United States Department of Agriculture
Forest Service

George Washington and Jefferson National Forest

Sherando Recreation Area Rehabilitation

Contract No: 12445123C0066
Project No: 6260275010602

Specifications – Final Construction Documents
May 2026

Submitted By:

Atriax GROUP

Planning, Design, Construction
and Related Services

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INTEGRITY ● SERVICE ● EXCELLENCE

Specifications - Bathhouse & Day Use Renovation (1b)

Sherando Recreation Area Rehabilitation
Project No.: 6260275010602

Specifications Manual

Final Construction Documents Submittal
May 8, 2026

OWNER: USDA Forest Service
Southern Region (R8)
1720 Peachtree Street, NW
Atlanta, GA 30309

Specification divisions and sections bound herein are listed below under the name of the Engineer responsible for their preparation, under whose seal and/or authority each document so listed is issued for the purpose(s) stated above. Seals and signatures do not apply to documents not listed below, nor to documents prepared by the government or others, including (except as otherwise indicated) sections in Division 00 Procurement and Contracting Requirements and Division 01 General Requirements, Geotechnical Reports, etc.

PROJECT MANAGER: Harold J. Marvin, PE, LEED AP BD+C

CERTIFICATION: I hereby certify that these Specifications were prepared by me or under my direct supervision, and that I am duly registered under the laws of the Commonwealth of Virginia.

ENGINEER OF RECORD: Harold J. Marvin, PE
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Specification Sections:

00 01 10;	00 01 15;	01 10 00;
01 20 00;	01 30 00;	01 40 00;
01 45 29;	01 50 00;	01 60 00;
01 70 00;	01 74 19;	01 78 00;
07 79 00;	02 41 00;	03 30 53;
04 01 00;	04 05 13;	04 05 16;
04 20 00;	04 72 00;	05 50 00
06 10 00;	06 16 63;	06 20 00;
06 40 23;	07 01 50.19;	07 13 00;
07 22 00;	07 31 34;	07 60 00;

07 71 00;	07 72 00	07 92 00;
08 11 13;	08 16 13;	08 52 13;
08 71 00;	08 80 00;	08 90 00;
09 05 16;	09 23 00;	09 29 00;
09 30 00;	09 30 13;	09 91 00;
10 14 00;	10 21 00;	10 28 00;
12 36 00;	22 13 53;	31 20 11;
32 05 23;	32 12 16;	32 17 23;
33 10 00;	33 30 00	

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Specification Sections:

22 00 10
22 07 19
22 11 16
22 13 16
22 13 19
22 33 00
22 40 00
23 05 00
23 05 93
23 31 13
23 34 23

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Specification Sections:

26 01 00
26 05 00
26 05 19
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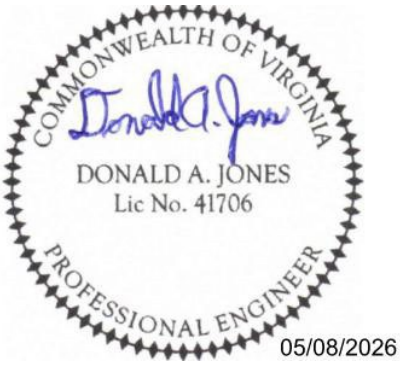

CONSTRUCTION SPECIFICATIONS

TABLE OF CONTENTS
Section 00 01 10

SECTION NO	DIVISION AND SECTION TITLES	DATE
	DIVISION 00 - SPECIAL SECTIONS	
00 01 15	List of Drawing Sheets	05-20
	DIVISION 01 - GENERAL REQUIREMENTS	
	PROVIDED BY FORESTRY SERVICE	
01 10 00	Summary	
01 20 00	Price and Payment Procedures	
01 30 00	Administrative Requirements	
01 40 00	Quality Requirements	
01 45 29	Testing Laboratory Services	11-18
01 50 00	Temporary Facilities and Controls	
01 60 00	Product Requirements	
01 70 00	Execution and Closeout Requirements	
01 74 19	Construction Waste Management	
01 78 00	Closeout Submittals	
01 79 00	Demonstration and Training	
	DIVISION 02 – EXISTING CONDITIONS	
02 41 00	Demolition	08-17
	DIVISION 03 – CONCRETE	
03 30 53	(Short-Form) Cast-in-Place Concrete	01-21
	DIVISION 04 – MASONRY	
04 01 00	Maintenance of Masonry	01-21
04 05 13	Masonry Mortaring	10-17
04 05 16	Masonry Grouting	01-21
04 20 00	Unit Masonry	08-17
04 72 00	Cast Stone Masonry	01-21
	DIVISION 05 – METALS	
05 50 00	Metal Fabrications	01-21
	DIVISION 06 – WOOD, PLASTICS AND COMPOSITES	
06 10 00	Rough Carpentry	10-17
06 16 63	Cementitious Sheathing	01-21
06 20 00	Finish Carpentry	01-21
06 40 23	Interior Architectural Woodwork	

SECTION NO	DIVISION AND SECTION TITLES	DATE
	DIVISION 07 - THERMAL AND MOISTURE PROTECTION	
07 01 50.19	Preparation for Re-Roofing	01-21
07 13 00	Sheet Waterproofing	01-21
07 21 13	Thermal Insulation	01-21
07 22 00	Roof and Deck Insulation	01-21
07 31 34	Composite Shake Roofing	01-18
07 60 00	Flashing and Sheet Metal	01-21
07 71 00	Roof Specialties	01-21
07 72 00	Roof Accessories	01-21
07 92 00	Joint Sealants	04-22
	DIVISION 08 - OPENINGS	
08 11 13	Hollow Metal Doors and Frames	01-21
08 16 13	Fiberglass Entry Doors	
08 52 13	Metal / Clad wood Windows	
08 71 00	Door Hardware	01-24
08 80 00	Glazing	01-21
08 90 00	Louvers and Vents	01-21
	DIVISION 09 – FINISHES	
09 05 16	Subsurface Preparation for Floor Finishes	01-21
09 06 00	Schedule of Finishes	
09 23 00	Gypsum Plastering	01-21
09 29 00	Gypsum Board	04-20
09 30 00	Tiling – SCHLUTER Product Spec	
09 30 13	Ceramic/Porcelain Tiling	01-21
09 91 00	Painting	01-21
	DIVISION 10 – SPECIALTIES	
10 14 00	Signage	01-21
10 21 00	Toilet Compartments	
10 28 00	Toilet, Bath, and Laundry Accessories	01-21
	DIVISION 11 – EQUIPMENT - NOT USED	
	DIVISION 12 – FURNISHINGS	
12 36 00	Countertops	12-23
	DIVISION 13 - SPECIAL CONSTRUCTION NOT USED	
	DIVISION 14– CONVEYING EQUIPEMENT – NOT USED	

SECTION NO	DIVISION AND SECTION TITLES	DATE
	DIVISION 21- FIRE SUPPRESSION – NOT USED	
	DIVISION 22 – PLUMBING	
22 00 10	General Plumbing Requirements	01-23
22 07 19	Plumbing Insulation	09-19
22 11 16	Domestic Water Piping	09-15
22 13 16	Sanitary Waste and Vent Piping	
22 13 19	Sanitary Waste Piping Specialties	
22 13 53	Facility Septic Tanks	
22 33 00	Electric Domestic Water Heaters	09-20
22 40 00	Plumbing Fixtures	12-22
	DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)	
23 05 00	HVAC	03-23
23 05 93	Testing, Adjusting, and Balancing for HVAC	03-23
23 31 13	Metal Ducts	03-23
23 34 23	HVAC Power Ventilators	03-23
	DIVISION 25 – INTEGRATED AUTOMATION – NOT USED	
	DIVISION 26 – ELECTRICAL	
26 01 00	Basic Electrical Requirements	
26 05 00	Common Work Results for Electrical	
26 05 19	Low-Voltage Electrical Power Conductors and Cables	11-22
26 05 26	Grounding and Bonding for Electrical Systems	11-22
26 05 29	Hangers and Supports for Electrical Systems	
26 05 33	Raceways, Boxes and Fittings for Electrical Systems	11-22
26 09 23	Lighting Control Devices	11-22
26 24 16	Panelboards	11-22
26 27 26	Wiring Devices	11-22
26 51 00	Interior Lighting	11-22
	DIVISION 27 – COMMUNICATIONS – NOT USED	
	DIVISION 28 – ELECTRONIC SAFETY AND SECURITY – NOT USED	
	DIVISION 31 – EARTHWORK	
31 20 11	Earthwork (Short Form)	10-12
	DIVISION 32 – EXTERIOR IMPROVEMENTS	
32 05 23	Cement and Concrete for Exterior Improvements	08-16

SECTION NO	DIVISION AND SECTION TITLES	DATE
32 12 16	Asphalt Paving	09-15
32 17 23	Pavement Markings	08-16
	DIVISION 33 – UTILITIES	
33 10 00	Water Utilities	03-17
33 30 00	Sanitary Sewer Utilities	06-13

SECTION 00 01 15
LIST OF DRAWING SHEETS

The drawings listed below accompanying this specification form a part of the contract.

Drawing No.	Title
	GENERAL
G-101	COVER SHEET
G-102	SHEET INDEX
G-103	GENERAL NOTES & SYMBOLS
G-104	TYPICAL ACCESSIBILITY REQUIREMENTS
G-105	TYPICAL ACCESSIBILITY REQUIREMENTS
G-106	TYPICAL ACCESSIBILITY REQUIREMENTS
	SURVEY
V-101	DAY USE AREA PEDESTRIAN WALKWAYS 005 - EXISTING CONDITIONS
V-102	DAY USE PICNIC AREA 006 - EXISTING CONDITIONS
V-103	BOAT DOCK PLAZA AND BOAT LAUNCH - 004 - EXISTING CONDITIONS
V-104	UPPER WHITE OAK LOOP A BATHHOUSE 003 - EXISTING CONDITIONS
	CIVIL DEMOLITION
CD101	DAY USE AREA PEDESTRIAN WALKWAYS 005 – DEMOLITION
CD102	DAY USE PICNIC AREA 006 - DEMOLITION
CD103	BOAT DOCK PLAZA AND BOAT LAUNCH 004 - DEMOLITION
CD104	UPPER WHITE OAK LOOP A BATHHOUSE 003 – DEMOLITION
	CIVIL
C-101	DAY USE AREA PEDESTRIAN WALKWAYS 005 - PROPOSED CONSTRUCTION
C-102	DAY USE PICNIC AREA 006 - PROPOSED CONSTRUCTION
C-103	BOAT DOCK PLAZA AND BOAT LAUNCH 004 - PROPOSED CONSTRUCTION
C-104	UPPER WHITE OAK LOOP A BATHHOUSE 003 – OVERALL SITE PLAN
C-105	UPPER WHITE OAK LOOP A BATHHOUSE 003 – SITE PLAN
C-106	UPPER WHITE OAK LOOP A BATHHOUSE 003 – SEPTIC FIELD LAYOUT PLAN
C-107	UPPER LOOP BATHHOUSE REPAIR FIELD LAYOUT PLAN
C-108	UPPER WHITE OAK LOOP A BATHHOUSE 003 - GRADING AND DRAINAGE PLAN
C-109	LOWER WHITE OAK LOOP A BATHHOUSE 002 – SITE PLAN
C-501	DAY USE PICNIC AREA 006 – DETAILS 1
C-502	DAY USE PICNIC AREA 006 – DETAILS 2
C-503	DAY USE PICNIC AREA 006 – DETAILS 3
C-504	UPPER WHITE OAK LOOP A BATHHOUSE 003 – CIVIL DETAILS 1
C-505	UPPER WHITE OAK LOOP A BATHHOUSE 003 – CIVIL DETAILS 2
C-506	UPPER WHITE OAK LOOP A BATHHOUSE 003 – CIVIL DETAILS 3
C-507	UPPER WHITE OAK LOOP A BATHHOUSE 003 – CIVIL DETAILS 4
C-508	UPPER WHITE OAK LOOP A BATHHOUSE 003 – CIVIL DETAILS 5
C-509	LOWER WHITE OAK LOOP A BATHHOUSE 002 – CIVIL DETAILS
C-510	EROSION AND SEDIMENTATION CONTROL DETAILS
	STRUCTURAL
S-101	ROOF FRAMING REPAIR PLAN & DETAILS

