system.

3. With the Fire Alarm Life Safety System in the Alarm Mode, the LCD shall automatically reconfigure into four logical windows.

8. Systems Status Window - The LCD shall show the system time, and the number of active points and disabled points in the system in this section of the LCD Display.
9. Current Event Window - The LCD shall show the first active event of the highest priority in reverse text to highlight the condition to the Emergency Operator. The top line of the reversed text shall show the sequence number in which the displayed event was received, as well as its event type. The second and third lines of reversed text shall display an identification message related to the displayed event.
10. Last Event Window - The LCD shall show the most recent, highest priority event received by the system.
11. Type Status Window - The LCD shall show the total number of active events in the system, by event type. There shall be four different System Event Types that shall be displayed, “Alarm Events”, “Supervisory Events”, “Active Trouble Events”, and “Active Monitor Events”.
12. System Message Processing: In order to simplify, and to clarify the System Status information that is given to the Emergency Operator, the Main LCD shall include queues for each of the System Event Types. The Main LCD shall allow the Emergency operator access to the System Status information contained within those queues by pressing an associated queue select switch. Whenever there is an unacknowledged event in any of the System Event queues, the associated Status LED shall flash. Viewing each event listed in a queue shall acknowledge all events in that queue, and shall cause the associated LED to illuminate steady. All messages contained in any of the System Event queues shall be accessible for review by the Emergency Operator using the “Previous/Next” message switch. It shall be possible to route additional event information to a printer.
13. Maintenance Menu: The Main LCD shall also allow the System Operator to access system maintenance functions through a four level password system. The authorized System Operator shall be able to access the following functions:
    a. System Status - The system shall allow the operator to determine the status of individual system components, including active points, disabled points, and active points by panel. **list additional**
    b. Enable - The system shall allow the operator to restore a disabled point (device) in the system, allowing that point (device) to operate as originally intended by the application program of the system. Additionally, the system shall allow the operator to restore any group function, guard patrol function, Panel, system module, “software - defined zone”, operator control, or time control function.
    c. Disable - The system shall allow the operator to disable any point (device) in the system, inhibiting that point (device) from operating as originally intended by the application program of the system. Additionally, the system shall allow the operator to disable any group function, guard patrol function, Panel, system module, “software - defined zone”, operator control, or time control function within the system.
    d. Activate - The system shall allow the operator to manually turn on any system output point, or system function. Alternate Smoke Detector sensitivity,

message routing within the system, guard patrol timing, and check-in group timings shall be modifiable with this simple command from the control panel.

e. Restore - The system shall allow the operator to restore the primary (application program defined) operation to the Smoke Detector sensitivity and the message routing functions with this simple command from the control panel.

f. Control Output - The system shall allow the operator to manually command and control relays and LEDs. Relays shall be able to be commanded to “Latch”, to energize as a “High Priority”, or as a “Low Priority”, to “Energize”, or to “De-Energize”.

14. LEDs shall be able to be commanded to “Latch”, to energize as a “High Priority”, or as a “Low Priority”, to turn “On“, to turn “Off”, to “Slow Blink”, or to “Fast Blink”.

15. Reports - The system shall provide the operator with system reports that give detailed description of the status of certain system parameters for corrective action, or for preventative maintenance programs. The system shall provide these reports via the Main LCD, and shall be capable of being printed on any of the connected system printers.

a. The system shall provide a report that gives a sensitivity listing of all detectors that have less than 75% environmental compensation remaining.

b. The system shall provide a report that provides a sensitivity listing of any particular detector.

c. The system shall provide a report that gives a listing of the sensitivity of all of the detectors on any given panel in the system, or any given SDC loop within any given panel.

d. The system shall provide a report that gives a chronological listing of up to the last 1740 system events.

e. The system shall provide a listing of all of the firmware revision listings for all of the installed network components in the system.

f. Program - The system shall allow the authorized operator to perform all of the following system functions:

1) Set the System Time
2) Set the System Date
3) Set (Change) the System Passwords.
4) Restart the System.
5) Set the Dates for the System Holiday Schedule.
6) Clear the Chronological System History File.

16. Test - The system shall allow the authorized operator to perform test functions within the installed system. Test functions shall be defined by the authorized operator to be performed on a per cabinet, circuit, or service group basis.

17. Local Control and Display Annunciators - Each panel in the installed system shall include local Control and Display Annunciators. These annunciators shall have integral membrane style, tactile push-button control switches, for the control of system functions, and LEDs with programmable (software-controlled) flash rates and slide-in labels for annunciation of system events.

a. The Local Control Display Annunciators shall provide the system with individual zone and / or device annunciation.
b. The Local Control Display Annunciators shall provide the system with individual zone and / or device annunciation with zone and / or device disable.
c. The Local Control and Display Annunciators shall provide the system with groups of three switches that have a software controlled interlock to allow only one of the switches to be active at any time.
d. The switch triads shall be used for all of the fan and damper controls in the protected premises.

4.

C. Life Safety System Operations Interface:

1. SDC Card - The Signature Device Card (SDC) shall be the interface between the Fire Alarm Control Panel and the Signature Series Detectors and Modules. The communications format between the SDC and the Signature Series Devices shall be 100% digital.
2. Communications to devices must incorporate BROADCAST POLLING and DIRECT ADDRESS SEARCH to ensure the fastest reporting of off-normal conditions to the system human interface layer.
3. It shall be possible to wire the SDC as Class A (Style 6 or Style 7) or Class B (Style 4) without twisted or shielded wire. It must be possible to wire branch circuits (T-Taps) from Class B Circuits. The associated controller (3-SSDC), through the SDC, shall provide the ability to set the sensitivity and alarm verification of each of the individual intelligent detectors on the circuit. It shall be possible to automatically set the sensitivity of individual intelligent detectors during day and night periods.
4. It shall be possible for the SDC to address all intelligent devices connected to it without having to set switches at the individual devices.
5. It shall be possible to obtain a mapping report of all devices connected to the circuit for confirmation of “as-built” wiring. The map shall show physical wiring of T-Taps, device types, and the panel addresses of devices connected to the circuit. The SDC shall be capable of reporting unexpected additional device addresses and changes to the wiring in the data circuit. A specific trouble shall be reported for any off-normal non-alarm condition.
6. The SDC shall be able to report the following information on a per intelligent device basis:
   a. Device Serial Number
   b. Device Address
   c. Device Type
   d. Current Detector Sensitivity Values and the Extent of Environmental Compensation.
   e. Any of 32 possible trouble codes to specifically diagnose faults.
7. Should a Signature Driver Controller CPU fail to communicate, the Signature circuit shall go into the stand alone mode. The circuit shall be capable of producing a loop alarm if an alarm type device becomes active during stand alone mode.

D. Hard Wired NAC Circuits

1. Provide where indicated on the plans supervised hard wired Notification Appliance Circuits (NAC) for the control of 24Vdc EST Integrity Series Signaling Appliances. The NAC shall be Class B (Style 4), and shall control up to 3.5 amps of power to the circuit.
2. Provide where indicated on the plans supervised hard wired Notification Appliance Circuits (NAC) for the control of 70.7Vrms EST Integrity Series Audio Signaling Appliances. The NAC shall be Class B (Style 4), and shall control up to 35 Watts of power to the circuit.
3. Provide where indicated on the plans supervised hard wired Notification Appliance Circuits (NAC) for the control of 25Vrms EST Integrity Series Audio Signaling Appliances. The NAC shall be Class B (Style 4), and shall control up to 50 Watts of power to the circuit .
4. Panel NACs shall be power limited to 3.5A at 24Vdc and 4.1A at 20.4Vdc to support higher current demand by visible appliances at lower battery voltages.

E. Hard Wired Initiating Device Circuits

1. Provide where indicated on the plans supervised hard wired initiating device circuits. It shall be possible to configure IDCs for alarm, supervisory, or monitor operation.

F. Life Safety System Programmable Operations:

1. System Message Processing and Display Operations:
   a) The Fire Alarm / Life Safety System shall allow Network Routing to be configured to any or all nodes (cabinets) in the network.
   b) All of the system Printer ports can be configured to display any or all of the following functions:
      1)Alarm
      2)Supervisory
      3)Trouble
      4)Monitor
      5)Service Group
2. Each LCD Display on each node (cabinet) in the system shall be configurable to show the status of any or all of the following functions anywhere in the system:
   a) Alarm
   b) Supervisory
   c) Trouble
   d) Monitor
3. The system shall provide the capability to label each of the system points with up to 256 characters of location message. The first 42 characters shall be directed to the LCD while the entire message shall be sent to the printer.
4. The system shall have the capability to provide up to 128 logical Counting AND Groups. Each group shall have a programmable ‘activation’ number. Whenever the number of active devices in an AND Group reaches the activation number, the AND

Groups' rules will execute. It shall be possible to 'overlap' AND groups by having devices appear in more than one group.

5. The system shall provide a means to monitor the well being of any or all of the occupants of the protected premises by means of a Check-In Group feature. The Check-In Group shall display an emergency alarm whenever any member of a check-in group fails to check-in during the programmable check-in period.
6. Subsequent check-in activations during the check-in period, or activations outside of the check-in period shall also activate an emergency response. It shall be possible to have a minimum of 128 check-in groups. All event messages for the Check-In feature shall be directable to any system monitor or printer.
7. The system shall have the ability to define a minimum of 64 Guard Patrols with up to 10 different tours each. For each tour it shall be possible to program a minimum-maximum time period between patrol stations. Each guard patrol can have up to 50 stations. Guard patrol can be started from the control panel or by operation of the first station in a tour. Guard patrol delinquencies occur when a guard is early to a station, late to a station and out of sequence. Delinquencies shall display at the control panel, perform programmable system responses, and may be directed to any printer.
8. The system shall have the ability to define a minimum of 128 Matrix Groups with up to 250 points each. For each matrix, it shall be possible to define a 'radius' and an 'activation' number. The radius number defines the proximity between detector locations. When two detectors activate at or within the value of the 'radius' or whenever the number of active devices reaches the activation number the Matrix Group activates. It shall be possible to 'overlap' Matrix groups by having devices appear in more than one group.
9. The system shall include the ability to define an alternate set of device commands that may be used in combination with the system test command for the testing of the connected Signature Series Smoke Detectors. This function shall disable the normal alarm command for each of the members of the group, so that the testing process will not result in an activation of the building evacuation signals, auxiliary relays or central station connections.
10. The system shall include Time Control functions that will have the ability to control any system output or function, or initiate any system operational sequence as a function of the Month, Day of Week, Date, Hour, Minute, or Holiday.
11. The system shall include up to 600 software defined Logical Zone Groups that may group any input from any Signature Data Circuit, or other Initiating Device Circuit, in order to control a system output or function, or initiate any system operational sequence. A device or IDC may be a member of one Logical Zone Group. Each of these zones shall have an associated message.
12. The system shall provide the ability to download data from the Signature Series Detectors to a P.C. while the system is on-line and operational in the protected premises. The downloaded data may then be analyzed in a diagnostic program supplied by the system manufacturer.

2.10 COMPONENTS

A. Remote Booster Power Supplies - General

1. The power supply shall provide a central processor with a watchdog circuit. It shall provide 2 initiating circuits, 2 notification appliance circuits rated at 24 Vdc at 2.5A, form 'C' alarm and trouble contacts, and auxiliary power at 24Vdc at 500 mA. The power supply shall be a high efficiency switch mode type providing 4 A total to the NACs, 500 mA of auxiliary power at 24Vdc, and an automatic battery charger capable of supporting up to 10 AH of sealed lead acid batteries. Site programming shall enable or disable the local trouble buzzer, allow the following of existing signal rates or select internally generated evacuation signal rates at continuous, 20 SPM, 120 SPM, temporal 3-3-3, or march time independent of the existing signal rate. Indicators shall be power on, system trouble, ground fault, battery trouble, and notification appliance circuit trouble. It shall be possible to activate the BPS via dry contact or by connection to an existing NAC circuit. It shall be possible to convert the BPS circuits ICs and NACs to Class 'A' operation. The base panel shall provide a communication channel and operating power for expansion modules.