ARCHITECTURAL DEMOLITION

AD101 CCC BEACH PAVILION BATHHOUSE 001 - DEMOLITION PLAN
AD102 LOWER WHITE OAK LOOP A BATHHOUSE 002 DEMOLITION PLANS

ARCHITECTURAL

A-101 CCC BEACH PAVILION BATHHOUSE 001 - FLOOR PLAN
A-102 LOWER WHITE OAK LOOP A BATHHOUSE 002 – PROPOSED PLANS
A-103 UPPER WHITE OAK LOOP A BATHHOUSE 003 - PROPOSED FOUNDATION, FLOOR AND DIMENSION PLANS
A-104 UPPER WHITE OAK LOOP A BATHHOUSE 003 - PROPOSED ROOF PLAN AND ROOF FRAMING PLANS
A-201 CCC BEACH PAVILION BATHHOUSE 001 - EXTERIOR ELEVATIONS
A-202 CCC BEACH PAVILION BATHHOUSE 001 - EXTERIOR ELEVATIONS
A-203 LOWER WHITE OAK LOOP A BATHHOUSE 002 - EXTERIOR ELEVATIONS
A-204 LOWER WHITE OAK LOOP A BATHHOUSE 002 - EXTERIOR ELEVATIONS
A-205 UPPER WHITE OAK LOOP A BATHHOUSE 003 - EXTERIOR ELEVATIONS
A-301 CCC BEACH PAVILION BATHHOUSE 001 - BUILDING SECTIONS
A-302 UPPER WHITE OAK LOOP A BATHHOUSE 003 - BUILDING PROFILE SECTIONS
A-401 LOWER WHITE OAK LOOP A BATHHOUSE 002 - ENLARGED TOILET PLANS
A-402 UPPER WHITE OAK LOOP A BATHHOUSE 003 - ENLARGED PLANS & SECTION
A-501 CCC BEACH PAVILION BATHHOUSE 001 – DETAILS
A-502 LOWER WHITE OAK LOOP A BATHHOUSE 002 – DETAILS
A-503 UPPER WHITE OAK LOOP A BATHHOUSE 003 - DETAILS

INTERIORS

IN001 CCC BEACH PAVILION BATHHOUSE 001 – INTERIOR FINISH LEGEND AND ABBREVIATIONS
IN002 LOWER WHITE OAK LOOP A BATHHOUSE 002 INTERIOR AND EXTERIOR FINISH LEGEND AND ABBREVIATIONS
IN003 UPPER WHITE OAK LOOP A BATHHOUSE 003 - INTERIOR FINISH LEGEND AND ABBREVIATIONS
IN101 CCC BEACH PAVILION BATHHOUSE 001 - FLOOR FINISH PLAN
IN102 LOWER WHITE OAK LOOP A BATHHOUSE 002 FLOOR FINISH PLAN
IN103 UPPER WHITE OAK LOOP A BATHHOUSE 003 - FLOOR FINISH PLAN
IN111 CCC BEACH PAVILION BATHHOUSE 001 - WALL FINISH PLAN
IN112 LOWER WHITE OAK LOOP A BATHHOUSE 002 - WALL FINISH PLAN
IN113 UPPER WHITE OAK LOOP A BATHHOUSE 003 - WALL FINISH PLAN
IN201 CCC BEACH PAVILION BATHHOUSE 001 - INTERIOR ELEVATIONS
IN202 LOWER WHITE OAK LOOP A BATHHOUSE 002 - INTERIOR ELEVATIONS
IN203 UPPER WHITE OAK LOOP A BATHHOUSE 003 - INTERIOR ELEVATIONS

PLUMBING DEMOLITION

PD101 CCC BEACH PAVILION BATHHOUSE 001 - DEMOLITION PLUMBING FLOOR PLAN
PD102 LOWER WHITE OAK LOOP A 002 - DEMOLITION PLUMBING FLOOR PLAN

PLUMBING

P-001 PLUMBING SCHEDULES NOTES AND DETAILS
P-101 CCC BEACH PAVILION BATHHOUSE 001 - PLUMBING FLOOR PLAN
P-102 LOWER WHITE OAK LOOP A 002 - PLUMBING FLOOR PLAN
P-103 UPPER WHITE OAK LOOP A BATHHOUSE 003 - PLUMBING FLOOR PLAN

MECHANICAL DEMOLITION

MD101 CCC BEACH PAVILION BATHHOUSE 001 - DEMOLITION FLOOR PLAN
MD102 LOWER WHITE OAK LOOP A 002 - DEMOLITION FLOOR PLAN

MECHANICAL

M-001 MECHANICAL NOTES LEGENDS AND SCHEDULES
M-101 CCC BEACH PAVILION BATHHOUSE 001 - FLOOR PLAN
M-102 LOWER WHITE OAK LOOP A 002 - FLOOR PLAN
M-103 UPPER WHITE OAK LOOP A BATHHOUSE 003 - FLOOR PLAN

ELECTRICAL DEMOLITION

ED101 ELECTRICAL - FLOOR PLAN - BATHHOUSE 001 - DEMO
ED102 ELECTRICAL - FLOOR PLAN - BATHHOUSE 002 - DEMO

ELECTRICAL

E-001 ELECTRICAL COVER SHEET
E-101 ELECTRICAL - FLOOR PLAN - BATHHOUSE 001
E-102 ELECTRICAL - FLOOR PLAN - BATHHOUSE 002
E-103 ELECTRICAL - FLOOR PLAN - BATHHOUSE 003
E-501 ELECTRICAL - RISER DIAGRAMS
E-601 ELECTRICAL - SCHEDULES
E-701 ELECTRICAL - DETAILS

- - - E N D - - -

SECTION 011000
SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: Sherando Recreation Area Rehabilitation.

B. Owner's Name: U.S. Forest Service, Southern Region.

C. Project Address: Lyndhurst, VA 22952

D. The Project consists of: Design services to renovate, rehabilitate, and/or repair existing bathhouse facilities within its Sherando Lake Recreation Area. Services will include interior and exterior designs that consider and preserve the historic character and aesthetic of the recreation area and its facilities. Design services to restore functionality to the boat launch, trails, and picnic areas adjacent to one of the area's two lakes requested.

1.02 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a firm, fixed price as described in Section B of the Contract.

1.03 PHASED CONSTRUCTION

A. Use if there is phasing, list constraints.

1.04 WORK BY OWNER

A. Items noted NIC (Not in Contract) will be supplied and installed by U.S. Forest Service before Substantial Completion. Items include:
   1. N/A

1.05 OWNER OCCUPANCY

A. U.S. Forest Service intends to vacate the site during the entire construction period.

B. U.S. Forest Service intends to continue to occupy adjacent portions of the site during the entire construction period.

C. U.S. Forest Service intends to occupy the Project upon Substantial Completion.

D. Cooperate with U.S. Forest Service to minimize conflict and to facilitate U.S. Forest Service's operations.

E. Schedule the Work to accommodate U.S. Forest Service occupancy.

1.06 CONTRACTOR USE OF SITE AND PREMISES

A. Arrange use of site and premises to allow:
   1. Access by FS personnel to all buildings, campground and work center at Sherando for duration of the contract

B. Provide access to and from site as required by law and by U.S. Forest Service:
   1. Do not obstruct roadways and sidewalks.

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

D. Utility Outages and Shutdown:
   1. Limit disruption of utility services to hours approved by COR at least 48 hours in advance.
   2. Prevent accidental disruption of utility services to other facilities.

1.07 CONTRACT DOCUMENT CONVENTIONS

A. Specification Content: The Specifications use certain conventions of style and intended meaning of certain terms, words, and phrasing.
   1. The Specifications are written in the future tense of the imperative mood. Streamlined language indicated by a colon (:) means "shall," "shall be," or "shall comply with" depending on the context.

2. Unless otherwise stated, the Specification requirements are to be performed by the Contractor.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the work results of all sections of the Specifications.

PART 2 PRODUCTS—NOT USED

PART 3 EXECUTION—NOT USED

END OF SECTION

SECTION 012000
PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

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

B. Documentation of changes in Contract Price and Contract Time.

C. Change procedures.

D. Correlation of Contractor submittals based on changes.

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

1.02 RELATED REQUIREMENTS

A. Section 017800 - Closeout Submittals: Project record documents.

1.03 SCHEDULE OF VALUES

A. After Contract Award and before the Construction Kick Off Meeting, submit a Schedule of Values based on the Contract Price Schedule. Breakdown each lump-sum item into component parts of construction work for which progress payments may be requested. The total costs for the component parts of work shall equal the contract line item amount for that lump-sum item. The CO may request data to verify accuracy of dollar values. Include mobilization, general condition costs, overhead and profit in the total dollar value of unit price items and in the component parts of work for each lump-sum item, as described below. Do not include mobilization, general condition costs, general requirement costs, overhead, or profit as a separate item.

B. Do not break down unit price items. Use only the contract line item amount for unit price items.

C. The total cost of all items shall equal the contract sum. The Schedule of Values will form the basis for progress payments.

D. An acceptable Schedule of Values shall be agreed upon by the Contractor and CO before the first progress payment is processed. A cost loaded Project Schedule is not an acceptable substitute for a Schedule of Values.

E. Use Schedule of Values Form: AIA G703 – 1992 in electronic form.

F. Other standard electronic forms will be considered in lieu of standard form specified; submit draft to the Contracting Officer for approval.

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

H. Revise schedule to list approved Change Orders, with each Application For Payment.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

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

B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to COR for approval.

C. Submit an advance copy of each Application for Progress Payment to the CO and COR for review prior to uploading to IPP.

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

E. For each item, provide a column for listing each of the following:
   1. Item Number.
   2. Description of work.
   3. Scheduled Values.
   4. Previous Applications.
   5. Work in Place under this Application.
   6. Authorized Change Orders.

7. Total Completed and Stored to Date of Application.
8. Percentage of Completion.
9. Balance to Finish.
10. Retainage.

F. Execute certification by signature of authorized officer.

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

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

I. Include the following with the application:
1. Transmittal letter as specified for submittals in Section 013000.
2. Construction Progress Schedule revised and current as specified in Section 013000.
3. Partial release of liens from major subcontractors and vendors.

J. When the Contracting Officer requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.05 MODIFICATION PROCEDURES

A. Submit name of the individual authorized to receive change documents and who will be responsible for informing others in Contractor's employ or subcontractors of changes to Contract Documents to the Contracting Officer.

B. For minor changes not involving an adjustment to the Contract Scope, Contract Price, or Contract Time, the COR will issue instructions directly to Contractor.

C. For other required changes, the Contracting Officer will issue a document instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
1. The document will describe the required changes and will designate method of determining any change in Contract Scope, Contract Price, or Contract Time.
2. Promptly execute the change.

D. For changes for which advance pricing is desired, the Contracting Officer will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 7 days.

E. Computation of Change in Contract Price:
1. For change requested by the Government for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Contracting Officer.
3. For pre-determined unit prices and quantities, the amount will be based on the fixed unit prices.

F. Substantiation of Costs: Provide full information required for evaluation.
1. Provide the following data:
   a. Quantities of products, labor, and equipment.
   b. Taxes, insurance, and bonds.
   c. Overhead and profit.
   d. Justification for any change in Contract Time.
   e. Credit for deletions from Contract, similarly documented.
2. Support each claim for additional costs with additional information:
   a. Origin and date of claim.
   b. Dates and times work was performed, and by whom.

c. Time records and wage rates paid.
d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.

G. Execution of Change Orders: The Contracting Officer will issue Change Orders for signatures of parties.

H. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Price.

I. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

J. Promptly enter changes in Project Record Documents.

1.06 APPLICATION FOR FINAL PAYMENT

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

B. Application for Final Payment will not be considered until the following have been accomplished:
1. All closeout procedures specified in Section 017000.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 013000
ADMINISTRATIVE REQUIREMENTS

1.01 PART 1 GENERAL

1.02 SECTION INCLUDES

A. General administrative requirements.

B. Project Management Information System.

C. Preconstruction meeting.

D. Site mobilization meeting.

E. Progress meetings.

F. Construction progress schedule.

G. Progress photographs.

H. Coordination drawings.

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

J. Number of copies of submittals.

K. Requests for Interpretation (RFI) procedures.

L. Submittal procedures.

1.03 RELATED REQUIREMENTS

A. Section 016000 - Product Requirements: General product requirements.

B. Section 017000 - Execution and Closeout Requirements: Additional coordination requirements.

C. Section 017800 - Closeout Submittals: Project record documents; operation and maintenance data; warranties, and bonds.

1.04 REFERENCE STANDARDS

A. AIA G716 - Request for Information 2004.

B. AIA G810 - Transmittal Letter 2001.

C. CSI/CSC Form 12.1A - Submittal Transmittal Current Edition.

D. CSI/CSC Form 13.2A - Request for Information Current Edition.

1.05 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 017000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

B. Make the following types of submittals to COR in the PMIS:
   1. Requests for Interpretation (RFI).
   2. Requests for Substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Design data.
   6. Manufacturer's instructions and field reports.
   7. Applications for payment and change order requests.
   8. Progress schedules.
   9. Coordination drawings.
   10. Correction Punch List and Final Correction Punch List for Substantial Completion.
   11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT MANAGEMENT INFORMATION SYSTEM (PMIS)

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.

B. Besides submittals for review, information, and closeout, this procedure applies to Requests for Information (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.

C. Contractor and the Government are required to use this service.

D. It is Contractor's responsibility to submit documents in allowable format.

E. Subcontractors, suppliers, the Government, and the Government's consultants are to be permitted to use the service at no extra charge.

F. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps, unless such software capability is provided by the service provider.

G. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.

H. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

I. PMIS Provider: The Government is presently in the procurement process for a corporate PMIS solution. If the Government-provided PMIS is available at Contract Award, then the Government’s system will be used. If the Government’s PMIS is not available by the start of construction, the Contractor’s system will be used throughout the project life.

J. Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of COR and the Government participating; further training is the responsibility of the user of the service.

K. Project Closeout: The Contracting Officer will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for the Government.

L. The Government intends to use the system to manage the project and provide a common collaboration and interaction platform for all project team members, including Government staff, external partners and cooperators, architecture and engineering consultants, constructors and construction managers, suppliers, and subcontractors.

M. This system will be the USDA Forest Service’s system of record and be used for all infrastructure project and contract management functions. All information will be gathered, stored, routed, and used from within the system.

N. At intervals determined by the Contracting Officer during a project and at individual project closeout, a snapshot in time will be taken and placed into Box, the Forest Service’s electronic file system and serve as the contract file of record.

O. Requirements:
   1. External and Internal collaboration tool that can be used by both internal USDA Forest Service employees and external customers and vendors. Contractor and A-E designers are required to use this service.
   2. Ability to track documents and correspondence with a history function or log through all project phases. Examples include, but are not limited to:
      a. Design Submittals.
      b. Construction Submittals.
      c. Requests for Information.
      d. Change Requests.
      e. Supplemental Instructions.

f. Field Reports.
g. Photos.
h. Contract Documents and Revisions.
i. Backup Materials for Invoices.

3. Master level scheduling that allows a broad overview of project progress. This is for major program and project milestones only. Constructors are responsible for providing detailed construction scheduling.
4. Mobile component for instantaneous communication and ability to make updates and take pictures on job sites using phones or tablets. Mobile apps need to include offline capacity and syncing when the device is near a signal again.
5. Centralized workflow and unlimited file capacity for the documents associated with the workflow.
6. Access to the application is based on role with fine grain permissions as well as separate log-in credentials for each user.
7. Robust and customizable reporting and dashboard features.
8. Audit trails for all actions in the system.
9. On-demand training for the system for all users.
10. Unlimited users.
11. Application will provide for management of user level access control to be administered by USDA Forest Service project leadership.
12. All data sets created, stored or manipulated by the solution design will be readily available for long term electronic storage and back up as part of official records requirements for government projects.

P. Project Closeout: Contractor will determine when to terminate the service for the project after Substantial Completion and is responsible for providing archive copies of files for the Government prior to Final Completion.

3.02 POST AWARD MEETING

A. The Contracting Officer will schedule a meeting after Contract Award.

B. Attendance Required:
1. Government Team:
a. Contracting Officer.
b. Contracting Officer's Representative.
c. Government’s Project Manager.
d. Local Line Officer or Designated Representative.
2. Contractor Team:
a. Contractor’s Project Manager.
b. Commissioning Agent.

C. Agenda (to be developed and maintained by Contractor):
1. Distribution of Contract Documents.
2. Submission of list of subcontractors, list of products, Schedule of Values, and Construction Progress Schedule.
3. Submission of initial Submittal schedule.
4. Designation of personnel representing the parties to Contract and U.S. Forest Service.
5. Routing for EDSS.
6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.

D. Record Meeting Minutes and upload for approval to the PMIS within two days after meeting.

3.03 PRECONSTRUCTION MEETING

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

B. Attendance Required:
1. Government Team:

a. Contracting Officer.
b. COR.
c. Government's Project Manager.
d. Local Line Officer or designee.

2. Contractor Team:
a. Contractor's Project Manager.
b. Contractor's Superintendent and/or QC Manager.
c. Major subcontractors.

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

D. Record Meeting Minutes and upload for approval to the PMIS within two days after meeting.

3.04 CONSTRUCTION PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the work at maximum monthly intervals.

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

C. Attendance Required:
1. Government Team:
a. Contracting Officer.
b. COR.
c. Government's Project Manager.
d. Local Line Officer or designee.

2. Contractor Team:
a. Contractor's Project Manager.
b. Contractor's Superintendent and/or QC Manager.
c. Major subcontractors.

D. Agenda (to be developed and maintained by Contractor):
1. Review minutes of previous meetings.
2. Review of work progress.
3. Field observations, problems, and decisions.
4. Identification of problems that impede, or will impede, planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of RFI log and status of responses.
7. Review of off-site fabrication and delivery schedules.
8. Maintenance of progress schedule.
9. Corrective measures to regain projected schedules.
10. Planned progress during succeeding work period.
11. Coordination of projected progress.
12. Maintenance of quality and work standards.
13. Effect of proposed changes on progress schedule and coordination.
14. Other business relating to work.

E. Record Meeting Minutes and upload for approval to the PMIS within two days after meeting.

3.05 PROJECT SCHEDULE

A. General: The Contractor shall provide the Project Schedule after award and before the Preconstruction Meeting. The schedule shall include a summary construction schedule with important milestones included for both phases.

B. Development and Updates: Fully develop the construction portion of the schedule and submit before the Preconstruction meeting or any construction begins. The Project Schedule shall be updated on a monthly basis throughout the entire contract period and until project substantial completion. The status date of each schedule update shall be 10 days before the progress payment request date.

C. Purpose: The purpose of the Project Schedule is to ensure adequate planning, coordination, scheduling, and reporting during construction activities of the Contractor. The Project Schedule will assist the Contractor and the Government in monitoring the progress of the work, evaluating proposed changes, and processing the Contractor's monthly progress payment requests.

D. Schedule Development: The Project Schedule shall cover the entire contract period. The late finish date of the Project Schedule shall be the same date as the established completion date of the contract.

E. The Contractor shall use the Critical Path Method (CPM) with limited use of lead or lag durations between schedule activities. The Contractor's Project Schedule shall consist of procurement activities (including mobilization, submittal, and the fabrication and delivery of key and long-lead procurement items) and construction activities.

F. The Contractor's Project Schedule shall consist of, but not be limited to, the following for each activity:
   1. Identify each and every activity number.
   2. Concise description of the work represented by the activity (maximum 48 characters). Avoid the use of non-standard abbreviations. The work related to each activity shall be limited to one work trade.
   3. Activity duration in whole working days, except for non-construction activities including mobilization, shop drawing and sample submittals, fabrication of materials, delivery of materials and equipment, and concrete curing.
   4. In developing the Project Schedule, the Contractor shall be responsible for ensuring that subcontractor work at all tiers, as well as its own work, is included in the Project Schedule.
   5. The Project Schedule, as developed, shall show the sequence and interdependence of activities required for complete performance of the work. The Contractor shall be responsible for ensuring all work sequences are logical and the Project Schedule shows a coordinated work plan. Proposed durations assigned to each activity shall be the Contractor's best estimate of time required to complete the activity considering the scope and resources planned for the activity. Resource loading of each activity shall list all personnel by labor category and equipment type and capacity proposed to complete the activity in the duration shown. Include permit requirements and constraints. Seasonal weather conditions shall be considered and included in the planning and scheduling of all work influenced by high or low ambient temperatures, wind and/or precipitation to ensure completion of all work within the contract time.

G. Project Schedule Updates:
   1. Monthly Updates: The monthly updating of the Project Schedule shall be an integral part and basic element of the estimate upon which progress payments shall be made under this contract. If, in the judgment of the CO, the Contractor fails or refuses to provide a Schedule of Values and a complete schedule update or revision as specified hereinafter, the Contractor shall be deemed to have not provided the required information upon which the progress payment may be made and shall be subject to retainage of a portion of the payment.

2. Time Impact Analysis for Contract Modifications, Changes, Delays, and Contractor Requests Requirements: When contract modifications or changes are initiated, delays are experienced, or the Contractor desires to revise the Project Schedule, the Contractor shall submit to the CO a written time impact analysis illustrating the influence of each modification, change, delay, or Contractor request on the contract time.
3. Time Extensions: Activity delays shall not automatically mean that an extension of the contract time is warranted or due the Contractor. It is possible that a modification, change, or delay will not affect existing critical activities or cause non-critical activities to become critical. A modification, change, or delay may result in only absorbing a part of the available total float that may exist within an activity chain of the Project Schedule, thereby not causing any effect on the contract time. Time extensions will be granted in accordance with the terms of the contract.
4. Float: Float is not for the exclusive use or benefit of either the Government or the Contractor. Extension of the contract time will be granted only to the extent the equitable time adjustments to the activity or activities affected by the modification, change, or delay exceeds the total (positive or zero) float available on a particular activity.

3.06 PROGRESS PHOTOGRAPHS

A. Photography Type: Digital; electronic files.

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

C. Photograph all elements and assemblies before enclosure.

D. Digital Photographs: 24 bit color, minimum resolution of 8 megapixels, in JPG format; provide files unaltered by photo editing software.
1. Delivery Medium: Upload to PMIS.
2. File Naming: Include project identification, date and time of view, and view identification.
3. Point of View Sketch: Include digital copy of point of view sketch with each electronic submittal; include point of view identification in each photo file name.
4. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.

3.07 COORDINATION DRAWINGS

A. Provide information required for preparation of coordination drawings.

B. Review drawings prior to submission to COR.

3.08 REQUESTS FOR INTERPRETATION (RFI)

A. Definition: A request seeking one of the following:
1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
2. A resolution to an issue which has arisen due to field conditions and affects design intent.