B. Remote Booster Power Supply, BPS

1. The remote booster power supply shall be Edwards Systems Technology (EST) type BPS Series incorporating all control electronics, relays, and necessary modules and components in a <surface> <semi-flush> mounted cabinet. The panel shall be supervised, site programmable, modular design with expansion modules to serve connection to existing NAC circuits. All initiating, notification, and low voltage power source circuits shall be power limited.
2. The booster power supply shall be provided with battery back-up. The batteries shall be of the sealed, lead-acid type and provide <four (4)> <twenty-four (24)> <sixty (60)> hours of normal standby operation and five (5) minutes of normal alarm operation at the end of the standby period. The batteries shall be supervised for placement and low voltage. It shall be possible to mount the batteries remote from the panel.
3. <The Relay/City Module shall have a yellow LED and an enable/disable switch. It shall be configurable with the BPS to serve as an auxiliary relay.>

C. Intelligent Detectors – General

1. The System Intelligent Detectors shall be capable of full digital communications using both broadcast and polling protocol. Each detector shall be capable of performing independent fire detection algorithms. The fire detection algorithm shall measure sensor signal dimensions, time patterns and combine different fire parameters to increase reliability and distinguish real fire conditions from unwanted deceptive nuisance alarms. Signal patterns that are not typical of fires shall be eliminated by digital filters. Devices not capable of combining different fire parameters or employing digital filters shall not be acceptable.
2. Each detector shall have an integral microprocessor capable of making alarm decisions based on fire parameter information stored in the detector head. Distributed intelligence shall improve response time by decreasing the data flow between

detector and Analog loop controller. Detectors not capable of making independent alarm decisions shall not be acceptable. Maximum total Analog loop response time for detectors changing state shall be 0.5 seconds.

3. Each detector shall have a separate means of displaying communication and alarm status. A green LED shall flash to confirm communication with the Analog loop controller. A red LED shall flash to display alarm status. Both LEDs on steady shall indicate alarm-standalone mode status. Both LEDs shall be visible through a full 360 degree viewing angle.
4. The detector shall be capable of identifying up to 32 diagnostic codes. This information shall be available for system maintenance. The diagnostic code shall be stored at the detector.
5. Each smoke detector shall be capable of transmitting pre-alarm and alarm signals in addition to the normal, trouble and need cleaning information. It shall be possible to program control panel activity to each level. Each smoke detector may be individually programmed to operate at any one of five (5) sensitivity settings.
6. Each detector microprocessor shall contain an environmental compensation algorithm that identifies and sets ambient “Environmental Thresholds” approximately six times an hour. The microprocessor shall continually monitor the environmental impact of temperature, humidity, other contaminates as well as detector aging. The process shall employ digital compensation to adapt the detector to both 24 hour long term and 4 hour short term environmental changes. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches 80% and 100% of the allowable environmental compensation value. Differential sensing algorithms shall maintain a constant differential between selected detector sensitivity and the “learned” base line sensitivity. The base line sensitivity information shall be updated and permanently stored at the detector approximately once every hour.
7. The intelligent Analog device and the Analog loop controller shall provide increased reliability and inherent survivability through intelligent Analog standalone operation. The device shall automatically change to standalone conventional device operation in the event of a loop controller polling communications failure.
8. In the Analog standalone detector mode, the Analog detector shall continue to operate using sensitivity and environmental compensation information stored in its microprocessor at the time of communications failure. The Analog loop controller shall monitor the loop and activate a loop alarm if any detector reaches its alarm sensitivity threshold.
9. Each Signature Series device shall be capable of automatic electronic addressing and/or custom addressing without the use of DIP or rotary switches. Devices using DIP or rotary switches for addressing, either in the base or on the detector shall not be acceptable.
10. The intelligent Analog detectors shall be suitable for mounting on any Signature Series detector mounting base.

D. Fixed Temperature Heat Detector, SIGA-HFS

1. Provide intelligent fixed temperature heat detectors <SIGA-HFS>. The heat detector shall have a low mass thermistor heat sensor and operate at a fixed temperature. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm.

2. The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data. Systems using central intelligence for alarm decisions shall not be acceptable. The heat detector shall have a nominal alarm point rating of 135°F (57°C). The heat detector shall be rated for ceiling installation at a minimum of 70 ft (21.3m) centers and be suitable for wall mount applications.

E. Fixed Temperature/Rate of Rise Heat Detector, SIGA-HRS Provide intelligent combination fixed temperature/rate-of-rise heat detectors <SIGA-HRS>. The heat detector shall have a low mass thermistor heat sensor and operate at a fixed temperature and at a temperature rate-of-rise. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm. The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data. Systems using central intelligence for alarm decisions shall not be acceptable. The intelligent heat detector shall have a nominal fixed temperature alarm point rating of 135°F (57°C) and a rate-of-rise alarm point of 15°F (9°C) per minute. The heat detector shall be rated for ceiling installation at a minimum of 70 ft (21.3m) centers and be suitable for wall mount applications.

F. Ionization Smoke Detector, SIGA-IS

1. Provide intelligent ionization smoke detectors <SIGA-IS>. The analog ionization detector shall utilize a unipolar ionization smoke sensor to sense changes in air samples from its surroundings. The integral microprocessor shall dynamically examine values from the sensor and initiate an alarm based on the analysis of data. Systems using central intelligence for alarm decisions shall not be acceptable. The detector shall continually monitor any changes in sensitivity due to the environmental affects of dirt, smoke, temperature, aging and humidity. The information shall be stored in the integral processor and transferred to the analog loop controller for retrieval using a laptop PC or the SIGA-PRO Signature Program/Service Tool. The ion detector shall be rated for ceiling installation at a minimum of 30 ft (9.1m) centers and be suitable for wall mount applications. The ion smoke detector shall be rated for operation in constant air velocities from 0 to 75 ft/min. (0-0.38 m/sec) and with intermittent air gusts up to 300 ft/min. (1.52m/sec) for up to 1 hour.
2. The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 0.7% to 1.6%. The ion detector shall be suitable for operation in the following environment:
   - Temperature: 32°F to 120°F (0°C to 49°C)
   - Humidity: 0-93% RH, non-condensing
   - Elevation: Up to 6,000 ft. (1828 m)

G. Photoelectric Smoke Detector, SIGA-PS

1. Provide intelligent photoelectric smoke detectors <SIGA-PS>. The analog photoelectric detector shall utilize a light scattering type photoelectric smoke sensor to sense

changes in air samples from its surroundings. The integral microprocessor shall dynamically examine values from the sensor and initiate an alarm based on the analysis of data. Systems using central intelligence for alarm decisions shall not be acceptable. The detector shall continually monitor any changes in sensitivity due to the environmental affects of dirt, smoke, temperature, aging and humidity. The information shall be stored in the integral processor and transferred to the analog loop controller for retrieval using a laptop PC <or the SIGA-PRO Signature Program/Service Tool>. The photo detector shall be rated for ceiling installation at a minimum of 30 ft (9.1m) centers and be suitable for wall mount applications. The photoelectric smoke detector shall be suitable for direct insertion into air ducts up to 3 ft (0.91m) high and 3 ft (0.91m) wide with air velocities up to 5,000 ft/min. (0-25.39 m/sec) without requiring specific duct detector housings or supply tubes.

2. The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5%. The photo detector shall be suitable for operation in the following environment:
   - Temperature: 32°F to 120°F (0°C to 49°C)
   - Humidity: 0-93% RH, non-condensing
   - Elevation: no limit

H. 3D Multisensor Detector, SIGA-PHS

1. Provide intelligent 3D multisensor smoke detectors <SIGA-PHS>. The multisensor analog detector shall use a light scattering type photoelectric smoke sensor and a fixed temperature type heat sensor to sense changes in air samples from its surroundings. The integral microprocessor shall employ time based algorithms to dynamically examine values from both sensors simultaneously and initiate an alarm based on that data. Systems using central intelligence for alarm decisions shall not be acceptable. The detector shall continually monitor any changes in sensitivity due to the environmental affects of dirt, smoke, temperature, aging and humidity. The information shall be stored in the integral processor and transferred to the analog loop controller for retrieval using a laptop PC or the SIGA-PRO Signature Program/Service Tool. Separately mounted photoelectric detectors and heat detectors in the same location are not acceptable alternatives. The 3D Multisensor detector shall be rated for ceiling installation at a minimum of 30 ft (9.1m) centers and be suitable for wall mount applications. The 3D Multisensor smoke detector shall be suitable for direct insertion into air ducts up to 3 ft (0.91m) high and 3 ft (0.91m) wide and with air velocities up to 5,000 ft/min. (0-25.39 m/sec) without requiring specific duct detector housings or supply tubes. The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5%. The fixed temperature alarm set point shall be 135°F (57°C) nominal.
2. The 3D Multisensor detector shall be suitable for operation in the following environment:
   - Temperature: 32°F to 100°F (0°C to 38°C)
   - Humidity: 0-93% RH, non-condensing.
   - Elevation: no limit.

I. 4D Multisensor Detector, SIGA-IPHS

1. Provide intelligent 4D multisensor smoke detectors <SIGA-IPHS>. The multisensor analog detector shall use a light scattering type photoelectric smoke sensor, a unipolar ionization smoke sensor and an ambient temperature sensor to sense changes in air samples from its surroundings. The integral microprocessor shall employ time based algorithms to dynamically examine values from the three sensors simultaneously and initiate an alarm based on that data. The 4D Multisensor shall be capable of adapting to ambient environmental conditions. The temperature sensor shall self-adjust to the ambient temperature of the surrounding air and input an alarm when there is a change of 65°F (35°C) in ambient temperature. Systems using central intelligence for alarm decisions shall not be acceptable. The detector shall continually monitor any changes in sensitivity due to the environmental affects of dirt, smoke, temperature, age and humidity. The information shall be stored in the integral processor and transferred to the analog loop controller for retrieval using a laptop PC or the SIGA-PRO Signature Program/Service Tool. Separately mounted photoelectric detectors, ionization detectors and heat detectors in the same location are not acceptable alternatives. The 4D Multisensor smoke detector shall be rated for ceiling installation at a minimum of 30 ft (9.1m) centers and suitable for wall mount applications. The 4D Multisensor shall be suitable for direct insertion into air ducts up to 3 ft (0.91m) high and 3 ft (0.91m) wide and air velocities up to 500 ft/min. (0-2.54 m/sec) without requiring specific duct detector housings or supply tubes.
2. The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5%. The integral heat sensor shall cause an alarm when it senses a change in ambient temperature of 65°F (35°C) or reaches it fixed temperature alarm set point of 135°F (57°C) nominal. The 4D Multisensor detector shall be suitable for operation in the following environment:
   - Temperature: 32°F to 100°F (0°C to 38°C)
   - Humidity: 0-93% RH, non condensing
   - Elevation : Up to 6,000 ft (1828 m)

J. Standard Detector Mounting Bases, SIGA-SB / SIGA-SB4

1. Provide standard detector mounting bases <SIGA-SB> <SIGA-SB4> suitable for mounting on <North American 1-gang, 31/2" or 4" octagon box and 4" square box> <European BESA or 1-gang>. The base shall, contain no electronics, support all Signature Series detector types and have the following minimum requirements:
   - Removal of the respective detector shall not affect communications with other detectors.
   - Terminal connections shall be made on the room side of the base. Bases which must be removed to gain access to the terminals shall not be acceptable.

- The base shall be capable of supporting one (1) Signature Series <SIGA-LED> Remote Alarm LED Indicator. Provide remote LED alarm indicators where shown on the plans.

K. Relay Detector Mounting Bases, SIGA-RB / SIGA-RB4

1. Provide relay detector mounting bases <SIGA-RB> <SIGA-RB4> suitable for mounting on <North American 1-gang, 3 1/2 " or 4" octagon box and 4" square box> <European BESA or 1-gang>. The relay base shall support all Signature Series detector types and have the following minimum requirements:
   a) The relay shall be a bi-stable type and selectable for normally open or normally closed operation.
   b) The position of the contact shall be supervised.
   c) The relay operation shall be exercised by the detector processor upon power up.
   d) The relay shall automatically de-energize when a detector is removed.
   e) The operation of the relay base shall be controlled by its respective detector processor. Detectors operating standalone mode shall operate the relay upon changing to alarm state. Relay bases not controlled by the detector microprocessor shall not be acceptable.
   f) Form "C" Relay contacts shall have a minimum rating of 1 amp @ 30 Vdc and be listed for "pilot duty".
   g) Removal of the respective detector shall not affect communications with other detectors.
   h) Terminal connections shall be made on the room side of the base. Bases which must be removed to gain access to the terminals shall not be acceptable.