B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.

C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
1. Prepare a separate RFI for each specific item.
   a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
   b. Do not forward requests which solely require internal coordination between subcontractors.
2. Prepare in a format and with content acceptable to the Government.

3. Prepare using software provided by the PMIS.
4. Combine RFI and its attachments into a single electronic file. PDF format is preferred.

D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
2. Unacceptable Uses for RFIs: Do not use RFIs to request the following:
a. Approval of submittals (use procedures specified elsewhere in this section).
b. Approval of substitutions (see Section - 016000 - Product Requirements).
c. Changes that entail change in Contract Time and Contract Price (comply with provisions of the Conditions of the Contract).
d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response.
4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response.

E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
1. Official Project name and number, and any additional required identifiers established in Contract Documents.
2. The Contracting Officer's, COR's, and Contractor's names.
3. Discrete and consecutive RFI number, and descriptive subject/title.
4. Issue date, and requested reply date.
5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.

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

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

H. Review Time: COR will respond and return RFIs to Contractor within 15 calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon on a regular working day will be considered as having been received on the following regular working day.
1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead

to a change to Contract Scope, Contract Price, or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to the Government.

1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
4. Notify COR within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.09 SUBMITTAL SCHEDULE

A. Submit to COR for review a schedule for submittals in the PMIS.
   1. Submit at the same time as the preliminary schedule.
   2. Coordinate with Contractor's construction schedule and Schedule of Values.
   3. Format schedule to allow tracking of status of submittals throughout duration of construction.
   4. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
   5. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
      a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

3.10 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.

B. Submit to COR for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.

C. Samples will be reviewed for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 017800 - Closeout Submittals.

3.11 SUBMITTALS FOR INFORMATION

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

B. Submit for Government’s knowledge.

3.12 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 017800 - Closeout Submittals:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Bonds.
   5. Other types as indicated.

D. Submit for the Government's benefit during and after project completion.

3.13 NUMBER OF COPIES OF SUBMITTALS

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

B. Samples: Submit the number specified in individual specification sections; one of which will be retained by COR. Log the submittal in the PMIS and provide a transmittal sheet with the sample.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.

3.14 SUBMITTAL PROCEDURES

A. General Requirements:
   1. Use a single transmittal for related items.
   2. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
   3. Transmit using PMIS form.
   4. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
   5. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
   6. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
      a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
   7. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
      a. Upload submittals in electronic form to PMIS website.
   8. Schedule submittals to expedite the Project, and coordinate submission of related items.
      a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
      b. For sequential reviews involving COR's consultants, the Government, or another affected party, allow an additional 7 days.
      c. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to COR's approval, allow an additional 30 days.
   9. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
   10. Provide space for Contractor and COR review stamps.
   11. When revised for resubmission, identify all changes made since previous submission.
   12. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
   13. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
   14. Submittals not requested will be recognized, and will be returned "Not Reviewed",

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

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

D. Samples Procedures:
   1. Transmit related items together as single package.
   2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
   3. Include with transmittal high-resolution image files of samples to facilitate electronic review and approval. Provide separate submittal page for each item image.

3.15 SUBMITTAL REVIEW

A. Submittals for Review: COR will review each submittal, and approve, or take other appropriate action.

B. Submittals for Information: COR will acknowledge receipt and review. See below for actions to be taken.

C. COR's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
   1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.

D. COR's and consultants' actions on items submitted for review:
   1. Authorizing purchasing, fabrication, delivery, and installation:
      a. Approved: Acceptable with no corrections
      b. Approved as Noted, Resubmission not required: Minor notes or clarifications required. All comments are clear, and no further review is required. Address all review comments when proceeding with the Work. At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
      c. Approved as Noted, Resubmit for Record: Minor notes or clarifications required. No further review is needed. Resubmit corrected item, with review notations acknowledged and incorporated. Resubmit separately, or as part of project record documents.
   2. Not Authorizing fabrication, delivery, and installation:
      a. Revise and Resubmit: Rejected as not in accordance with the Contract or requiring major correction or clarifications. The Government will identify the reasons for not approving. Clearly identify changes when submitting revision.
      b. Resubmit revised item, with review notations acknowledged and incorporated.

E. COR's and consultants' actions on items submitted for information:
   1. Items for which no action was taken:
      a. "Received" - to notify the Contractor that the submittal has been received for record only.
   2. Items for which action was taken:
      a. "Reviewed" - no further action is required from Contractor.

END OF SECTION

SECTION 014000
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.

B. Quality assurance.

C. References and standards.

D. Testing and inspection agencies and services.

E. Control of installation.

F. Mock-ups.

G. Tolerances.

H. Manufacturers' field services.

I. Defect Assessment.

1.02 REFERENCE STANDARDS

A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants 2008 (Reapproved 2014).

B. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation 2017.

C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry 2019.

D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction 2019.

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

F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing 2015.

G. ASTM E699 - Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components 2016.

H. IAS AC89 - Accreditation Criteria for Testing Laboratories 2018.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Construction Quality Control Plan: prior to the Preconstruction meeting, submit for approval a written Contractor Quality Control Plan.
   1. If the plan requires any revisions or corrections, the Contractor shall resubmit the plan within ten (10) days.
   2. The Government reserves the right to require changes in the plan during the contract period as necessary to obtain the quality specified.
   3. No change in the approved plan may be made without written concurrence by the CO.
   4. The plan shall include:
      a. A list of personnel responsible for quality control and assigned duties. Include each person's qualifications.
      b. A copy of a letter of direction to the Contractor's Quality Control Supervisor outlining assigned duties.
      c. Names, qualifications, and descriptions of laboratories to perform sampling and testing, and samples of proposed report forms.
      d. Methods of performing, documenting, and enforcing quality control of all work.

e. Methods of monitoring and controlling environmental pollution and contamination as required by regulations and laws.

C. Test Reports: After each test/inspection, promptly submit two copies of report to the Government and to Contractor.
1. Include:
a. Date issued.
b. Project title and number.
c. Name of inspector.
d. Date and time of sampling or inspection.
e. Identification of product and specifications section.
f. Location in the Project.
g. Type of test/inspection.
h. Date of test/inspection.
i. Results of test/inspection.
j. Compliance with Contract Documents.
k. When requested by COR, provide interpretation of results.
2. Test report submittals are for COR's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for the Government's information.

D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to COR, in quantities specified for Product Data.
1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

E. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Government's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

F. Manufacturer's Field Reports: Submit reports for the Government.
1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

G. Erection Drawings: Submit drawings for the Government.
1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.
2. Data indicating inappropriate or unacceptable Work may be subject to action by COR or the Government.

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications:
1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
3. Qualification Statement: Provide documentation showing testing laboratory is accredited under IAS AC89.

B. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

C. Contractor's Quality Control (CQC) Plan:

1. Prior to start of Construction, submit a comprehensive plan describing how contract deliverables will be produced. Tailor CQC plan to specific requirements of the project. Include the following information:
   a. Management Structure: Identify personnel responsible for quality. Include a chart showing lines of authority.
      1) Include qualifications (in resume form), duties, responsibilities of each person assigned to CQC function.
   b. Management Approach: Define, describe, and include in the plan specific methodologies used in executing the work.
      1) Management and control of documents and records relating to quality.
      2) Communications.
      3) Coordination procedures.
      4) Resource management.
      5) Process control.
      6) Inspection and testing procedures and scheduling.
      7) Control of noncomplying work.
      8) Tracking deficiencies from identification, through acceptable corrective action, and verification.
      9) Control of testing and measuring equipment.
      10) Project materials certification.
      11) Managerial continuity and flexibility.
   c. The Government will not make a separate payment for providing and maintaining a Quality Control Plan. Include associated costs in the Contract Price.
   d. Acceptance of the plan is required prior to start of construction activities not including mobilization work. the Government's acceptance of the plan will be conditional and predicated on continuing satisfactory adherence to the plan. the Government reserves the right to require Contractor to make changes to the plan and operations, including removal of personnel, as necessary, to obtain specified quality of work results.

D. Quality-Control Personnel Qualifications. Engage a person with requisite training and experience to implement and manage quality assurance (QA) and quality control (QC) for the project.

1.05 REFERENCES AND STANDARDS

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

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

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

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

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

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

1.06 TESTING AND INSPECTION AGENCIES AND SERVICES

A. The Contractor shall employ and pay for services of an independent testing agency to perform testing and inspection.

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

C. Contractor Employed Agency:
   1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM E699, ASTM C1021, ASTM C1077, ASTM C1093, and ASTM D3740.
   2. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.
   3. Laboratory Qualifications: Accredited by IAS according to IAS AC89.
   4. Laboratory: Authorized to operate in the State in which the Project is located.
   5. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
   6. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

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

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

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

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

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

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

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

3.02 MOCK-UPS

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

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

C. COR will use accepted mock-ups as a comparison standard for the remaining Work.

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

3.03 TOLERANCES

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

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

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

3.04 TESTING AND INSPECTION

A. Testing Agency Duties:
   1. Provide qualified personnel at site. Cooperate with COR and Contractor in performance of services.

2. Perform specified sampling and testing of products in accordance with specified standards.
3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
4. Promptly notify COR and Contractor of observed irregularities or non-compliance of Work or products.
5. Perform additional tests and inspections required by COR.
6. Submit reports of all tests/inspections specified.

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

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

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

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

3.05 OFF-SITE CONTROL

A. Items that are fabricated or assembled off-site shall be inspected for quality control at the place of fabrication.

B. On-Site Control: Notify the Contracting Officer at least 48 hours in advance of the preparatory phase meeting.

C. Notify the Contracting Officer at least 24 hours in advance of the initial and follow-up phases.

D. Submit inspection reports prior to shipment.

3.06 MANUFACTURERS' FIELD SERVICES

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

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

3.07 DEFECT ASSESSMENT

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

B. If, in the opinion of the Contracting Officer, it is not practical to remove and replace the work, the Contracting Officer will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 01 45 29
TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies materials testing activities and inspection services required during project construction to be provided by a Testing Laboratory retained by the General Contractor. All testing or tests that are referenced in these specifications or on the contract drawings are to be performed by a contractor supplied testing firm meeting the requirements listed below. The general contractor shall be responsible for the cost and payment for all the required testing. Any reference to a VA or Government supplied testing is the responsibility of the general contractor. This means that if there is any reference in these specifications to a Government furnished test it is the total responsibility of the general contractor to secure and pay for these tests. This also means that the contractor should be prepared and include costs in his bid proposal for any and all tests that are shown on the drawing sheets or shown in the table in the below sections.

1.2 APPLICABLE PUBLICATIONS:

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

B. American Association of State Highway and Transportation Officials (AASHTO):

T27-11.....Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates

T96-02 (R2006).....Standard Method of Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

T99-10.....Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5 Kg (5.5 lb.) Rammer and a 305 mm (12 in.) Drop

T104-99 (R2007).....Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate

T180-10.....Standard Method of Test for Moisture-Density Relations of Soils using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop

T191-02(R2006).....Standard Method of Test for Density of Soil In-Place by the Sand-Cone Method

T310-13.....Standard Method of Test for In-place Density and Moisture Content of Soil and Soil-aggregate by Nuclear Methods (Shallow Depth)

C. American Concrete Institute (ACI):

506.4R-94 (R2004).....Guide for the Evaluation of Shotcrete

D. American Society for Testing and Materials (ASTM):

A370-12.....Standard Test Methods and Definitions for Mechanical Testing of Steel Products

A416/A416M-10.....Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete

C31/C31M-10.....Standard Practice for Making and Curing Concrete Test Specimens in the Field

C33/C33M-11a.....Standard Specification for Concrete Aggregates

C39/C39M-12.....Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

C109/C109M-11b.....Standard Test Method for Compressive Strength of Hydraulic Cement Mortars

C136-06.....Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

C138/C138M-10b.....Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete

C140-12.....Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units

C143/C143M-10a.....Standard Test Method for Slump of Hydraulic Cement Concrete

C172/C172M-10.....Standard Practice for Sampling Freshly Mixed Concrete

C173/C173M-10b.....Standard Test Method for Air Content of freshly Mixed Concrete by the Volumetric Method

C330/C330M-09.....Standard Specification for Lightweight Aggregates for Structural Concrete

C567/C567M-11.....Standard Test Method for Density Structural Lightweight Concrete

C780-11.....Standard Test Method for Pre-construction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry

C1019-11.....Standard Test Method for Sampling and Testing Grout

C1064/C1064M-11.....Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete

C1077-11c.....Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation

C1314-11a.....Standard Test Method for Compressive Strength of Masonry Prisms

D422-63(2007).....Standard Test Method for Particle-Size Analysis of Soils

D698-07e1.....Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort

D1140-00(2006).....Standard Test Methods for Amount of Material in Soils Finer than No. 200 Sieve

D1143/D1143M-07e1.....Standard Test Methods for Deep Foundations Under Static Axial Compressive Load

D1188-07e1.....Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples

D1556-07.....Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

D1557-09.....Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft lbf/ft3 (2,700 KNm/m3))

D2166-06.....Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

D2167-08).....Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method

D2216-10.....Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

D2974-07a.....Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils

D3666-11.....Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials

D3740-11.....Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as used in Engineering Design and Construction

D6938-10.....Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

E94-04(2010).....Standard Guide for Radiographic Examination

E164-08.....Standard Practice for Contact Ultrasonic Testing of Weldments

E329-11c.....Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

E543-09.....Standard Specification for Agencies Performing Non-Destructive Testing

E605-93(R2011).....Standard Test Methods for Thickness and Density of Sprayed Fire Resistive Material (SFRM) Applied to Structural Members

E709-08.....Standard Guide for Magnetic Particle Examination

E1155-96(R2008).....Determining FF Floor Flatness and FL Floor Levelness Numbers

F3125/F3125M-15.....Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions

E. American Welding Society (AWS):

D1.D1.1M-10.....Structural Welding Code-Steel

1.3 REQUIREMENTS:

A. Accreditation Requirements: Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope

of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards (i.e.; E329, C1077, D3666, D3740, A880, E543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the "Corporate Office."

B. Inspection and Testing: Testing laboratory shall inspect materials and workmanship and perform tests described herein and additional tests requested by COR. When it appears materials furnished, or work performed by Contractor fail to meet construction contract requirements, Testing Laboratory shall direct attention of COR to such failure.

C. Written Reports: Testing laboratory shall submit test reports to COR, Contractor, unless other arrangements are agreed to in writing by the COR. Submit reports of tests that fail to meet construction contract requirements on colored paper.

D. Verbal Reports: Give verbal notification to COR immediately of any irregularity.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EARTHWORK:

A. General: The Testing Laboratory shall provide qualified personnel, materials, equipment, and transportation as required to perform the services identified/required herein, within the agreed to schedule and/or time frame. The work to be performed shall be as identified herein and shall include but not be limited to the following:

1. Observe fill and subgrades during proof-rolling to evaluate suitability of surface material to receive fill or base course. Provide recommendations to the COR regarding suitability or unsuitability of areas where proof-rolling was observed. Any proof-rolls shall be coordinated where the COR is also present. This means that the COR shall have the option of attending any proof-roll. The proof-roll shall be scheduled in advance in order to have the COR attend the proof-roll. Where unsuitable results are observed, witness excavation of unsuitable material and recommend to COR extent of removal and replacement of unsuitable materials and

observe proof-rolling of replaced areas until satisfactory results are obtained.

2. Provide full time observation of fill placement and compaction and field density testing in building areas and full time observation of fill placement and compaction and field density testing in pavement areas to verify that earthwork compaction obtained is in accordance with contract documents.
3. Provide supervised geotechnical technician to inspect excavation, subsurface preparation, and backfill for structural fill.

B. Testing Compaction:

1. Determine maximum density and optimum moisture content for each type of fill, backfill and subgrade material used, in compliance with ASTM D698 and/or ASTM D1557.
2. Make field density tests in accordance with the primary testing method following ASTM D6938 wherever possible. Field density tests utilizing ASTM D1556, or ASTM D2167 shall be utilized on a case by case basis only if there are problems with the validity of the results from the primary method due to specific site field conditions. Should the testing laboratory propose these alternative methods, they should provide satisfactory explanation to the COR before the tests are conducted.
   a. Building Slab Subgrade: At least one test of subgrade for every 185 m^2 (2000 square feet) of building slab, but in no case fewer than three tests. In each compacted fill layer, perform one test for every 185 m^2 (2000 square feet) of overlaying building slab, but in no case fewer than three tests.
   b. Foundation Wall Backfill: One test per 30 m (100 feet) of each layer of compacted fill but in no case fewer than two tests.
   b. Pavement Subgrade: One test for each 84 m^2 (100 square yards), but in no case fewer than two tests.
   c. Curb, Gutter, and Sidewalk: One test for each 30 m (100 feet).
   d. Trenches: One test at maximum 30 m (100 foot) intervals per 300 mm (1 foot) of vertical lift and at changes in required density, but in no case fewer than two tests.
   e. Footing Subgrade: At least one test for each layer of soil on which footings will be placed. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested subgrade when

acceptable to COR. In each compacted fill layer below wall footings, perform one field density test for every 30 m (100 feet) of wall. Verify subgrade is level, all loose or disturbed soils have been removed, and correlate actual soil conditions observed with those indicated by test borings.

C. Fill and Backfill Material Gradation: One test per 100 cubic yards stockpiled or in-place source material. Gradation of fill and backfill material shall be determined in accordance with ASTM C136. This frequency is only if all fill and backfill is from the same source and type.

D. Testing Materials: Test suitability of on-site and off-site borrow as for each source and type meeting the material specification. The contractor shall be responsible for any and all tests.

3.2 FOUNDATION PILES (NOT USED):

3.3 FOUNDATION CAISSONS (NOT USED):

3.4 LANDSCAPING:

A. Test topsoil for organic materials, pH, phosphate, potash content, and gradation of particles.
   1. Test for organic material by using ASTM D2974.
   2. Determine percent of silt, sand, clay, and foreign materials such as rock, roots, and vegetation.

B. Submit laboratory test report of topsoil to COR.

3.5 ASPHALT CONCRETE PAVING:

A. Aggregate Base Course: Contractor shall perform tests in accordance with VDOT Road and Bridge Specifications and Virginia Test Methods, including sampling of aggregates per AASHTO T2 (Sampling of Aggregates) as referenced or modified in VDOT’s Manual of Instructions for Materials Division (current edition):
   1. Determine maximum density and optimum moisture content for aggregate base material in accordance with AASHTO T180, Method D.
   2. Make a minimum of three field density tests on each day's final compaction on each aggregate course in accordance with AASHTO T191 .
   3. Sample and test aggregate as necessary to insure compliance with specification requirements for gradation, wear, and soundness as specified in the applicable state highway standards and specifications.

B. Asphalt Concrete: Contractor shall perform tests in accordance with VDOT Road and Bridge Specifications and Virginia Test Methods, including sampling of asphalt mixtures per Virginia Test Method – 48 (VTM-48) "Sampling Asphalt Paving Mixtures" (current edition)for all asphalt mixes:

1. Aggregate: Sample and test aggregates in stock pile and hot-bins as necessary to insure compliance with specification requirements for gradation (AASHTO T27), wear (AASHTO T96), and soundness (AASHTO T104).
2. Temperature: Check temperature of each load of asphalt concrete at mixing plant and at site of paving operation.
3. Density: Make a minimum of two field density tests in accordance with ASTM D1188 of asphalt base and surface course for each day's paving operation.

3.6 SITE WORK CONCRETE:

Test site work concrete including materials for concrete as required in Article CONCRETE of this section.

3.7 POST-TENSIONING OF CONCRETE: (NOT USED)

3.8 CONCRETE:

A. Batch Plant Inspection and Materials Testing:

1. Perform continuous batch plant inspection until concrete quality is established to satisfaction of COR with concurrence of COR and perform periodic inspections thereafter as determined by COR.
2. Periodically inspect and test batch proportioning equipment for accuracy and report deficiencies to COR.
3. Sample and test mix ingredients as necessary to insure compliance with specifications.
4. Sample and test aggregates daily and as necessary for moisture content. Test the dry rodded weight of the coarse aggregate whenever a sieve analysis is made, and when it appears there has been a change in the aggregate.
5. Certify, in duplicate, ingredients and proportions and amounts of ingredients in concrete conform to approved trial mixes. When concrete is batched or mixed off immediate building site, certify (by signing, initialing or stamping thereon) on delivery slips (duplicate) that ingredients in truck-load mixes conform to proportions of aggregate weight, cement factor, and water-cement ratio of approved trial mixes.

B. Field Inspection and Materials Testing:

1. Provide a technician at site of placement at all times to perform concrete sampling and testing.
2. Review the delivery tickets of the ready-mix concrete trucks arriving on-site. Notify the Contractor if the concrete cannot be placed within the specified time limits or if the type of concrete delivered is incorrect. Reject any loads that do not comply with the Specification requirements. Rejected loads are to be removed from the site at the Contractor’s expense. Any rejected concrete that is placed will be subject to removal.
3. Take concrete samples at point of placement in accordance with ASTM C172. Mold and cure compression test cylinders in accordance with ASTM C31. Make at least three cylinders of each concrete type, and at least three cylinders for any one day's pour for each concrete type. Label each cylinder with an identification number. COR may require additional cylinders to be molded and cured under job conditions.
4. Perform slump tests in accordance with ASTM C143. Test the first truck each day, and every time test cylinders are made. Test pumped concrete at the hopper and at the discharge end of the hose at the beginning of each day’s pumping operations to determine change in slump.
5. Determine the air content of concrete per ASTM C173. For concrete required to be air-entrained, test the first truck and every 20 m^3 (25 cubic yards) thereafter each day. For concrete not required to be air-entrained, test every 80 m^3 (100 cubic yards) at random or as required by the COR. For pumped concrete, initially test concrete at both the hopper and the discharge end of the hose to determine change in air content.
6. If slump or air content fall outside specified limits, make another test immediately from another portion of same batch.
7. Perform unit weight tests in compliance with ASTM C138 for normal weight concrete and ASTM C567 for lightweight concrete. Test the first truck and each time cylinders are made.
8. Notify laboratory technician at batch plant of mix irregularities and request materials and proportioning check.
9. Verify that specified mixing has been accomplished.

10. Environmental Conditions: Determine the temperature per ASTM C1064 for each truckload of concrete during hot weather and cold weather concreting operations:
    a. When ambient air temperature falls below 4.4 degrees C (40 degrees F), record maximum and minimum air temperatures in each 24 hour period; record air temperature inside protective enclosure; record minimum temperature of surface of hardened concrete.
    b. When ambient air temperature rises above 29.4 degrees C (85 degrees F), record maximum and minimum air temperature in each 24 hour period; record minimum relative humidity; record maximum wind velocity; record maximum temperature of surface of hardened concrete.
11. Inspect the reinforcing steel placement, including bar size, bar spacing, top and bottom concrete cover, proper tie into the chairs, and grade of steel prior to concrete placement. Submit detailed report of observations.
12. Observe conveying, placement, and consolidation of concrete for conformance to specifications.
13. Observe condition of formed surfaces upon removal of formwork prior to repair of surface defects and observe repair of surface defects.
14. Observe curing procedures for conformance with specifications, record dates of concrete placement, start of preliminary curing, start of final curing, end of curing period.
15. Observe preparations for placement of concrete:
    a. Inspect handling, conveying, and placing equipment, inspect vibrating and compaction equipment.
    b. Inspect preparation of construction, expansion, and isolation joints.
16. Observe preparations for protection from hot weather, cold weather, sun, and rain, and preparations for curing.
17. Observe concrete mixing:
    a. Monitor and record amount of water added at project site.
    b. Observe minimum and maximum mixing times.