L. Isolator Detector Mounting Bases, SIGA-IB / SIGA-IB4

1. Provide isolator detector mounting bases <SIGA-IB> <SIGA-IB4> suitable for mounting on <North American 1-gang, 3 1/2 " or 4" octagon box and 4" square box>. The operation of the isolator base shall be controlled by its respective detector processor. Isolators which are not controlled by a detector processor shall not be accepted. Following a short circuit condition, each isolator/detector shall be capable of performing an internal self-test procedure to re-establish normal operation. Isolator/detectors not capable of performing independent self tests shall not be acceptable.

2. The isolator base shall support all Signature Series Detector types and have the following minimum requirements:

   a) The isolator shall operate within a minimum of 23 msec. of a short circuit condition on the communication line.
   b) When connected in Class A configuration the Signature Loop Controller shall identify an isolated circuit condition and provide communications to all non isolated analog devices.

c) Terminal connections shall be made on the room side of the base. Bases which must be removed to gain access to the terminals shall not be acceptable.

M. Detector Mounting Plate, SIGA-DMP

1. Provide detector mounting plate assemblies <SIGA-DMP> to facilitate mounting a Signature Series detector for direct insertion into a low velocity duct 3 ft (0.91m) high and 3 ft (0.91m) wide, ceiling plenum, or raised floor. Mounting plate shall be code gauge steel with corrosion resistant red enamel finish. The detector mounting plate shall support an intelligent analog Photoelectric Detector <SIGA-PS>, or 3D Multisensor Detector <SIGA-PHS>, or 4D Multisensor Detector <SIGA-IPHS> along with a standard, relay or isolator detector mounting base.

N. Intelligent Modules – General

1. It shall be possible to address each Intelligent Signature Series module without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable. The personality of multifunction modules shall be programmable at site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller. Modules requiring EPROM, PROM, ROM changes or DIP switch and/or jumper changes shall not be acceptable. The modules shall have a minimum of 2 diagnostic LEDs mounted behind a finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes which can be retrieved for troubleshooting assistance. Input and output circuit wiring shall be supervised for open and ground faults. The module shall be suitable for operation in the following environment:
   - Temperature: 32°F to 120°F (0°C to 49°C)
   - Humidity: 0-93% RH, non-condensing

O. Single Input Module, SIGA-CT1

1. Provide intelligent single input modules <SIGA-CT1>. The Single Input Module shall provide one (1) supervised Class B input circuit capable of a minimum of 4 personalities, each with a distinct operation. The module shall be suitable for mounting on North American 2 1/2" (64mm) deep 1-gang boxes and 1 1/2" (38mm) deep 4" square boxes with 1-gang covers. The single input module shall support the following circuit types:
   - Normally-Open Alarm Latching (Manual Stations, Heat Detectors, etc.)
   - Normally-Open Alarm Delayed Latching (Waterflow Switches)
   - Normally-Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.)
   - Normally-Open Active Latching (Supervisory, Tamper Switches)

P. Dual Input Module, SIGA-CT2

1. Provide intelligent dual input modules <SIGA-CT2>. The Dual Input Module shall provide two (2) supervised Class B input circuits each capable of a minimum of 4 personalities, each with a distinct operation. The module shall be suitable for mounting on North American 2 1/2" (64mm) deep 1-gang boxes and 1 1/2" (38mm) deep 4" square boxes with 1-gang covers. The dual input module shall support the following circuit types:
   - Normally-Open Alarm Latching (Manual Stations, Heat Detectors, etc.)
   - Normally-Open Alarm Delayed Latching (Waterflow Switches)
   - Normally-Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.)
   - Normally-Open Active Latching (Supervisory, Tamper Switches)

Q. Monitor Module, SIGA-MM1

1. Provide intelligent monitor modules <SIGA-MM1>. The Monitor Module shall be factory set to support one (1) supervised Class B Normally-Open Active Non-Latching Monitor circuit. The monitor module shall be suitable for mounting on North American 2 1/2" (64mm) deep 1-gang boxes and 1 1/2" (38mm) deep 4" square boxes with 1-gang covers.

R. Waterflow/Tamper Module, SIGA-WTM

1. Provide intelligent waterflow/tamper modules <SIGA-WTM>. The Waterflow/Tamper Module shall be factory set to support two (2) supervised Class B input circuits. Channel A shall support a Normally-Open Alarm Delayed Latching Waterflow Switch circuit. Channel B shall support a Normally-Open Active Latching Tamper Switch. The waterflow/tamper module shall be suitable for mounting on North American 2 1/2" (64mm) deep 1-gang boxes and 1 1/2" (38mm) deep 4" square boxes with 1-gang covers.

S. Single Input Signal Module, SIGA-CC1

1. Provide intelligent single input signal modules <SIGA-CC1>. The Single Input (Single Riser Select) Signal Module shall provide one (1) supervised Class B output circuit capable of a minimum of 2 personalities, each with a distinct operation. When selected as a telephone power selector, the module shall be capable of generating its own "ring tone". The module shall be suitable for mounting on North American 2 1/2" (64mm) deep 2-gang boxes and 1 1/2" (38mm) deep 4" square boxes with 2-gang covers. The single input signal module shall support the following operations:
   - Audible/Visible Signal Power Selector (Polarized 24 Vdc @ 2A, 25Vrms @50w or 70 Vrms @ 35 Watts of Audio)
   - Telephone Power Selector with Ring Tone (Fire Fighter's Telephone)

T. Dual Input Signal Module, SIGA-CC2

1. Provide intelligent dual input signal modules <SIGA-CC2>. The Dual Input (Dual Riser Select) Signal Module shall provide a means to selectively connect one of two (2) signaling circuit power risers to one (1) supervised output circuit. The module shall be suitable for mounting on North American 2 1/2" (64mm) deep 2-gang boxes and 1 1/2" (38mm) deep 4" square boxes with 2-gang covers.

2. The dual input signal module shall support the following operation:
   - Audible/Visible Signal Power Selector (Polarized 24 Vdc @ 2A, 25 Vrms @ 50w or 70 Vrms @ 35w of Audio)

U. Control Relay Module, SIGA-CR

1. Provide intelligent control relay modules <SIGA-CR>. The Control Relay Module shall provide one form "C" dry relay contact rated at 2 amps @ 24 Vdc to control external appliances or equipment shutdown. The control relay shall be rated for pilot duty and releasing systems. The position of the relay contact shall be confirmed by the system firmware. The control relay module shall be suitable for mounting on North American 2 1/2" (64mm) deep 1-gang boxes and 1 1/2" (38mm) deep 4" square boxes with 1-gang covers.

V. Universal Class A/B Module, SIGA-UM

1. Provide intelligent class A/B modules <SIGA-UM>. The Universal Class A/B Module shall be capable of a minimum of fifteen (15) distinct operations. The module shall be suitable for mounting on North American 2 1/2" (64mm) deep 2-gang boxes and 1 1/2" (38mm) deep 4" square boxes with 2-gang covers. The universal class A/B module shall support the following circuit types:

   - One (1) supervised Class A Normally-Open Alarm Latching.
   - One (1) supervised Class A Normally-Open Alarm Delayed Latching.
   - One (1) supervised Class A Normally-Open Active Non-Latching.
   - One (1) supervised Class A Normally-Open Active Latching.
   - One (1) supervised Class A 2-wire Smoke Alarm Non-Verified.
   - One (1) supervised Class A 2-wire Smoke Alarm Verified
   - One (1) supervised Class A Signal Circuit, 24Vdc @ 2A.

W. Isolator Module, SIGA-IM

1. Provide intelligent fault isolators modules <SIGA-IM>. The Isolator Module shall be capable of isolating and removing a fault from a class A data circuit while allowing the remaining data loop to continue operating. The module shall be suitable for mounting on North American 2 1/2" (64mm) deep 2-gang boxes and 1 1/2" (38mm) deep 4" square boxes with 2-gang covers.

X. Intelligent Manual Pull Stations -- General

1. It shall be possible to address each Signature Series fire alarm pull station without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable. The manual stations shall have a minimum of two diagnostic LEDs mounted on their integral, factory assembled single or two stage input module. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The station shall be capable of storing up to 24 diagnostic codes which can be retrieved for troubleshooting assistance. Input circuit wiring shall be supervised for open and ground faults.
2. The fire alarm pull station shall be suitable for operation in the following environment:
   - Temperature: 32°F to 120°F (0°C to 49°C)
   - Humidity: 0-93% RH, non-condensing

Y. Conventional Fire Alarm Initiating Devices – General

1. All initiating devices shall be UL Listed for Fire Protective Service. All initiating devices shall be of the same manufacturer as the Fire Alarm Control Panel specified to assure absolute compatibility between the devices and the control panels, and to assure that the application of the initiating devices is done in accordance with the single manufacturer's instructions.
2. Any devices that do not meet the above requirements, and are submitted for use must show written proof of their compatibility for the purposes intended. Such proof shall be in the form of documentation from all manufacturers that clearly states that their equipment (as submitted) is 100% compatible with each other for the purposes intended.

Z. Heat Detectors

1. Combination Fixed Temperature/Rate-of-Rise Heat Detectors, 281B, 282B. Provide low profile heat detectors rated for a maximum smooth ceiling rating of <2500 sq. ft.> <232 m2>. The detector shall be finished pure white and have a positive identification for the operation of the fixed temperature element. The detectors shall be rated at <15°F (9°C) per minute rate-of-rise and 135°F (57°C) fixed temperature.> <15°F (9°C) per minute rate-of-rise and 194°F (88°C) fixed temperature.>

2. Fixed Temperature Heat Detectors, 283B, 284B. Provide low profile heat detectors rated for a maximum smooth ceiling rating of <2500 sq. ft.> <232 m2>. The detector shall be finished pure white and have a positive identification for the operation of the fixed temperature element. The detectors shall be rated at <135°F (57°C) fixed temperature.> <194°F (88°C) fixed temperature.>

AA. Smoke Detectors

1. Ionization Smoke Detectors, 6250 Series. Provide stable, solid state, unipolar ionization detectors capable of detecting visible and invisible products of combustion. Provide the detectors with a measuring chamber and a protected reference chamber sensitive to changes in temperature and humidity only. Protect the measuring chamber from damage and insects. Provide a built-in five second delay to minimize

alarms due to transient smoke. Safeguard radioactive parts and protect circuitry against electrical transients, electromagnetic interference, and polarity reversal. Factory set the detector sensitivity and provide for field adjustment within the range of ULI defined sensitivity. <Connect remote LED Alarm Indicators where shown on the plans.> The detector shall be tamper resistant plug mounted to a separate base. A built-in shorting device shall permit checking of the installation wiring before detector installation. Provide a concealed test switch to allow full logical testing without the use of smoke or aerosol spays.

2. Photoelectric Smoke Detectors, 6270 Series. Provide stable, solid state, photoelectric detectors capable of detecting visible products of combustion. Provide the detectors with self-compensating circuitry to protect its stability against the effects of aging, dust and film accumulation. Protect the measuring chamber from damage and insects. Provide a built-in five second delay to minimize alarms due to transient smoke. Safeguard and protect circuitry against electrical transients, electromagnetic interference, and polarity reversal. Factory set the detector sensitivity. <Connect a remote LED Alarm Indicator where shown on the plans.> The detector shall be tamper resistant plug mounted to a separate base. A built-in shorting device shall permit checking of the installation wiring before detector installation. Provide a concealed test switch to allow full logical testing without the use of smoke or aerosol spays. <Provide an auxiliary 135°F (57°C) fixed temperature heat detector.>
3. Beam Type Smoke Detectors, 6424. Provide projected beam type smoke detectors. The beam detectors shall be four wire 24 Vdc and powered from the control panel 4 wire smoke power source. This unit shall consist of a separate transmitter and receiver capable of being powered separately or together. This unit shall operate in either a short range of 30 to 100 ft. (9.14 to 30.4 m) or a long range of 100 to 300 ft. (30.4 to 91.4 m). The detector shall feature a bank of four alignment LEDs on both the receiver and transmitter that are used to ensure proper alignment without the use of special tools. The beam detector shall feature automatic gain control which will compensate for gradual signal deterioration from dirt accumulation on lenses. Ceiling or wall mount as shown on the plans. Testing shall be carried out using calibrated test filters. <Provide a <magnet> <key> activated remote test station.>

BB. Notification Appliances – General

1. All appliances shall be UL Listed for Fire Protective Service. All strobe appliances or combination appliances with strobes shall be capable of providing the "Equivalent Facilitation" which is allowed under the Americans with Disabilities Act Accessabilities Guidelines (ADA(AG)), and shall be UL 1971, and ULC S526 Listed. All appliances shall be of the same manufacturer as the Fire Alarm Control Panel specified to insure absolute compatibility between the appliances and the control panels, and to insure that the application of the appliances are done in accordance with the single manufacturers' instructions. Any appliances which do not meet the above requirements, and are submitted for use must show written proof of their compatibility for the purposes intended. Such proof shall be in the form of

documentation from all manufacturers which clearly states that their equipment (as submitted) are 100% compatible with each other for the purposes intended.