C. Laboratory Tests of Field Samples:
1. Test compression test cylinders for strength in accordance with ASTM C39. For each test series, test one cylinder at 7 days and one cylinder at 28 days. Use remaining cylinder as a spare tested as

directed by COR. Compile laboratory test reports as follows: Compressive strength test shall be result of one cylinder, except when one cylinder shows evidence of improper sampling, molding or testing, in which case it shall be discarded and strength of spare cylinder shall be used.

2. Make weight tests of hardened lightweight structural concrete in accordance with ASTM C567.
3. Furnish certified compression test reports (duplicate) to COR. In test report, indicate the following information:
   a. Cylinder identification number and date cast.
   b. Specific location at which test samples were taken.
   c. Type of concrete, slump, and percent air.
   d. Compressive strength of concrete in MPa (psi).
   e. Weight of lightweight structural concrete in kg/m^3 (pounds per cubic feet).
   f. Weather conditions during placing.
   g. Temperature of concrete in each test cylinder when test cylinder was molded.
   h. Maximum and minimum ambient temperature during placing.
   i. Ambient temperature when concrete sample in test cylinder was taken.
   j. Date delivered to laboratory and date tested.

3.9 REINFORCEMENT:

A. Review mill test reports furnished by Contractor.

C. Written report shall include, in addition to test results, heat number, manufacturer, type and grade of steel, and bar size.

3.10 SHOTCRETE: (NOT USED)

3.11 PRESTRESSED CONCRETE: (NOT USED)

3.12 ARCHITECTURAL PRECAST CONCRETE: (NOT USED

3.13 MASONRY: (NOT USED)

3.14 STRUCTURAL STEEL: (NOT USED)

3.15 STEEL DECKING: (NOT USED)

3.16 SHEAR CONNECTOR STUDS: (NOT USED)

3.17 SPRAYED-ON FIREPROOFING: (NOT USED)

3.18 TYPE OF TEST:

Approximate Number of Tests Required

The COR can request any number of additional tests at his discretion. The Contractor is ultimately responsible to provide quantity and

quality of testing to comply with project specifications and verify quality of work.

A. Earthwork:

Laboratory Compaction Test, Soils:	_75___
Field Density, Soils (AASHTO T191, T205, or T310)	_25___
Penetration Test, Soils	_____

B. Landscaping:

Topsoil Test	_____

C. Aggregate Base:

Laboratory Compaction, (AASHTO T180)	__25_
Field Density,(AASHTO T191)	__10_
Aggregate, Base Course Gradation (AASHTO T27)	__10_
Wear (AASHTO T96)	_____
Soundness (AASHTO T104)	_____

D. Asphalt Concrete:

Field Density, ASTM D1188	__10_
Aggregate, Asphalt Concrete Gradation (AASHTO T27)	__10_
Wear (AASHTO T96)	_____
Soundness (AASHTO T104)	_____

E. Concrete:

Making and Curing Concrete Test Cylinders (ASTM C31)	_20 sets of 3_
Compressive Strength, Test Cylinders (ASTM C39)	_60_
Concrete Slump Test (ASTM C143)	_20_
Concrete Air Content Test (ASTM C173)	__40_
Unit Weight, Lightweight Concrete (ASTM C567)	_____
Aggregate, Normal Weight: Gradation (ASTM C33)	_____
Deleterious Substances (ASTM C33)	_____
Soundness (ASTM C33)	_____
Abrasion (ASTM C33)	_____
Aggregate, Lightweight Gradation (ASTM C330)	_____
Deleterious Substances (ASTM C330)	_____
Unit Weight (ASTM C330)	_____
Flatness and Levelness Readings (ASTM E1155) (number of days)	_____

F. Inspection:

Technical Personnel (Man-days) _100_

- - - E N D - - -

SECTION 015000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Dewatering.

B. Temporary utilities.

C. Temporary telecommunications services.

D. Temporary sanitary facilities.

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

F. Security requirements.

G. Vehicular access and parking.

H. Waste removal facilities and services.

I. Project identification sign.

J. Field offices.

1.02 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

B. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

1.03 DEWATERING

A. Provide temporary means and methods for dewatering all temporary facilities and controls.

1.04 TEMPORARY UTILITIES

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

B. New permanent facilities may be used.

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

1.05 TELECOMMUNICATIONS SERVICES

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

B. The Government will pay for its own telecommunications services.

1.06 TEMPORARY SANITARY FACILITIES

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

B. New permanent facilities may not be used during construction operations.

C. Maintain daily in clean and sanitary condition.

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

1.07 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

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

C. Protect non-owned vehicular traffic, site, and structures from damage.

1.08 FENCING

A. Construction: Contractor's option for material and organization.

B. Provide 6 foot (1.8 m) high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.09 SECURITY

A. Provide security and facilities to protect Work from unauthorized entry, vandalism, or theft.

1.10 VEHICULAR ACCESS AND PARKING

A. Coordinate access and haul routes with governing authorities and the Government.

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

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

D. Existing on-site roads may be used for construction traffic.

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

F. Provide 3 parking spaces for the Government’s use.

1.11 WASTE REMOVAL

A. Provide a Construction Waste Disposal plan at the Construction Documents Submittal. Divert as much demolition and construction waste as feasible from landfills or non-power generating incinerating.

B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

C. Provide containers with lids. Remove trash from site periodically.

D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.12 PROJECT IDENTIFICATION

A. Provide project identification sign of design, construction, and location approved by the Government.

B. No other signs are allowed without the Government permission except those required by law.

1.13 FIELD OFFICES

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

B. Provide space for Project meetings, with table and chairs to accommodate 8 persons.

C. Locate offices a minimum distance of 30 feet (10 m) from existing and new structures.

D. Provide a desk for the COR.

1.14 CONSTRUCTION CAMPS

A. Establishment of a construction camp on the Site is not permitted.

1.15 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to the Substantial Completion inspection.

B. Remove underground installations to a minimum depth of 2 feet (600 mm). Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore existing facilities used during construction to original condition.

E. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 016000
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Re-use of existing products.

C. Transportation, handling, storage, and protection.

D. Product option requirements.

E. Substitution limitations.

F. Procedures for the Government-supplied products.

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

1.02 RELATED REQUIREMENTS

A. Section 011000 - Summary: Identification of the Government-supplied products.

B. Section 014000 - Quality Requirements: Product quality monitoring.

C. Section 017419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging, and substitutions.

1.03 REFERENCE STANDARDS

A. 16 CFR 260.13 - Guides for the Use of Environmental Marketing Claims; Federal Trade Commission; Recycled Content Current Edition.

B. ASTM D6866 - Standard Test Methods for Determining the Biobased Content of Solid, Liquid, and Gaseous Samples Using Radiocarbon Analysis 2021.

C. BIFMA e3 - Furniture Sustainability Standard; Business and Institutional Furniture Manufacturers Association 2019.

D. C2C (DIR) - C2C Certified Products Registry; Cradle to Cradle Products Innovation Institute Current Edition.

E. EN 15804 - Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products 2014.

F. GreenScreen (LIST) - GreenScreen for Safer Chemicals List Translator; Clean Production Action Current Edition.

G. GreenScreen (METH) - GreenScreen for Safer Chemicals Method v1.2; Clean Production Action Current Edition.

H. ISO 14025 - Environmental labels and declarations -- Type III environmental declarations -- Principles and procedures 2006 (Confirmed 2020).

I. ISO 14040 - Environmental management - Life cycle assessment - Principles and framework 2006 (Amended 2020).

J. ISO 14044 - Environmental management - Life cycle assessment - Requirements and guidelines 2006 (Amended 2020).

K. ISO 21930 - Sustainability in buildings and civil engineering works -- Core rules for environmental product declarations of construction products and services 2017.

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

M. NSF 332 - Sustainability Assessment for Resilient Floor Coverings 2015.

1.04 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

1. Submit within 15 days after date of Agreement.
2. For products specified only by reference standards, list applicable reference standards.

B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

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

D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

E. Sustainable Design Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

1.05 QUALITY ASSURANCE

A. Bio-Based Content: Of vegetable or animal origin, not including products made by killing the animal.
1. Determine percentage of bio-based content in accordance with ASTM D6866.
2. Bio-based content must be sourced from a Sustainable Agriculture Network certified farm.

B. Chain-of-Custody (COC): A procedure that tracks a product from the point of harvest or extraction to its end use, including successive stages of processing, transformation, manufacturing, and distribution.

C. Chain-of-Custody Certificates: Certificates signed by manufacturers and fabricators certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001.

D. Composite Wood and Agrifiber: Products made of wood particles and/or plant material pressed and bonded with adhesive or resin such as particleboard, medium density fiberboard (MDF), plywood, wheatboard, strawboard, panel substrates, and door cores.

E. Cradle-to-Cradle Certified: End use product certified Cradle-to-Cradle v2 Basic or Cradle-to-Cradle v3 Bronze, minimum, as evidenced by C2C (DIR).

F. Environmental Product Declaration (EPD): Publicly available, critically reviewed life cycle analysis having at least a cradle-to-gate scope.
1. Good: Product-specific; compliant with ISO 14044.
2. Better: Industry-wide, generic; compliant with ISO 21930, or with ISO 14044, ISO 14040, ISO 14025, and EN 15804; Type III third-party certification with external verification, in which the manufacturer is recognized as the program operator.
3. Best: Commercial-product-specific; compliant with ISO 21930, or with ISO 14044, ISO 14040, ISO 14025, and EN 15804; Type III third-party certification with external verification, in which the manufacturer is recognized as the program operator.
4. Where demonstration of impact reduction below industry average is required, submit both industry-wide and commercial-product-specific declarations; or submit at least 5 declarations for products of the same type by other manufacturers in the same industry.

G. GreenScreen Chemical Hazard Analysis: Ingredients of 100 parts-per-million or greater evaluated using GreenScreen (METH).
1. Good: GreenScreen (LIST) evaluation to identify Benchmark 1 hazards; a Health Product Declaration includes this information.
2. Better: GreenScreen Full Assessment.
3. Best: GreenScreen Full Assessment by GreenScreen Licensed Profiler.
4. Acceptable Evidence: GreenScreen report.

H. Health Product Declarations (HPD): Complete, published declaration with full disclosure of known hazards, prepared using one of the HPDC (HPD-OLT) online tools.

I. Multi-Attribute Certifications: Lifecycle-based environmental certifications that indicate that a product has undergone rigorous scientific testing, exhaustive auditing, or both, to prove its compliance with stringent, third-party, environmental performance standards. Third-party certifications include the following:

J. Rapidly Renewable Materials: Made from agricultural products that are typically harvested within a 10-year or shorter cycle.

K. Recycled Content: Determine percentage of post-consumer and pre-consumer (post-industrial) content separately, using the guidelines contained in 16 CFR 260.13.
   1. Previously used, reused, refurbished, and salvaged products are not considered recycled.
   2. Wood fabricated from timber abandoned in transit to original mill is considered reused, not recycled.
   3. Determine percentage of recycled content of any item by dividing the weight of recycled content in the item by the total weight of materials in the item.
   4. Determine value of recycled content of each item separately, by multiplying the content percentage by the value of the item.
   5. Acceptable Evidence:
      a. For percentage of recycled content, information from manufacturer.
      b. For cost, Contractor's cost data.

L. Regional Materials: Materials that are extracted, harvested, recovered, and manufactured within a radius of 500 miles from the Project site.

M. Source Location: Location of harvest, extraction, recovery, or manufacture; where information about source location is required to be submitted, give the postal address:
   1. In every case, indicate the location of final assembly.
   2. For harvested products, indicate location of harvest.
   3. For extracted (i.e. mined) products, indicate location of extraction.
   4. For recovered products, indicate location of recovery.
   5. For products involving multiple manufacturing steps, provide a description of the process at each step, with location.
   6. Acceptable Evidence:
      a. Manufacturer's certification.
      b. Life cycle analysis (LCA) performed by third-party.

N. Sustainably Harvested Wood: Solid wood, wood chips, and wood fiber certified or labeled by an organization accredited by one of the following:
   1. American Forest Foundation, The American Tree Farm System; refer to http://www.treefarmsystem.org.
   2. The Forest Stewardship Council, The Principles for Natural Forest Management; for Canada visit http://www.fsccanada.org, for the USA visit http://www.fscus.org.
   3. Sustainable Forestry Board, under The Sustainable Forestry Initiative® of the American Forest & Paper Association; refer to http://www.afandpa.org.
   4. Acceptable Evidence: Copies of invoices bearing the certifying organization's certification numbers.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

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

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

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

2.02 NEW PRODUCTS

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

B. See Section 014000 - Quality Requirements, for additional source quality control requirements.

C. Use of products having any of the following characteristics is not permitted:
   1. Made outside the United States, its territories, Canada, or Mexico.
   2. Made using or containing CFC's or HCFC's.
   3. Made of wood from newly cut old growth timber.
   4. Containing lead, cadmium, or asbestos.

D. Where other criteria are met, Contractor shall give preference to products that:
   1. If used on interior, have lower emissions.
   2. If wet-applied, have lower VOC content.
   3. Are extracted, harvested, and/or manufactured closer to the location of the project.
   4. Have longer documented life span under normal use.
   5. Result in less construction waste.
   6. Are made of vegetable materials that are rapidly renewable.
   7. Are made of recycled materials.
   8. If made of wood, are made of sustainably harvested wood, wood chips, or wood fiber.
   9. If bio-based, other than wood, are or are made of Sustainable Agriculture Network certified products.
   10. Are Cradle-to-Cradle Certified.

E. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.

F. Cord and Plug: Provide minimum 6 foot (2 m) cord and plug including grounding connector for connection to electric wiring system. Cord of longer length is specified in individual specification sections.

2.03 PRODUCT OPTIONS

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

B. Products Specified by Naming a Mandatory Product: Use the product specified, no options or substitutions allowed. Unless noted, products specified by name are either a Basis of Design or Reference Product.

C. Products Specified by Naming a Basis of Design or Reference Product: Use any product meeting the standards or description of the Basis of Design or Reference Product.

D. Elements Made Up of More Than One Product:
   1. Where an element is specified by performance criteria, the project shall use construction either proven-in-use or proven-by-mock-up, unless otherwise indicated.
      a. Proven-In-Use: Proven to comply by having actually been built to the same or very similar design with the same materials as specified and functioning as specified.
      b. Proven-by-Mock-Up: Compliance reasonably predictable by having been tested in full-scale mock-up using the same materials and design as specified and functioning as specified. Testing need not have been accomplished specifically for this project; when published listings of independent agencies include details of testing and results, citation of test by listing number is sufficient (submittal of all test details is not required).
      c. The Contractor may choose whether to use elements proven-in-use or proven-by-mock-up, unless either option is indicated as specifically required.

2. Where test methods accompany performance requirements, those test methods shall be used to test the mock-up.
3. Where a type of product is specified, without performance criteria specifically applicable to the element, the project shall use the type of product specified.
4. Where more than one type of product is specified, without performance criteria specifically applicable to the element, the Contractor shall use one of the types of products specified.
5. Where a type of product is specified, with applicable performance criteria, the Contractor shall use either the type of product specified or another type of product that meets the performance criteria as proven-in-use or proven-by-mock-up.
6. Where more than one type of product is specified, with applicable performance criteria, the Contractor shall use either one of the types of products specified or another type of product that meets the performance criteria as proven-in-use or proven-by-mock-up.

E. Where neither type of product nor performance criteria are specified, the Contractor shall use products that will perform well within the specified life span of the building.

2.04 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 CONSTRUCTION PHASE SUBMISSIONS

A. The Contractor shall identify actual brand name products used for every product, except commodity products specified by performance or description.

B. Where a product is specified by performance requirements with test methods, and if so specified, the Contractor shall provide test reports showing compliance.

C. The Contractor shall provide manufacturer's product literature for each brand name product.

D. The Contractor shall provide the manufacturer's certification that the product used on the project complies with the contract documents.

3.02 OWNER-SUPPLIED PRODUCTS

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

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

3.03 TRANSPORTATION AND HANDLING

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

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

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

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

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

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

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

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

3.04 STORAGE AND PROTECTION

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

B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 017419.

1. Structural Loading Limitations: Handle and store products and materials so as not to exceed static and dynamic load-bearing capacities of project floor and roof areas.

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

D. Store with seals and labels intact and legible.

E. Arrange storage of materials and products to allow for visual inspection for the purpose of determination of quantities, amounts, and unit counts.

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

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

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

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

J. Do not store products directly on the ground.

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

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

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

N. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 017000
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Pre-installation meetings.

C. Cutting and patching.

D. Surveying for laying out the work.

E. Cleaning and protection.

F. Starting of systems and equipment.

G. Demonstration and instruction of the Government personnel.

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

I. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

A. Section 011000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 017900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
   1. On request, submit documentation verifying accuracy of survey work.
   2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
   3. Submit signed and sealed survey plats, legal descriptions, and survey logs for the project record.
   4. The surveyor shall be a licensed professional surveyor in the state the project is located.

C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
   1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences. Include design drawings and calculations for bracing and shoring.
   2. Identify demolition firm and submit qualifications.
   3. Include a summary of safety procedures.

D. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of the Government or separate Contractor.

E. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.04 QUALIFICATIONS

A. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to COR. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and

experienced in collecting and recording accurate data relevant to ongoing construction activities,

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

C. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.05 PROJECT CONDITIONS

A. Use of explosives is not permitted.

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

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

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

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

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

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

H. Working Days and Hours:
   1. Limit work and deliveries to weekdays between 6 AM and 6 PM unless approved in advance by the COR.
   2. No work shall occur on Federal holidays without prior approval of the Contracting Officer.

I. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations. Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.

J. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from invading the premises or damaging the work.

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

L. Smoking: Prohibit smoking and vaping within buildings or enclosed spaces.

M. Welding: Perform torch cutting or welding only when adequate fire protection and ventilation is provided.

1.06 COORDINATION

A. See Section 011000 for occupancy-related requirements.

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

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

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

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

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

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

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

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

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

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

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

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

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

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

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

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

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

3.02 PREPARATION

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

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

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

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify COR four days in advance of meeting date.

D. Prepare agenda and preside at meeting:
   1. Review conditions of examination, preparation, and installation procedures.
   2. Review coordination with related work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to COR, the Government, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

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

B. Promptly notify COR of any discrepancies discovered.

C. Contractor shall locate and protect survey control and reference points.

D. Control datum for survey is that indicated on drawings.

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

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

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

H. Utilize recognized engineering survey practices.

I. Establish a minimum of two permanent benchmarks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.

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

K. Periodically verify layouts by same means.

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

M. On completion of foundation walls and major site improvements, prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

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

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

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

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

3.06 CUTTING AND PATCHING

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

B. Perform whatever cutting and patching is necessary to:

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

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

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

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

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

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

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

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

3.07 PROGRESS CLEANING

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

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

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

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

3.08 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.09 SYSTEM STARTUP

A. Coordinate with requirements of Section 019113 - General Commissioning Requirements.

B. Coordinate schedule for start-up of various equipment and systems.

C. Notify COR seven days prior to start-up of each item.

D. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

E. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

F. Verify that wiring and support components for equipment are complete and tested.

G. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

H. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

I. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.10 DEMONSTRATION AND INSTRUCTION

A. See Section 017900 - Demonstration and Training.

B. Demonstrate operation and maintenance of products to the Government's personnel two weeks prior to date of Substantial Completion.

C. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.

D. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of Owner's personnel.

F. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with the Government's personnel in detail to explain all aspects of operation and maintenance.

G. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

H. The amount of time required for instruction on each item of equipment and system is that specified in individual sections.

3.11 ADJUSTING

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

3.12 FINAL CLEANING

A. Execute final cleaning after Substantial Completion but before making final application for payment.

B. Clean areas to be occupied by the Government prior to final completion before the Government occupancy.

C. Use cleaning materials that are nonhazardous.

D. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

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

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

G. Clean filters of operating equipment.

H. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.

I. Clean site: sweep paved areas, rake clean landscaped surfaces.

J. Remove waste, surplus materials, trash, rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.13 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.

B. Accompany COR on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.

C. Notify the Contracting Officer when work is considered ready for the Contracting Officer’s Substantial Completion inspection.

D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Contracting Officer’s Substantial Completion inspection.

E. The Government will occupy all of the building as specified in Section 011000.

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

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

H. Notify COR when work is considered finally complete and ready for the Government’s Final Inspection.

I. Complete items of work determined by the Contracting Officer listed in executed Certificate of Substantial Completion.

3.14 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

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

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

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Government.

F. Provide consumable supplies for systems and equipment for one year of operations as recommended by the Commissioning Authority and system manufacturer.

END OF SECTION

SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the requirements for the management of non-hazardous building construction and demolition waste.

B. Waste disposal in landfills shall be minimized to the greatest extent possible. Of the inevitable waste that is generated, as much of the waste material as economically feasible shall be salvaged, recycled or reused.

C. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators, and facilitate their salvage and recycle not limited to the following:

D. Waste Management Plan development and implementation.

E. Techniques to minimize waste generation.

F. Sorting and separating of waste materials.

G. Salvage of existing materials and items for reuse or resale.

H. Recycling of materials that cannot be reused or sold.

I. At a minimum the following waste categories shall be diverted from landfills:

1. Soil.
2. Inerts (eg, concrete, masonry and asphalt).
3. Clean dimensional wood and palette wood.
4. Green waste (biodegradable landscaping materials).
5. Engineered wood products (plywood, particle board and I-joists, etc).
6. Metal products (eg, steel, wire, beverage containers, copper, etc).
7. Sheathings
8. Cardboard, paper and packaging.
9. Bitumen roofing materials.
10. Plastics (eg, ABS, PVC).
11. Carpet and/or pad.
12. Gypsum board.
13. Insulation.
14. Paint.
15. Fluorescent lamps.

1.2 RELATED WORK

A. Section 02 41 00, DEMOLITION.

1.3 QUALITY ASSURANCE

A. Contractor shall practice efficient waste management when sizing, cutting and installing building products. Processes shall be employed to ensure the generation of as little waste as possible. Construction /Demolition waste includes products of the following:
   1. Excess or unusable construction materials.
   2. Packaging used for construction products.
   3. Poor planning and/or layout.
   4. Construction error.
   5. Over ordering.
   6. Weather damage.
   7. Contamination.
   8. Mishandling.
   9. Breakage.

B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.

C. Contractor shall develop and implement procedures to recycle construction and demolition waste to a minimum of 50 percent.

D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.

E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations.

F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.

G. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties during waste generating stages.