CC. Self-Synchronized Strobes.

1. 1-Gang Strobes, 202 Series. Provide strobes manufactured by EST, Cat No. 202 Series. In - Out screw terminals shall be provided for wiring. The strobes shall have a <red> <white> plastic face plate. They shall provide <15 cd> <15/75 cd> <30 cd> <60 cd> <110 cd> synchronized flash outputs. Strobes shall mount in a North American 1-gang box. The strobe shall have lens markings oriented for <wall> <ceiling> mounting. It shall be possible to replace the lens markings with LKW series or LKC series lens marking kits. <Ceiling mounted strobes shall have lens markings with correctly oriented lettering.> Removal of a installed strobe to change the lens markings shall not be acceptable. <Provide weatherproof wall boxes for outdoor mounting.>
2. Strobes, 405 Series. Provide strobes manufactured by EST, Cat No. 405 Series. In - Out screw terminals shall be provided for wiring. The strobes shall have a <red> <white> metal face plate. They shall provide <15 cd> <15/75 cd> <30 cd> <60 cd> <110 cd> synchronized flash outputs. Strobes shall mount in a North American 4" square box. The strobe shall have lens markings oriented for <wall> <ceiling> mounting. It shall be possible to replace the lens markings with LKW series or LKC series lens marking kits. <Ceiling mounted strobes shall have lens markings with correctly oriented lettering.> Removal of a installed strobe to change the lens markings shall not be acceptable. <Provide weatherproof wall boxes for outdoor mounting.>

DD. Horns

1. Mini-Horns, 682 Series. Provide electronic horns manufactured by EST, Cat. No. 682 Series. In - Out screw terminals shall be provided for wiring. The horn shall have a <red> <white> plastic housing. A sound output level of 91 dBA shall be provided. Horn shall mount to a North American 1-gang masonry electrical box (2-1/2" deep).
2. Temporal Horns, 757 Series. Provide electronic horns manufactured by EST, Cat. No. 757 Series. In - Out screw terminals shall be provided for wiring. The horn shall have a <red> <white> plastic housing. Horns shall be selectable for high or low dBA output. Selection of low or high output shall be reversible. Horns shall be selectable for steady or temporal output. Selection of steady or temporal output shall be reversible. <A synchronized temporal pattern sound output level of 100 dBA shall be provided.> Horn shall mount to a North American 4" electrical box (2-1/8" deep) using the 2 screws provided with box or to a 2-gang (2-3/4" deep) electric box. <Provide weatherproof wall boxes for outdoor mounting.>

EE. Horn/Strobes

1. Mini-Horn/Strobes, 692 Series. Provide electronic horn/strobes manufactured by EST, Cat. No. 692 Series. The horn/strobe shall have a <red> <white> plastic housing. A sound output level of 91 dBA average shall be provided. The strobe shall provide <15 cd> <15/75 cd> <30 cd> <110 cd> synchronized flash outputs. The strobe shall

have lens markings oriented for <wall> <ceiling> mounting. It shall be possible to replace the lens markings with LKW series or LKC series lens marking kits. <Ceiling mounted strobes shall have lens markings with correctly oriented lettering.> Removal of a installed Horn/Strobe to change the lens markings shall not be acceptable. Horn/strobe shall mount to a North American 1-gang masonry electrical box (2-1/2" deep).

2. Temporal Horn/Strobes, 757 Series. Provide electronic horn/strobes manufactured by EST, Cat. No. 757 Series. In - Out screw terminals shall be provided for wiring. The horn/strobe shall have a <red> <white> plastic housing. Horn/strobes shall be selectable for high or low dBA output. Selection of low or high output shall be reversible. Horns shall be selectable for steady or temporal output. Selection of steady or temporal output shall be reversible. <A synchronized temporal pattern sound output level of 97 dBA average shall be provided.>The strobe shall provide <15 cd> <15/75 cd> <30 cd> <110 cd> synchronized flash outputs. The strobe shall have lens markings oriented for <wall> <ceiling> mounting. It shall be possible to replace the lens markings with LKW series or LKC series lens marking kits. <Ceiling mounted strobes shall have lens markings with correctly oriented lettering.> Removal of a installed Horn/Strobe to change the lens markings shall not be acceptable. Horn/strobe shall mount to a North American 4" electrical box (2-1/8" deep) using the 2 screws provided with box or to a 2-gang (2-3/4" deep) electric box. <Provide weatherproof wall boxes for outdoor mounting.>

FF. Remote Relays

1. Multi-Voltage Control Relays, MR-100 Series. Provide remote control relays connected to supervised ancillary circuits for control of fans, dampers, door releases, etc. Relay contact ratings shall be SPDT and rated for 10 amperes at 115 Vac. A single relay may be energized from a voltage source of 24 Vdc, 24 Vac, 115 Vac, or 230 Vac. A red LED shall indicate the relay is energized. <A metal enclosure shall be provided.>
2. Multi-Voltage Control Relays, MR-200 Series. Provide remote control relays connected to supervised ancillary circuits for control of fans, dampers, door releases, etc. Relay contact ratings shall be DPDT and rated for 10 amperes at 115 Vac. A single relay may be energized from a voltage source of 24 Vdc, 24 Vac, 115 Vac, or 230 Vac. A red LED shall indicate the relay is energized. <A metal enclosure shall be provided.>
3. Multi-Voltage Control Relays, MR-700 Series. Provide remote control relays connected to supervised ancillary circuits for control of fans, dampers, door releases, etc. Relay contact ratings shall be SPDT and rated for 10 amperes at 115 Vac. A single relay may be energized from a voltage source of 12 Vdc, 12 Vac, 24 Vdc, or 24 Vac. A red LED shall indicate the relay is energized.
4. Multi-Voltage Control Relays, MR-800 Series. Provide remote control relays connected to supervised ancillary circuits for control of fans, dampers, door releases, etc. Relay contact ratings shall be SPDT and rated for 10 amperes at 115 Vac. A single relay may be energized from a voltage source of 24 Vdc, or 24 Vac, or 115 Vac. A red LED shall indicate the relay is energized.

5. Manual Override Control Relays, MR-600 Series. Provide remote control relays each with manual override feature connected to supervised ancillary circuits for control of fans, dampers, door releases, etc. Relay contact ratings shall be SPDT and rated for 10 amperes at 115 Vac or 24 Vdc. A single relay may be energized from a voltage source of 24 Vdc or 24 Vac. A red LED shall indicate the relay is energized.
6. Heavy Duty Power Relays, MR-199 Series. Provide remote control relays connected to supervised ancillary circuits for control of fans, dampers, door releases, etc. Relay contact ratings shall be DPDT and rated for 30 amperes at 300 Vac or 2 HP motor load. A single relay may be energized from a voltage source of <24 Vac> <115 Vac>. <A metal enclosure shall be provided.>

GG. Electromagnetic Doorholders – General

1. Electromagnetic doorholders submitted for use must have written proof of their compatibility for the purposes intended. Such proof shall be in the form of documentation from all manufacturers that clearly states that their equipment (as submitted) is 100% compatible with each other for the purposes intended.

HH. Electromagnetic Doorholders, 1500 Series

1. Floor Mounted, 1501/1502 Series. Provide <single door> <double door> floor mounted electromagnetic doorholder/releases rated at <12 Vdc> <24 Vac/dc> <120 Vac> input. Finish shall be brushed zinc.
2. Wall Mounted, 1504/1505/1508/1509 Series. Provide <flush> <semi-flush> <surface> wall mounted electromagnetic doorholder/releases rated at <12 Vdc> <24 Vac/dc> <120 Vac>. Finish shall be brushed zinc.
3. Telephone Devices – General. All telephone devices shall be UL Listed for Fire Protective Service.
4. All telephone devices shall be of the same manufacturer as the Fire Alarm Control Panel specified to assure absolute compatibility between the telephone devices and the control panels, and to assure that the application of the appliances is done in accordance with the single manufacturer's instructions.
5. Any telephone devices that do not meet the above requirements, and are submitted for use must show written proof of their compatibility for the purposes intended. Such proof shall be in the form of documentation from all manufacturers that clearly states that their equipment (as submitted) is 100% compatible with each other for the purposes intended.

2.11 GRAPHIC COMMAND WORKSTATION

A. Graphical Command Workstation

The graphical command workstation(s) shall display a different color text for each message type and color graphic diagrams/floor plans. The graphical command workstation shall simultaneously display the following system event views; system event display, graphical diagram display, detailed event message/instructions, and user event log. The workstation shall be an IBM-compatible personal computer listed for UL Standards 864 (Control Units for Fire-Protective Signaling Systems) under categories

UOJZ, APOU, and UUKL. The workstation(s) shall be capable of annunciation and control of all fire detection and smoke control points.

B.The computer shall be minimum of an Pentium Grade Pentium Processor 2.4 Ghz with a 533Mhz front side bus, 512 MB RAM, 80 GB Hard Drive, and 19" LCD monitor. Installation of the computer or monitor can be either desktop or floor mounting or rack/panel mounting.

C.The software shall provide multitasking type environment that allows the user to run several applications simultaneously. The operating program shall run within a 32-bit operating system such as Windows® XP. These Windows applications shall run simultaneously with other programs. The mouse or Alt-Tab keys shall be used to quickly select and switch between multiple applications. The operator shall be able to work in Microsoft Word, Excel and other Windows based software packages, while concurrently annunciating on-line alarms and monitoring functions.

D. Graphic Workstation Operations

1. The graphic display screen shall organize and structure system events for easy user comprehension. The workstation display shall use four relational quadrants. When any event occurs:

a.The "list of events area" shall display the address of the alarm or off-normal point with type and description and time of the event in a prioritized color-coded event list. Highlighting an event in the event list area shall automatically cause the display of a graphical map and other three areas (described below) to display information relating to the highlighted event.
b.The "map area" shall display color graphical representation of the area location in which the alarm or off-normal device is located. It shall be possible for the operator to manually zoom down to any portion of a vector-based graphic without aliasing, artifacting, or pixilation of the image. Preset zoom levels shall not be considered equal.
c.The "event action area" shall display a customized set of written operator instructions for every state (alarm, trouble, restore, etc.) of each point. An event log shall record all events and operator actions to history for future review. An operator's log shall record operator's comments for each event in system history with time and date.
d.The "image area" shall display a stored image of the device relating to the event highlighted in the event list area.

2. When processing fire alarm events the graphic workstation:

   a. Shall be capable of acknowledging, silencing, and resetting all fire alarm functions.
   b. Shall be capable of manually activating, deactivating, enabling, and disabling individual fire alarm points.
   c. Shall be capable of generating status, maintenance and sensitivity reports for fire alarm components.

3. Receipt of a fire alarm shall activate an audio WAV file over the workstation speakers alerting the operator to a fire alarm, and providing audible instructions.

4. The graphical command workstation(s) shall be an EST FW-CGSUL FireWorks standalone workstation complete with all software and hardware programming required to operate with EST fire alarm life safety and property protection systems.

END OF SECTION

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping, or sealing site utilities.
7. Temporary erosion and sedimentation control.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at project site located at, 1824 East McKinley Street, Phoenix, AZ., with ownership and Architect.

1.3 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

B. Upon approval of geotechnical engineer, roto-millings maybe used as back fill sub-grade preparation for asphalt paving.

1.4 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.

B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises.

C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

D. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.

PART 2 - PRODUCTS

2.1 MATERIALS

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

1. Arrange with utility companies to shut off indicated utilities.

B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

3.4 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 6 inches and compact each layer to a density equal to adjacent original ground. See earth Moving Section 312000, for backfill placement specifications.

3.5 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

3.6 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Asphalt has been listed for removal and roto-milling as shown for line and grade on the plans.

C. Precise saw cut lines shall be used for full depth asphalt removal.

3.7 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials.

END OF SECTION 311000

SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for slabs on grade, walks and pavement.
3. Excavating and backfilling for structures.
4. Drainage course for concrete slabs-on-grade.
5. Subbase course for concrete walks and pavement.
6. Excavating and backfilling trenches for utilities and pits for buried utility structures.

1.2 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving if required.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

F. Fill: Soil materials used to raise existing grades.

G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

H. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

I. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

J. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.3 PRE-INSTALLATION MEETINGS

1. Preinstallation Conference: Conduct pre-excavation conference at. Project Location: 1824 East McKinley Street, Phoenix, AZ., 85006

1.4 INFORMATIONAL SUBMITTALS

A. Material compaction test reports for all earthwork and backfill operations.

1.5 FIELD CONDITIONS

A. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth-moving operations.

1.6 GEOTECHNICAL REPORT

A. Review all recommendations from geotechnical report, “McKinley Street Improvements”, by Western Technologies Inc, dated February 3, 2021.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. All soil materials to be used for fill import must be approved by Geotechnical Engineer, per his recommendations in geotechnical report.

C. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

D. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

E. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

F. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

G. Recycled asphalt material from roto-milling, may be used as back fill material beneath any asphalt paving, based on geotechnical engineer's approval.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect all existing structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.3 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 0.5 inches. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
.
2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 0.5 inches. Do not disturb bottom of excavations intended as bearing surfaces.

3.4 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.5 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls per rules and regulations of supporting governing agency.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

3.6 SUBGRADE INSPECTION

A. Proof-roll subgrade below asphalt paved areas, with a pneumatic-tired dump truck to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

B. Reconstruct subgrades damaged by rain, accumulated water, or construction activities, as directed by Geotechnical Engineer, without additional compensation.

3.7 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.8 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud or unsuitable materials.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Initial Backfill: Place and compact initial backfill of subbase material, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

D. Final Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation per geotechnical recommendation.

3.9 SOIL FILL

A. Place and compact fill material in layers to required elevations to meet recommendations of geotechnical engineer.

3.10 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy.
2. Remove and replace, or scarify and air dry, otherwise soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.11 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 6 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D698 and geotechnical recommendation.

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent standard proctor.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent standard proctor.
3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent standard proctor.
4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent standard proctor.

3.12 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:

1. Turf or Unpaved Areas: Plus or minus 0.5 inches.
2. Walks: Plus or minus 0.5 inches.
3. Pavements: Plus or minus 0.5 inches.

3.13 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified third party inspector to perform inspections:

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.14 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.15 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

SECTION 313116 - TERMITE CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Soil treatment with termiticide

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site**.**

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components, and profiles for termite control products.
   2. Include the EPA-Registered Label for termiticide products.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Certificates: For each type of termite control product.

C. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:
   1. Date and time of application.
   2. Moisture content of soil before application.
   3. Termiticide brand name and manufacturer.
   4. Quantity of undiluted termiticide used.
   5. Dilutions, methods, volumes used, and rates of application.
   6. Areas of application.
   7. Water source for application.

D. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located.

B. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA Registered Label.

C. Source Limitations: Obtain termite control products from a single source from a single manufacture.

1.6 FIELD CONDITIONS

A. Soil Treatment:
   1. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.
   2. Related Work: Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.
   3. Existing Building Restoration, Provide Rodding at approximately 12 inches minimum on center around the perimeter walls of the building exterior, applying pesticide under the existing building concrete floor slab.

1.7 WARRANTY

A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work consisting of applied soil termiticide treatment will prevent infestation of subterranean termites**.** If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

A. Termiticide: Provide an EPA-Registered termiticide complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product’s EPA-Registered Label.
   1. Active Chemical: Fipronil 9.1% or Imiacloprid 21.4% or other approved product.
   2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than 15 years against infestation of subterranean termites.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.

B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Prepare work areas according to the requirements of authorities having jurisdiction and according to manufacturer's written instructions before beginning application and installation of termite control treatment(s). Remove extraneous sources of wood cellulose and other edible materials, such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
   1. Fit filling hose connected to water source at the site with a backflow preventer, according to requirements of authorities having jurisdiction.

3.3 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Distribute treatment uniformly. Apply treatment at the product's EPA-Registered Label volume and rate for maximum specified concentration of termiticide to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction.
   1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed and under existing concrete floor slabs..
   2. Foundations: Soil adjacent to and along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing.
   3. Penetrations: At expansion joints, control joints, and areas where slabs and below-grade walls will be penetrated.

B. Post warning signs in areas of application.

C. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

3.4 PROTECTION

A. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

B. Protect termiticide solution dispersed in treated soils and fills from being diluted by exposure to water spillage or weather until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

END OF SECTION 313116

SECTION 32 01 90

OPERATION AND MAINTENANCE OF PLANTING

PART 1 GENERAL

1.01 SUMMARY

A. Description
1. Work included: Provide labor, materials, and installation necessary to provide a 1 year warranty period from date of acceptance of installation.
2. Related work described elsewhere:
a. Section 32 93 00 – Planting

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 ACCEPTANCE OF INSTALLATION

A. At the completion of all landscape installation, the Contractor shall request in writing, 48 hours in advance, an inspection for acceptance in which the Contractor, Owner's Representative and Landscape Architect shall be present. After this inspection, a "Punch List" will be prepared by the Contractor. Upon completion of all punch list items, the Landscape Architect and/or Owner's Representative shall re-inspect the project and issue a written statement of acceptance and establish the beginning of the project warranty and maintenance period.

B. Landscape work may be inspected for acceptance in parts agreeable to Owner's Representative provided work offered for inspection is completed, including maintenance as required.

C. For work to be inspected for partial acceptance, Contractor shall provide a drawing outlining work completed, and supply a written statement requesting acceptance of the work completed to date.

3.02 PROJECT WARRANTY

A. The project warranty period begins upon written acceptance of the project installation by Owner's Representative.

B. The Contractor shall guarantee trees, saguaros, accents, and irrigation system for one year, and shrubs for 90 days after date of acceptance (Substantial Completion) of installation against defects including death and unsatisfactory growth, except for defects resulting from neglect by Owner, abuse, or damage by others, or unusual phenomena or incidents which are beyond Contractor’s control. Contractor shall be responsible for reviewing the status of warrantee items during specified project warranty.

3.03 MAINTENANCE PERIOD

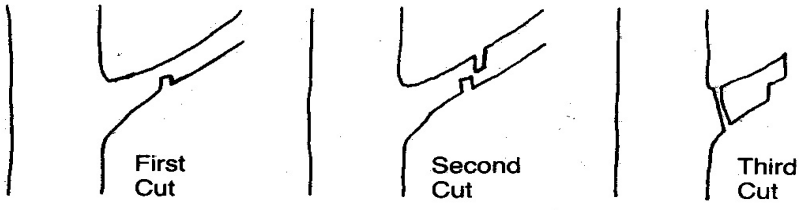
A. Maintenance shall begin immediately with the planting of each plant and continue after Substantial Completion of the project through a period of 90 days.

B. To ensure warranty standards, the following maintenance procedures shall be executed during construction and for the full project warranty period.

C. Maintenance of trees, shrubs and ground covers:

1. Contractor shall be responsible for replacement of any plant materials that are dead or are in an unhealthy or unsightly condition, or having lost natural shape, resulting from dieback, excessive pruning or inadequate or improper maintenance as part of the guarantee.
2. Replacements must meet specifications i.e., quality, size, form, species of plant material and planting procedures to receive approval of replacement.
   Costs for replacements are assumed part of bid quotations and therefore will not result in an additional cost to Owner.
3. The Contractor shall be responsible for watering all plantings through the warranty period and shall keep guy wires taut, raise tree balls which settle, furnish and apply sprays as necessary to keep the plantings free of disease and insects until the end of the warranty period.
4. Pruning of all project trees should occur on a regular schedule to maintain general aesthetics, to ensure canopy clearance for pedestrians, and above all to reduce potential damage from wind and ensure strong and healthy trees.
5. **Pruning**: Selectively remove dead branches, cross-branching and witches broom from trees. Cross-branching is a condition where several branches cross and touch. This condition is undesirable because at the place where the crossed branches touch they can rub from wind movement damaging bark. Witches broom is unnaturally dense growth at the end of branches often caused from incorrect maintenance such as shearing. This condition is undesirable because it causes the tree canopy to become too dense, which can cause wind damage. Trees should be thinned to prevent wind damage. Selectively prune the tree to allow wind to pass through the canopy. When a tree becomes top heavy, it can easily blow over in a windstorm.
6. Depending on the size of the stems, use bypass-type pruning shears, loppers or a pruning saw.
7. If shears twist and turn when you try to cut through a branch, use loppers. In general, use hand pruners for branches up to ½-inch diameter, loppers for branches 1-inch diameter and a pruning saw for larger limbs. Avoid using bow-type saws; the blade is difficult to control. For delicate work such as pinching off new growth, use your fingers or pruning shears.

Pruning a Large Limb



8. **Accents** -When dead leaves occur at the base of Agaves, Aloes or Bear Grass, remove them by pulling off or cutting off with a sharp knife. Do not remove lower leaves from these plants unless the leaves are dead. Removing too many leaves

from the base of these plants creates unsightly trunks. Remove dead flower stalks with hand held pruners.

9. Arrange with Owner's Representative to walk the site monthly during warranty period to review maintenance standards. *Remove and replace* trees, shrubs, or other plants found to be dead or in an unhealthy condition. Remove rejected plants and materials promptly. Make replacements during the normal planting schedule. Replace trees and shrubs which are in doubt, unless, in opinion of Owner's Representative, it is advisable to extend warranty period.
10. Remove all stakes, guy wires, tree wrap paper, dead twigs and branches from tree and plant material at the end of this warranty period.
11. Keep planting beds free of weeds during guarantee period.
12. Apply pre-emergent in fall and in spring to all decomposed granite areas. Contractor shall be responsible for replacing seasonal annuals during Maintenance Period if applicable.

E. Final acceptance upon conclusion of the warranty period.

1. At the conclusion for the project warranty period, the Contractor shall request a project inspection for final acceptance in which the Contractor and Owner's Representative shall be present. The Contractor shall provide a 5-day notice for scheduling the inspection.
2. After this inspection, a "Final Warranty Punch List" will be prepared by the Contractor.
3. Upon completion of all punch list items, the Owner's Representative and Landscape Architect shall re-inspect the project and issue a written statement of final acceptance.
4. Upon final acceptance, the Owner assumes all maintenance responsibilities for the landscape of the project.

END OF SECTION

SECTION 321216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Hot-mix asphalt paving.
   2. Hot-mix asphalt patching.

B. Related Requirements:
   1. Section 312000 "Earth Moving" for subgrade preparation, fill material, separation geotextiles, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.
   2. Section 321313 "Concrete Paving" for concrete pavement and for separate concrete curbs, gutters, and driveway aprons.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at, 1824 East McKinley Street, Phoenix, AZ., with ownership and Architect.

1.3 ACTION SUBMITTALS

A. Hot-mix asphalt designs as stipulated for depth to meet the geotechnical paving design. Paving design is available in the final geotechnical report.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates:

   1. Aggregates.
   2. Asphalt binder.
   3. Tack coat.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of City of Phoenix roadway standards for asphalt paving work.

   1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. Coarse Aggregate: ASTM D692/D692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.

B. Fine Aggregate: ASTM D1073, sharp-edged natural sand or sand prepared from stone or gravel.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: ASTM D6373 binder designation PG70-16TR with ½ and ¾ stone.

B. Asphalt Cement: ASTM D3381/D3381M for viscosity-graded material

C. Tack Coat: ASTM D977 emulsified asphalt, of suitable grade and consistency for application.

D. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes approved by Architect in accordance with procedures in AI MS-2, "Asphalt Mix Design Methods"; and complying with the following requirements:

E. Provide mixes with a history of satisfactory performance in geographical area.

PART 3 - EXECUTION

3.1 PATCHING

A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

1. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.

B. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 to 0.15 gal./sq. yd..

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

C. Placing Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

3.2 SURFACE PREPARATION

A. Ensure that prepared subgrade is ready to receive paving. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces.

1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

B. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd..

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.3 HOT-MIX ASPHALT PLACEMENT

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt surface course in single lift.
2. Spread mix at a minimum temperature of 250 deg F.
3. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.4 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method in accordance with AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations**.**

3.5 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density, Rice Test Method: 92 percent of reference maximum theoretical density in accordance with ASTM D2041/D2041M, but not less than 90 percent or greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

G. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.6 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce thickness indicated within the following tolerances:

1. Surface Course: Plus 1/4 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Surface Course: 1/8 inch.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Replace and compact hot-mix asphalt where core tests were taken.

C. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

END OF SECTION 321216

SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes Concrete Paving for the following:

1. Driveways.
2. Curbs and gutters.
3. Walks.
4. ADA ramping.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.3 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1.4 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures prior to placement.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2.2 STEEL REINFORCEMENT

A. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, fabricated from as-drawn steel wire into flat sheets.

B. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.

C. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

2.3 CONCRETE MATERIALS

A. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:

1. Portland Cement: ASTM C150/C150M, Type I cement.
2. Fly Ash: ASTM C618, Class C.

B. Normal-Weight Aggregates: ASTM C33/C33M, , uniformly graded. Provide aggregates from a single source.

C. Air-Entraining Admixture: ASTM C260/C260M.

D. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain no more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

E. Water: Potable and complying with ASTM C94/C94M.

2.4 CURING MATERIALS

A. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

B. Water: Potable.

C. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, dissipating.

2.5 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Compressive Strength (28 Days): 4000 psi.
2. Maximum W/C Ratio at Point of Placement: 0.45.
3. Slump Limit: 4 inches for hand placed concrete, 6 inch for machine placed concrete.

2.6 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M and ASTM C1116/C1116M. Furnish batch certificates for each batch discharged and used in the Work.

PART 3 - EXECUTION

3.1 EXAMINATION

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

B. Confirm compaction recommendation have been met, prior to pour concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 INSTALLATION OF STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, to match jointing of existing adjacent concrete paving.

PART 4 - Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, to match jointing of existing adjacent concrete paving.

4.1 CONCRETE PLACEMENT

A. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

B. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

C. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

D. Screed paving surface with a straightedge and strike off.

E. Commence initial floating using bull floats or derbies to impart an open-textured and uniform surface plane before excess moisture or bleed-water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

4.2 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
2. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.
3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 deep with a stiff-bristled broom, perpendicular to line of traffic.

C. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on paving surface according to manufacturer's written instructions.

1. Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.
2. After curing, lightly work surface with a steel-wire brush or abrasive stone and water to expose nonslip aggregate.

4.3 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb./sq/ft or manufacturers recommendations before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure concrete by moisture curing or curing compound.

4.4 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 0.5 inches.
2. Thickness: Plus, or minus 1/4 inch.
3. Surface: Gap below 10-feet- (3-m-) long; unleveled straightedge not to exceed 1/4 inch.
4. Joint Spacing: 3 inches (75 mm).
5. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
6. Joint Width: Plus 1/8 inch (3 mm), no minus.

4.5 REPAIR AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

C. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 321723 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Painted markings applied to asphalt paving.
2. Painted markings applied to concrete surfaces.

1.2 ACTION SUBMITTALS

A. Product Data:
1. Pavement-marking paint, latex.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in "2010 ADA Standards for Accessible Design" and to meet the City of Phoenix rules and regulations requirement.

2.2 PAVEMENT-MARKING PAINT

A. Pavement-Marking Paint, Latex: MPI #97, latex traffic-marking paint.

1. Color: White.

PART 3 - EXECUTION

3.1 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow asphalt paving or concrete surfaces to age for a minimum of 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 0.02 inches.

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to asphalt paving or concrete surface.

END OF SECTION 321723

SECTION 32 84 00

PLANTING IRRIGATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Drip Irrigation

1.02 DESCRIPTION

A. Work included: Provide all labor, materials, equipment and service necessary to furnish, lay out and install an automatic irrigation system as indicated or specified.
B. Related work described elsewhere: Irrigation system shall irrigate all plant materials described in the following Sections. Planting (32 93 00).

1.03 SUBMITTALS

A. General: Make all submittals in accordance with General conditions.

B. Shop Drawings: Provide one bond plan set of the irrigation layout to the installer before construction. Before inspection for substantial completion, plan shall be revised to record the entire system as constructed in the field.

C. Controller Charts: Record drawing shall be reviewed by the Landscape Architect before controller charts are prepared.

1. Provide one controller chart for each controller supplied.
2. The chart shall show the area controlled by the automatic controller and shall be the maximum size which the controller door will allow.
3. The chart is to be a reduced drawing of the actual installed system, color coded to show separate valve areas. However, in the event the controller sequence is not legible when the drawing is reduced, it shall be enlarged to a size that will be readable when reduced.
4. The chart shall be a blackline bond print and a different color shall be used to indicate the area of coverage for each station.
5. When completed and approved, the chart shall be sealed in a waterproof coating.
6. These charts shall be completed and approved prior to final observation of the irrigation system.

D. Contract closeout submittals: Submit Project Record Drawings, operation, instruction and maintenance manuals, and manufacturers' warranties, along with date of purchase and supplier's invoice number for all equipment installed in accordance with general conditions.

E. Product Data: Submit manufacturer's literature for each product listed below:
1. Pipe
2. Fittings and Solvent
3. Gate Valves
4. Valve Boxes
5. Emitters
6. Automatic Valves
7. Automatic Controls
8. Wire and Connectors

9. Air Relief Valves
10. Pressure Reg. Valves
11. Quick Coupling Valves
12. Pumping Station

1.04 QUALITY ASSURANCE

A. Use adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 DELIVERY, STORAGE AND HANDLING

A. Exercise care in handling, loading, unloading, and storing plastic pipe and fittings. Store under cover until ready to install and transport only on a vehicle with a bed long enough to allow the pipe to lay flat to avoid undue bending and concentrated external load. Pipe which has been dented or damaged will not be accepted. Store all materials per manufacturer's recommendations. Protect all equipment pipes from sunlight.

1.06 SUBSTITUTIONS

A. Must be approved in writing by Landscape Architect.

1.07 WARRANTY

A. The Contractor shall agree to repair or replace any defects in material or workmanship which may develop during the period of one year from date of acceptance and also to repair or replace any damage resulting from the repairing or replacing of such defects at no additional cost to the Owner. The Contractor shall make such repairs or replacements within a reasonable time, as determined by the Owner, after receipt of written notice.

B. Check irrigation system on a regular basis throughout the year to determine if all heads and emitters are operating correctly. Adjust watering schedules by season according to information herein. Each season should require an adjustment in the number of watering days per week as well as the amount of time for each individual watering cycle.

C. **Spring**: Heavy irrigation should be given to the plants at the end of February or early March as the daytime highs begin to approach 75 degrees. Ideally, this should take place prior to the first fertilization of the year. **Summer:** Increase the watering times and frequencies as the daytime temperatures begin to exceed 90 degrees. This is the period of greatest stress and weak plants are more susceptible to pests and disease. Check all irrigation heads and emitters at least once a week throughout the summer months. Watch out for signs of drought stress and react quickly if stress is noticed. **Fall:** Begin to taper off the water schedule as autumn nears and the daytime temperatures drop consistently below 90 degrees to harden growth. Too much water during this time of the year encourages succulent growth that can be easily damaged by cold weather.
Winter: Cut back the watering schedule by approximately ½ throughout the winter, being careful not to over water. Check soil moisture to see that it is moist but not wet. During the winter months, it is usually better to slightly under water rather than to over water.

D. In the event of the Contractor's failure to make such repairs or replacements within a reasonable time after receipt of written notice from the Owner, the Owner shall proceed to have said repairs or replacement made at the Contractor's expense and he shall pay the costs and charges upon demand.

E. Contractor to warrant that all trenches and other disturbed areas to be free from heaving or settling more than 1/2 inch. Should it become necessary to adjust the grade, re-grade the trench

and re-grade or re-sod. This no-settlement clause shall extend over the entire warranty period of the job. Minor maintenance and adjustment will be made by the Owner.

PART 2 PRODUCTS

2.01 MATERIALS

A. Copper pipe: Comply with ASTM B 42 or ASTM A 53, Schedule 40, threaded, coupled, and hot-dip galvanized steel, or Type "K" hard copper. Use 200 lb rated galvanized malleable iron, banded pattern fittings (steel), or Type "K" copper fittings with solder.

B. PVC Pressure Main Line Pipe and Fittings: Pressure main line piping shall be PVC schedule 40.

1. Pipe shall be made from an NSF Type I, Grade I, PVC compound conforming to ASTM D 1785. All pipe must meet requirements as set forth in PS-21-70, with an appropriate standard dimension (S.D.R.) (Solvent-Weld Pipe).
2. PVC solvent-weld fittings shall be Schedule 40, 1-2, II-I NSF approved conforming to ASTM D 2461.
3. Solvent cement and primer for PVC solvent-weld pipe and fittings shall be of type and installation methods prescribed by the manufacturer.

C. All PVC Pipe shall bear the following markings:

1. Manufacturer's name
2. Nominal pipe size
3. Schedule or class
4. Pressure rating in P.S.I.
5. NSF approval
6. Date of extrusion

D. All fittings shall bear the manufacturer's name or trademark, material designation, size, applicable I.P.S. schedule and NSF seal of approval.

2.02 PVC NON-PRESSURE LATERAL LINE PIPING

A. Non-pressure buried lateral line piping shall be PVC class 200 or class 315 with solvent-weld joints.

B. Pipe shall be made from NSF approved, Type I, Grade II PVC compound conforming to ASTM D 1784. All pipe must meet requirements set forth in Federal Specification PS-22-70 with an appropriate standard dimension ratio.

C. Except as noted above, all requirements for non-pressure main line pipe and fittings shall be the same as for solvent-weld pressure main line pipe and fittings as set forth above.

2.03 CONTROL WIRING AND CONNECTIONS

A. Wiring: Connections between the automatic controllers and the electric control valves shall be made with direct burial copper wire AWG-U.F. 600 volt. Pilot wires shall be a different color wire for each automatic controller. Common wires shall be white with a different color stripe for each automatic controller. In no case shall wire size be less than #14.

B. Splices: All splices shall be made with Scotch-Lok #3576 Connector Sealing Packs, or RainBird Snap-Tite wire connector. Use one splice per connector sealing pack.

C. Electrical control valves: All electric control valves shall be of the same manufacturer

2.04 FITTINGS AND HARDWARE

A. Brass pipe and fittings: Where indicated on the Drawings, use red brass screwed pipe conforming to FS WW-P-351.

1. Fittings shall be red brass conforming to FS WW-P-460.

B. Ball valves shall be similar, of bronze construction as manufactured by Watts.

C. Quick coupling valves: Quick coupling valves shall have a brass two-piece body designed for working pressure of 150 psi operable with quick coupler. Shall be 3/4" brass two-piece type or equal.

D. Backflow preventers: shall be of size and type indicated on the Drawings and shall conform to local regulatory agency.

E. Control valve boxes: Use 9-1/2" x 16" x 11 rectangular boxes for electrical control valves as manufactured by Carson Industries (#1419-12B) or Brooks. Use other valve boxes as called out on the Drawings. Extension sleeve shall be PVC-6" minimum size. Color: tan unless specific on plans differently. RainBird VB Series or approved equal.

2.05 EQUIPMENT

A. Any equipment specified on plan to supercede items specified with this section.

B. Supply the following tools:

1. Two (2) sets of any special tools required for equipment adjustment supplied on this project.
2. Two (2) keys for each automatic controller.
3. Two (2) quick coupler key with matching hose bibb and shut-off valves.
4. Two (2) valve box key for every six (6) valve boxes installed.
5. The above mentioned equipment shall be turned over to the Owner at the conclusion of the project. Before final observation can occur, evidence that the Owner has received material must be submitted to the Landscape Architect.

C. Rotary Type Sprinkler Head: Not used

D. Spray Type Sprinkler Head: Not used

E. Emitter: Bowsmith drip emitters.

F. Bubbler: RainBird 1400 series. Not used

G. Quick Coupler: Hunter HQ-33 DRC ¾ Quick Coupler Valve.

H. Mainline Valves:
1. Valves: Bronze construction- Hunter ICV-101G 2” Electrical Valve.
2. Backflow Preventers: FEBCO 825YA-2” R.P. Backflow Preventer.
3. Valve Box and Cover: 1419 Carson 12” Tan Box. Color: Tan in Granite Areas; Green in Turf Areas.
4. Drain Valve: Not used

I. Controls:
1. Controller: Rainbird IQ ESP-LXMEF Satellite Controller with Flow Smart Module and IQ NCC RS232 Cartridge in Metal Cabinet. See plan for station size.
2. Controller Housing: See above.
3. Transformer: To convert building service voltage to control voltage or 24 volts.
4. Circuit Control: Each circuit variable from approximately 5 to 60 minutes. Include switch for manual or automatic operation of each circuit.
5. Timing Device: Adjustable, 24-hour and 7 or 14 day clocks to operate any time of day and skip any day in a 7 or 14 day period.

J. Control Valves: Electric Solenoid; XCZ-PRB-100-COM 1” commercial control zone kit in square valve box; provide wiring, including required fittings and accessories.

K. Wire Conductors: Color coded.

2.06 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Landscape Architect.

PART 3 EXECUTION

3.01 INSPECTION

A. Surface conditions: Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Field measurements: Make necessary measurements in the field to ensure precise fit of items in accordance with the approved design. Dimensions from two (2) permanent points of reference, building corners, sidewalk, or road intersections, etc., the location of the following items:

1. Connection to existing water lines;
2. Connection to existing electrical power;
3. Gate valves;
4. Routing of sprinkler pressure lines (dimension maximum 100' along routing);
5. Sprinkler control valves;
6. Routing of control wiring;
7. Quick coupling valves;
8. Other related equipment as directed by the Landscape Architect.

B. Coordination: Coordinate as required with other trades to assure proper and adequate provision of the work of those trades for interface with the work of this Section. Coordinate schedules for installation of the work of this Section with schedules for other installations, to assure orderly progress of the total construction sequence.

1. No irrigation work is to be performed until all areas are finished to proper grade and until soil preparation is completed, and has been approved by the Landscape Architect.
2. Utility connections: The automatic irrigation system shall be connected to water supply and electrical power points of hook-up as indicated on the Drawings.

Contractor shall be responsible for minor changes caused by actual site conditions.

3. The Contractor shall furnish and install all sleeves for his work through or under concrete or masonry.

C. Piping layout indicated is diagrammatic only. Route piping to avoid plants, ground cover, and structures.

D. Layout and stake locations of system components.

E. Review layout requirements with other affected work. Coordinate locations of sleeves under paving to accommodate system.

3.03 INSTALLATION

A. General: Provide a 100%-coverage, complete automatic irrigation system as schematically diagrammed. In-field layout shall be by this Contractor and reviewed by the Landscape Architect prior to installation. Any substantial deviation of in-field requirements to those specified shall be reported before beginning construction.

B. Trenching: Trench shall be excavated straight and shall support pipe continuously on bottom of trench. Lay pipe to an even grade. Trenching excavation shall follow pipe layout as indicated on the Drawings.

C. Install pressure supply lines and control wiring with a minimum cover of 20" based on finish grade.

1. Provide a minimum 24" of cover when pressure lines are located below aggregate base course at traffic bearing pavings.
2. Install non-pressure irrigation materials with a minimum cover of 12" based on finished grades.

D. Backfilling: Trenches shall not be backfilled until all required tests are performed. Carefully backfill trenches with approved material, consisting of topsoil granular earth fill, sand, or other approved materials free from earthen clods or rocks large than 2" in each dimension.

1. Fill trench to within 6" of final grade. The top 6" of backfill shall be clean, fertile, friable topsoil free from earthen clods, subsoil, noxious weeds or other foreign matter such as stones, roots, sticks and other extraneous materials.
2. Any special soil mixture shall be replaced to the original condition it was prior to irrigation installation.

E. Compaction: Mechanically or manually compact backfill material in landscape areas to a dry density of 90%. Backfill under traffic paving and hardscape areas with a minimum sand layer of 2" below the pipe and 6" layer above the pipe; compact the earthen backfill material to a dry density of 95% in depths of 8" loose material lifts.

F. Existing trees: Where is necessary to excavate adjacent to existing trees, the Contractor shall use all possible care to avoid injury to trees and tree roots. Excavation in areas where 2" and larger roots occur shall be done by hand. All roots 2" and larger in diameter, except directly in the path of pipe or conduit, shall be tunneled under and shall be heavily wrapped with burlap, to prevent scarring or excessive drying. Where a ditching machine is run close to trees having roots smaller than 2" in diameter, the wall of the trench adjacent to the tree shall be hand trimmed, making clean cuts through. Roots 1" and larger in diameter shall be painted with two coats of Tree Seal, or equal. Trenches

adjacent to trees should be closed within 24 hours; and where this is not possible, the side of the trench adjacent to the tree shall be kept shaded with burlap or canvas.

G. Piping layout: Lay out the piping system in accordance with arrangement shown on the Drawings. Where piping is shown on the Drawings to be under paved areas but running parallel and adjacent to planted areas, the intention is to install the piping in the planted areas. No direct contact between pipes or structures will be permitted at crossing.

H. Piping under pavement: Piping under existing walks or roadways shall be installed by jacking, boring or hydraulic driving; or it shall be sleeved with minimum Schedule 40 PVC or as indicated on the Drawings. Permission to cut or break pavement and/or concrete shall be obtained through the Landscape Architect prior to work. Should this method become necessary, it shall be removed and replaced by the Contractor at no additional cost to the Owner. No hydraulic driving will be permitted under concrete paving.

I. Inspection of materials: Carefully inspect pipe and fittings before installation, removing all dirt, scale, and burrs; and reaming as required. Install pipe with markings up for visual inspection.

J. Pipe installation: Repair dented and damaged pipe by cutting out and discarding the dented or damaged section, and rejoining with a coupling. In joining, use only the specified solvent and make joints in accordance with the manufacturer's recommendations. Give solvent welds at least 15 minutes set-uptime before moving or handling, and 24 hours curing time before filling with water. Centerload plastic pipe with a small amount of backfill to prevent arching and whipping under pressure.

1. Routing of sprinkler irrigation lines as indicated on the Drawings is diagrammatic. Install lines (and various assemblies) in such a manner as to conform with details shown.
2. Parallel lines shall not be installed directly over one another. All lines shall have a minimum 6" clearance from each other and from lines of other trades.
3. Install all assemblies specified herein in accordance with respective detail. In absence of detail drawings or specifications pertaining to specific items required to complete work, perform such work in accordance with best standard practice with prior approval of Landscape Architect.
4. On PVC to metal connections, the Contractor shall work the metal connections first. Teflon tape or approved equal, shall be used on all threaded PVC to PVC, and on all threaded PVC to metal joints. Light wrench pressure is all that is required. Where threaded PVC connections are required, use threaded PVC adapters into which the pipe may be welded.

K. Automatic controller: Install as per manufacturer's instructions. Remote control valves shall be connected to controller in numerical sequence as shown on the Drawings. Final location of automatic controller shall be approved by the Landscape Architect.

L. Remote control valves: Install where shown on Drawings and details. When grouped together, allow at least 12" between valves. Install each remote control valve in a separate valve box on a 3" base of pea gravel for stability. Each valve number shall be embossed on valve box top.

3.04 VALVE INSTALLATION

A. Control valve boxes: All electrical and manual valves shall be enclosed in an appropriate width valve box. This box shall be installed flush with finish grade.

1. Install valve access boxes on a suitable base of gravel to provide a level foundation at proper grade and to provide drainage of the access box.
2. Color: Tan in granite areas, Green in turf areas.

B. Control wiring installation: Unless otherwise noted, the 120 volt electrical power to the automatic controller location shall be furnished by the Electrical Subcontractor. The final electrical hook-up shall be the responsibility of the Landscape Contractor.

1. Wiring shall occupy the same trench and shall be installed along the same route as pressure supply or lateral lines wherever possible, consistently along on side of the trench. Install one spare control wire in each direction from the controller to the farthest valve locations.
2. Where more than 1 wire is placed in a trench, the wiring shall be taped together at intervals of 10'-0".
3. An expansion curl shall be provided within 3'-0" of each wire connection. Expansion curl shall be of sufficient length at each splice connection at each electric control, so that in case of repair, the valve bonnet may be brought to the surface without disconnecting the control wires. Control wires shall be laid loosely in trench without stress or stretching of control wire conductors.
4. Field splices between the automatic controller and electrical control valves will not be allowed without prior approval of the Landscape Architect. Locate all field splices on the Record Drawings. All connections shall be water tight and leak proof.

C. Flushing of system: After all pipe lines are in place and connected, all necessary diversion work has been completed, and prior to installation of emission points, the control valves shall be opened and full head of water used to flush out the system.

3.05 FLUSHING, TESTING AND ADJUSTMENT

A. General: Do not allow or cause the work of this Section to be covered up or enclosed prior to testing and inspecting.

B. Prior to backfilling: Before backfilling the main line, completely flush and test the main line. Repair leaks and flush out each section of lateral pipe before emission points area attached.

C. Testing: Make necessary provision for thoroughly bleeding the line of air and debris. Before testing, fill the line with water for a period of at least 24 hours. Test live water lines for leaks at a hydrostatic pressure of 150 psi for a period of 2 hours, with couplings exposed with pipe sections center loaded. Provide required testing equipment and personnel. Repair leaks and retest until accepted by the Landscape Architect.

1. Testing of pressure mainlines shall occur prior to installation of electrical control valves.
2. All hydrostatic tests shall be made only in the presence of the Landscape Architect. No pipe shall be backfilled until it has been inspected, tested and approved in writing.
3. When the irrigation system is completed, perform a coverage test in the presence of the Landscape Architect, to determine if the water coverage for planting in all

areas is complete and adequate. Furnish all materials and perform all work required to correct any inadequacies of coverage due to deviations from Drawings, or where the system has been willfully installed as indicated on the Drawings when it is obviously inadequate, without bringing this to the attention of the Landscape Architect. This test shall be accomplished before any ground cover is planted.

4. Upon completion of each phase of work, entire system shall be tested and adjusted to meet site requirements.

D. Valve operation: Automatic valve operations shall be tested by activation at the controller. Wiring and valves shall be repaired for proper operation as required.

D. Final observation prior to acceptance: The Contractor shall operate each system in its entirety for the Landscape Architect at time of final observation. An items deemed not acceptable by the Landscape Architect shall be reworked to the complete satisfaction of the Landscape Architect.

1. The Contractor shall show evidence to the Landscape Architect that the Owner has received all accessories, charts, record drawings, and equipment as required before final inspection can occur.

3.06 INSTRUCTIONS

A. Legend: Attach a typewritten legend inside each controller door, stating the areas covered by each remote control valve.

B. Instruction: After the system has been completed, and prior to final acceptance, instruct the Owner's maintenance personnel in the operation and maintenance of the system in writing by maintenance manual, as well as in person.

3.07 MAINTENANCE

A. The Landscape Architect has the right to waive or shorten the operation period.

B. Clean-up: Clean-up shall be made as each portion of work progresses. Refuse and excess dirt shall be removed from the site, all walks and paving shall be swept or washed down, and any damage sustained on the work of other trades shall be repaired to original conditions.

C. Temporary repairs: The Owner reserves the right to make temporary repairs as necessary to keep the sprinkler system equipment in operating condition. The exercise of this right by the Owner shall not relieve the Contractor of his responsibilities under the terms of the guarantee as herein specified.

END OF SECTION

SECTION 32 92 00 - TURF

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Uniform Standard Specifications for Public Works Construction by the Maricopa Association of Governments (MAG), latest edition.

1.2 SUMMARY

A. Section Includes:
   1. Turf sodding.

B. Related Sections:
   1. Division 32 Section "Planting Irrigation" for turf irrigation.
   2. Division 32 Section “Planting” for soil testing requirements.

1.3 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

C. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

D. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

E. Planting Soil: existing, in-place surface soil or manufactured topsoil that is modified with soil amendments and fertilizers to produce a soil mixture best for plant growth.

F. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.

G. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

1. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to this Project.

B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

1. Certification of each seed mixture for turfgrass sod. Include identification of source and name and telephone number of supplier.

C. Qualification Data: For qualified landscape Installer.

D. Product Certificates: For soil amendments and fertilizers, from manufacturer.

E. Material Test Reports: For existing in-place surface soil as outlined in Section 32 “Plants.”

F. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required initial maintenance periods.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf establishment.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
2. Experience: Five years' experience in turf installation in addition to requirements in Division 01 Section "Quality Requirements."
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
4. Personnel Certifications: Installer's field supervisor shall have certification in the following category from the Professional Landcare Network:

a. Certified Turfgrass Professional, designated CTP.

5. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.
6. Pesticide Applicator: AZ licensed, commercial.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk fertilizers, lime and soil amendments with appropriate certificates.

1.7 PROJECT CONDITIONS

A. Planting Restrictions: Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

1.8 MAINTENANCE SERVICE

A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:

1. Sodded Turf: 90 days from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TURFGRASS SOD

A. Turfgrass Sod: Certified, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.

B. Turfgrass Species: Hybrid Bermuda-grass ‘Midiron’ Sod, also known as EZ-Turf as supplied by Western Sod, phone (800) 832-TURF.

2.2 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: T, with a minimum of 99 percent passing through No. 8 sieve and a minimum of 75 percent passing through No. 60 sieve.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, and with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 sieve.

G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.3 FERTILIZERS

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 1 percent nitrogen and 10 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.4 PLANTING SOILS

A. Existing Planting Soil: Existing, native site soil formed under natural conditions. Verify suitability of existing surface topsoil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

1. Supplement with existing planting soil when quantities are insufficient.
2. Mix existing, native soil with amendments as outlined in the soils report recommendations per Section 32 93 00 “Planting.”

2.5 PESTICIDES

A. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds including but not limited to nut sedge, within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated, including but not limited to nut sedge.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Landscape Architect and replace with new planting soil.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect grade stakes set by others until directed to remove them.

3.3 TURF AREA PREPARATION

A. Limit turf subgrade preparation to areas to be planted.

B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 6 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Apply soil amendments as outlined in laboratory recommendations.

2. Spread planting soil to a depth of 6 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is muddy, or excessively wet.

a. Reduce elevation of planting soil to allow for thickness of sod.

C. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

D. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

E. Before planting, obtain Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 SODDING

A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Lay sod across angle of slopes exceeding 1:3.

C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.5 TURF MAINTENANCE

A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, re-grade, and

replant bare or eroded areas and re-mulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.

1. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow bermudagrass to a height of 1/2 to 1 inch with power reel or rotary motor.

3.6 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Landscape Architect:

1. Satisfactory Sodded Turf: At end of 60 day establishment, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.7 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents in accordance with requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations. Turf areas shall be maintained weed free including nutsedge, throughout maintenance period.

3.8 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

END OF SECTION 329200

SECTION 32 93 00

PLANTING

PART 1 GENERAL

1.01 SUMMARY

A. Section includes: Fine grading, incidental grading, planting and related items as indicated or specified.

1.02 SUBMITTALS

A. Shop Drawings: If required by landscape architect, contractor shall submit a landscape irrigation system layout for the Landscape architect's review prior to doing any work for areas requiring field adjustments and changes.

B. Certificates: Submit inspection certificates by state, federal and others indicating the origin and health of the plant material in duplicate. Submit affidavit that the inspection certificates refer to the plant material installed.

C. Samples: Architect reserves the right to take and analyze samples of materials for conformity to specifications at any time. Architect also reserves the right to refuse any material not in accordance with specifications.

1.03 QUALITY ASSURANCE

A. Plant material shall be reviewed by the Landscape architect prior to planting. Landscape architect reserves the right to refuse any plant material that is unacceptable.

B. Quality and size shall conform with the current edition of "Horticultural Standards" for number one grade nursery stock as adopted by the American Association of Nurserymen.

C. Plant materials shall be placed in their proper location and reviewed by the landscape architect prior to planting for critical areas determined by the landscape architect.

D. Provide a written guarantee warranting that all shrubs and ground cover material will be in a healthy, thriving condition for 90 days and that trees will be in a healthy, thriving condition for one year from the date of installation which is approved by landscape architect. Material that is not shall be replaced at no cost to the Owner within thirty days of written notice. Warranty planting that is replaced for 90 days from the date of planting.

1.04 DELIVERY, STORAGE AND HANDLING

A. Each tree, shrub, groundcover flat, container of fertilizer or other construction material shall be labeled by grower or manufacturer as separate items. Bulk deliveries of mulch, granite, topsoil, etc., shall be accompanied with two delivery tickets. One delivery ticket shall be provided to the Contractor.

1.05 PROJECT CONDITIONS

A. Site shall have grades at $\pm$ one tenth of a foot except as noted. The planting areas shall be free of waste or debris developed by other trades. Discrepancy from these conditions shall be reported to the Landscape architect before beginning construction.

B. Locate and identify existing underground and overhead services and utilities within contract limit work areas. (Call Blue Stake.) Provide adequate means of protection of utilities and services designated to remain. Repair utilities damaged during site work operations at Contractor's expense.

C. When uncharted or incorrectly charted underground piping or other utilities and services are encountered during site work operations, notify the applicable utility company immediately to obtain procedure directions. Cooperate with the applicable utility company in maintaining active services in operation.

D. Protect and maintain during construction any plant material designated to remain.

E. Protect and maintain control boxes, curb boxes, valves and other services, except items designated for removal.

F. Stockpiled topsoil locations shall be as designated by the Owner. Use care in protecting stockpiled soil.

G. Hard Pan Conditions: When encountered, coordinate dig solutions with Landscape Architect to provide desired tree pit drainage.

1.09 PLANT QUANTITIES

A. If differences occur between quantities of plants shown on plan and in the plant list, the plants shown on the plan will be considered the correct number of plants to be supplied.

PART 2 PRODUCTS

2.01 MATERIALS

A. Plant material: Furnish plant species and size as indicated on the Drawings. Substitutions in plant species or size can be made only by written approval of the Owner’s representative and/or Landscape Architect.

B. Trees, shrubs and groundcovers: Grown in pots, tubs, cans, boxes, or flats as indicated. Plants shall have sufficient roots to hold earth intact after rootball is removed from the container without being rootbound. Plants shall be approved or rejected at the Landscape architect's discretion for damage, health, form, and size before planting. Plant materials that are poor in health or damaged prior to substantial completion and during the warranty period will be identified and shall be replaced by the Contractor within 14 days of written notice.

C. Water: Use clean, fresh water free from impurities injurious to vegetation. Water for planting purposes to be supplied by Owner. Contractor to provide all hoses, connections, and other equipment necessary to transport water from source to required locations. Do not waste water, nor let it run into city thoroughfares.

D. Tree Supports:
1. Stakes: 2-1/2” diameter x 10’-0” Lodgewood poles, free of knots and cracks.
2. Ties: Wire of pliable zinc-coated iron of #10 gauge; provide a minimum of two per tree.
3. Hose covering: Two-ply reinforced, rubber garden hose minimum of ½” diameter.

PART 3 EXECUTION

3.01 INSTALLATION

A. Topsoil installation: Do not work soil when moisture content is so great that compaction will occur nor when it is so dry that clods will not break readily. Apply water if necessary to bring soil to an optimum moisture content for filling and planting.

B. All compacted soils will be treated as necessary to provide adequate aeration.

C. Fine grade all planting areas. Provide incidental grading of all areas adjacent to curbs and sidewalks. Provide a finish grade 1-1/2" below curbs or sidewalks. When sod or crushed rock is to be installed, the appropriate subgrade shall be graded prior to installation of such materials.

D. Site preparation: Prepare site by applying contact herbicide as per label directions to weed growth on site. Scarify planting areas to a minimum depth of 6". Float beds to grade and rake to remove weeds, clods, or rocks 1" in diameter or greater. Thoroughly water settle all soil.

E. Planting beds: Materials from flats shall have 3 cubic yards of mulch, 150 pounds of Gro-Power, and 150 pounds of gypsum per 1000 S.F., incorporated into the top 6" of the bed.

F. Pits for container grown plant material shall be excavated twice the size of the rootball of the plant being planted.

G. Planting: Remove plants from containers without disturbing the rootball. Set plants in pit, cradling and supporting the rootball. Position plant for the "best side" view and for minimum obstruction to traffic on adjacent pavement.

H. Backfilling: Backfill pit with a blended mixture containing one part mulch, three parts native soil, one-half part gypsum, and one-fourth cup of Iron- Sul per cubic yard of backfill (except raised beds and planters containing potting mix). When the plant is set and the backfill has been water settled, the top of the rootball shall be 2" below finish grade. Par-Ex tablets shall be placed approximately 6" below finish grade in this process in quantity as follows:
1. 2 per one gallon plant
2. 5 per five gallon plant
3. 15 per fifteen gallon plant
4. 3 per 1/2" of trunk diameter on boxed and field grown trees.

I. Iron-Sul:
1. An alternate method for the application of Iron-Sul for the planting of container plants would be to place:
   a. One handful divided equally in 6 one gallon plant pits.
   b. One handful divided equally in 4 five gallon plant pits.
   c. One handful in each 15 gallon plant pit.
   d. Two handfuls in each 24" box plant pit.
   e. Four handfuls in each 36" box plant pit.
2. Apply before backfilling and setting of the plant, so rootball does not contact concentrations of Iron-Sul.

J. Root stimulator: Apply vitamin B-1 at the rate of one tablespoon per gallon.

K. Staking: Stake or guy trees as detailed, minimum, or as directed to properly support the plant material supplied.

L. Pruning: Prune each tree and shrub to preserve the natural character of the plant per American Standard for Nursery Stock, as published by the American Association of Nurserymen. Prune to remove all suckers, deadwood, and broken or badly bruised branches.

M. Mulching: Mulch all plant pits, shrub beds, and groundcover beds with a 2" depth of mulch immediately after planting, except raised beds and planters containing potting mix and areas containing decomposed granite.

N. Decomposed granite: Apply and rake to the finished grade. Thoroughly water-settle the granite to dissipate the fines, roll entire surface. Apply pre-emergent weed control per manufacturer's recommendations.

3.02 CLEANING AND ADJUSTING

A. Remove all waste and debris; clean all pavement of soil and mulch created by this work from site.

3.03 MAINTENANCE AND PROTECTION

A. Maintenance shall begin immediately with the planting of each plant and continue through a period of 90 days after substantial completion of the landscape and irrigation work. Contractor shall manually water each tree for a period which shall begin immediately following the planting of each tree and run until the automatic irrigation system is completely operable. Substantial completion shall be documented in writing from the Contractor.

3.04 COORDINATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those for interface with the work of this Section. Coordinate schedules for installation of the work of this Section with schedules for other installations, to assure orderly progress of the total construction sequence.

3.05 FIELD QUALITY CONTROL

A. Fine grade all planting areas. Provide incidental grading of all areas adjacent to curbs and sidewalks. Provide a finish grade 1-1/2" below curbs or sidewalks for areas receiving sod. Provide a finish grade 2" below curbs or sidewalks for areas receiving decomposed granite.

B. Trim irrigation distribution line to 1” above finish grade of top dressing. Adjust emitter end locations away from stem of plants to edge root ball as a minimum setback. See planting details for other emitter locations.

C. Confirm proper plant locations prior to review with landscape architect.

END OF SECTION

SECTION 32 95 16

STONE TOPDRESS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes supplying and spreading imported topdress materials.

1. Division 31 “Earthwork” for grade control and elevations.
2. Division 32 “Plants” for related landscape planting.
3. Division 32 “Planting Irrigation” for irrigation system installation.

1.3 SAMPLES

A. If substitute source is requested then contractor shall provide one 5-gallon buckets of imported materials for review and approval by Landscape Architect.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All Materials are called out in Construction Documents.

1. Decomposed Granite topdress. Size: ½ Inch Minus. Depth 2” minimum. Color: Express Brown. As supplied by Pioneer. www.pioneersand.com

PART 3 - EXECUTION

3.1 COORDINATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those for interface with the work of this Section. Coordinate schedules for installation of the work of this Section with schedules for other installations, to assure orderly progress of the total construction sequence.

3.2 CLEAN-UP

A. Remove all waste and debris; clean all pavement of debris created by this work from site.

- - - E N D - - -

SECTION 333000 – SANITARY SEWER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes sanitary sewer piping and related components outside the building for sanitary service.

B. All work and materials in this specification must meet the guidelines and rules of the City of Phoenix Water Service Department; “Design Standards Manual for Water and Wastewater Systems”, dated 2017.

1.2 ACTION SUBMITTALS

A. Product Data and Shop Drawings approved by the contractor: For each type of product indicated or to be used in the installation of sanitary services.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

B. Final inspection and approval by City of Phoenix Water Service Department.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying sanitary service. Include all manholes, piping and clean-outs.
2. Comply with standards of authorities having jurisdiction for sanitary service piping, including materials, installation, testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.6 COORDINATION

A. Coordinate connection to sanitary conduit with utility company.

PART 2 - PRODUCTS

All materials shall meet the requirements of the City of Phoenix Water Service Department; “Design Standards Manual for Water and Wastewater Systems”, dated 2017.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

3.3 FIELD QUALITY CONTROL

A. Piping Tests: Conduct all testing per government agency standards.

B. Prepare reports of testing activities.

3.4 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground sanitary service piping. Locate below finished grade, directly over piping.

END OF SECTION 333000