H. Record on daily reports any problems in complying with laws, regulations and ordinances with corrective action taken.

1.4 TERMINOLOGY

A. Class III Landfill: A landfill that accepts non-hazardous resources such as household, commercial and industrial waste resulting from construction, remodeling, repair and demolition operations.

B. Clean: Untreated and unpainted; uncontaminated with adhesives, oils, solvents, mastics and like products.

C. Construction and Demolition Waste: Includes all non-hazardous resources resulting from construction, remodeling, alterations, repair and demolition operations.

D. Dismantle: The process of parting out a building in such a way as to preserve the usefulness of its materials and components.

E. Disposal: Acceptance of solid wastes at a legally operating facility for the purpose of land filling (includes Class III landfills and inert fills).

F. Inert Backfill Site: A location, other than inert fill or other disposal facility, to which inert materials are taken for the purpose of filling an excavation, shoring or other soil engineering operation.

G. Inert Fill: A facility that can legally accept inert waste, such as asphalt and concrete exclusively for the purpose of disposal.

H. Inert Solids/Inert Waste: Non-liquid solid resources including, but not limited to, soil and concrete that does not contain hazardous waste or soluble pollutants at concentrations in excess of water-quality objectives established by a regional water board, and does not contain significant quantities of decomposable solid resources.

I. Mixed Debris: Loads that include commingled recyclable and non-recyclable materials generated at the construction site.

J. Mixed Debris Recycling Facility: A solid resource processing facility that accepts loads of mixed construction and demolition debris for the purpose of recovering re-usable and recyclable materials and disposing non-recyclable materials.

K. Permitted Waste Hauler: A company that holds a valid permit to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal.

L. Recycling: The process of sorting, cleansing, treating, and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.

1. On-site Recycling – Materials that are sorted and processed on site for use in an altered state in the work, i.e. concrete crushed for use as a sub-base in paving.
2. Off-site Recycling – Materials hauled to a location and used in an altered form in the manufacture of new products.

M. Recycling Facility: An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of new products. Depending on the types of materials accepted and operating procedures, a recycling facility may or may not be required to have a solid waste facilities permit or be regulated by the local enforcement agency.

N. Reuse: Materials that are recovered for use in the same form, on-site or off-site.

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

P. Salvage: To remove waste materials from the site for resale or re-use by a third party.

Q. Source-Separated Materials: Materials that are sorted by type at the site for the purpose of reuse and recycling.

R. Solid Waste: Materials that have been designated as non-recyclable and are discarded for the purposes of disposal.

S. Transfer Station: A facility that can legally accept solid waste for the purpose of temporarily storing the materials for re-loading onto other trucks and transporting them to a landfill for disposal, or recovering some materials for re-use or recycling.

1.5 SUBMITTALS

A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish the following:

B. Prepare and submit to the COR

C. a written demolition debris management plan. The plan shall include, but not be limited to, the following information:

1. Procedures to be used for debris management.
2. Techniques to be used to minimize waste generation.
3. Analysis of the estimated job site waste to be generated:
   a. List of each material and quantity to be salvaged, reused, recycled.
   b. List of each material and quantity proposed to be taken to a landfill.

4. Detailed description of the Means/Methods to be used for material handling.
   a. On site: Material separation, storage, protection where applicable.
   b. Off site: Transportation means and destination. Include list of materials.
      1) Description of materials to be site-separated and self-hauled to designated facilities.
      2) Description of mixed materials to be collected by designated waste haulers and removed from the site.
         a) The names and locations of mixed debris reuse and recycling facilities or sites.
         b) The names and locations of trash disposal landfill facilities or sites.
         c) Documentation that the facilities or sites are approved to receive the materials.

D. Designated Manager responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.

E. Monthly summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling.

F. Target waste diversion rate by material and an overall diversion rate.

G. Final report documenting the results of implementation of the preconstruction waste management plan.

1.6 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced by the basic designation only. In the event that criteria requirements conflict, the most stringent requirements shall be met.

B. U.S. Green Building Council (USGBC): LEED Green Building Rating System for New Construction

1. Green Building Initiative (GBI): Green Globes for New Construction 2019

1.7 RECORDS

A. Maintain records to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. Records shall be kept in accordance with the LEED Reference Guide and LEED Template.

PART 2 - PRODUCTS

2.1 MATERIALS

A. List of each material and quantity to be salvaged, recycled, reused.

B. List of each material and quantity proposed to be taken to a landfill.

C. Material tracking data: Receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices, net total costs or savings.

PART 3 - EXECUTION

3.1 COLLECTION

A. Provide all necessary containers, bins and storage areas to facilitate effective waste management.

B. Clearly identify containers, bins and storage areas so that recyclable materials are separated from trash and can be transported to respective recycling facility for processing.

C. Hazardous wastes shall be separated, stored, disposed of according to local, state, federal regulations.

3.2 DISPOSAL

A. Contractor shall be responsible for transporting and disposing of materials that cannot be delivered to a source-separated or mixed materials recycling facility to a transfer station or disposal facility that can accept the materials in accordance with state and federal regulations.

B. Construction or demolition materials with no practical reuse or that cannot be salvaged or recycled shall be disposed of at a landfill or incinerator.

3.3 REPORT

A. With each application for progress payment, submit a summary of construction and demolition debris diversion and disposal including beginning and ending dates of period covered.

B. Quantify all materials diverted from landfill disposal through salvage or recycling during the period with the receiving parties, dates removed, transportation costs, weight tickets, manifests, invoices.

Include the net total costs or savings for each salvaged or recycled material.

C. Quantify all materials disposed of during the period with the receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices. Include the net total costs for each disposal.

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SECTION 017800
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project record documents.

B. Operation and maintenance data.

C. Materials transparency manual.

D. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 013000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Section 017000 - Execution and Closeout Requirements: Contract closeout procedures.

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

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

1.03 SUBMITTALS

A. Project Record Documents: Submit documents through PMIS to COR at Substantial Completion.

B. Operation and Maintenance Data:
   1. Submit preliminary draft or proposed formats and outlines of contents before start of Work. COR will review draft and return with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by the Government, submit completed documents within ten days after acceptance.
   3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with COR comments. Revise content of all document sets as required prior to final submission.
   4. Submit two sets of revised final documents in final form within 10 days after final inspection.

C. Materials Transparency Manual:
   1. Compile and submit a digital and a printed version of information disclosing materials content for interior finishes, furnishings (including workstations), built-in furniture. Meet IWBI (BS) requirements for format and content.

D. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with the Government's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.

4. Change Orders and other modifications to the Contract.
5. Reviewed shop drawings, product data, and samples.
6. Manufacturer's instruction for assembly, installation, and adjusting.

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

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

D. Record information concurrent with construction progress.

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

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

G. As-Constructed BIM Models:
1. Provide as-constructed BIM models by updating the approved Signed and Stamped Construction Documents to reflect as-installed conditions.
2. Follow the formats required for documents in Section F: Deliveries or Performance of the Contract.

3.02 OPERATION AND MAINTENANCE DATA

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

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

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

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

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
1. Product data, with catalog number, size, composition, and color and texture designations.
2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

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

E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

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

D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

E. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
   1. Include HVAC outdoor and exhaust air damper calibration strategy.
      a. Include provisions which ensure that full closure of dampers can be achieved.
   2. Include Carbon Dioxide Monitoring Protocol.
   3. Include Carbon Monoxide Monitoring Protocol.
   4. Include Frost Mitigation Strategy for ventilation heat-recovery system.

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

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

H. Include sequence of operation by controls manufacturer.

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

J. Provide control diagrams by controls manufacturer as installed.

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

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

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

N. Include test and balancing reports.

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

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for the Government's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

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

C. Provide both electronic version in PDF and two paper copies.

D. Binders: Commercial quality, 8-1/2 by 11 inch (216 by 280 mm) three D side ring binders with durable plastic covers; 2 inch (50 mm) maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

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

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

G. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

H. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

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

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

K. Arrangement of Contents: Organize each volume in parts as follows:
   1. Project Directory.
   2. Table of Contents, of all volumes, and of this volume.
   3. Operation and Maintenance Data: Arranged by system, then by product category.
      a. Source data.
      b. Product data, shop drawings, and other submittals.
      c. Operation and maintenance data.
      d. Field quality control data.
      e. Photocopies of warranties and bonds.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with the Government's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

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

C. Co-execute submittals when required.

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

E. Include originals of each in operation and maintenance manuals, indexed separately on Table of Contents.

END OF SECTION

SECTION 017900
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.

B. Training of the Government personnel in operation and maintenance is required for:
   1. All software-operated systems.
   2. HVAC systems and equipment.
   3. Plumbing equipment.
   4. Electrical systems and equipment.
   5. Conveying systems.
   6. Landscape irrigation.
   7. Items specified in individual product Sections.

C. Training of the Government personnel in care, cleaning, maintenance, and repair is required for:
   1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
   2. Finishes, including flooring, wall finishes, ceiling finishes.
   3. Fixtures and fittings.
   4. Items specified in individual product Sections.

1.02 RELATED REQUIREMENTS

A. Section 017800 - Closeout Submittals: Operation and maintenance manuals.

B. Section 019113 - General Commissioning Requirements: Additional requirements applicable to demonstration and training.

C. Other Specification Sections: Additional requirements for demonstration and training.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures; except:
   1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.
   2. Submit one copy to the Commissioning Authority, not to be returned.
   3. Make commissioning submittals on time schedule specified by Commissioning Authority.
   4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 preferred.

B. Draft Training Plans: The Government will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit to Commissioning Authority for review and inclusion in overall training plan.
   2. Submit not less than four weeks prior to start of training.
   3. Revise and resubmit until acceptable.
   4. Provide an overall schedule showing all training sessions.
   5. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such as slides, hand-outs, etc.

h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
1. Include applicable portion of O&M manuals.
2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
3. Provide one extra copy of each training manual to be included with operation and maintenance data.

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

E. Video Recordings: Submit digital video recording of each demonstration and training session for the Government's subsequent use.

1.04 QUALITY ASSURANCE

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by the Government.

B. Demonstrations conducted during Functional Testing need not be repeated unless the Government personnel training is specified.

C. Demonstration may be combined with the Government personnel training if applicable.

D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
1. Perform demonstrations not less than two weeks prior to Substantial Completion.
2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Contractor shall prepare the Training Plan based on draft plans submitted.

B. Conduct training on-site unless otherwise indicated.

C. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.

D. Provide training in minimum two hour segments.

E. The COR is responsible for determining that the training was satisfactorily completed and will provide approval forms.

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

G. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. The location of the O&M manuals and procedures for use and preservation; backup copies.
   2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
   3. Typical uses of the O&M manuals.

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

I. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

SECTION 02 41 00
DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies demolition and removal of buildings, portions of buildings, utilities, other structures and debris from trash dumps shown.

1.2 RELATED WORK:

A. Demolition and removal of roads, walks, curbs, and on-grade slabs outside buildings to be demolished: Section 31 20 11, EARTH MOVING (SHORT FORM).

1.3 PROTECTION:

A. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures. Comply with requirements of GENERAL CONDITIONS Article, ACCIDENT PREVENTION.

B. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations. Comply with requirements of Section 01 30 00, ADMINISTRATIVE REQUIREMENTS, Article PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND IMPROVEMENTS. Coordinate location of construction barriers with Forest Service Project COR / Staff.

C. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.

D. Provide enclosed dust chutes with control gates from each floor to carry debris to truck beds and govern flow of material into truck. Provide overhead bridges of tight board or prefabricated metal construction at dust chutes to protect persons and property from falling debris.

E. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable condition such as, but not limited to; ice, flooding, or pollution. Vacuum and dust the work area daily.

F. In addition to previously listed fire and safety rules to be observed in performance of work, include following:
   1. No wall or part of wall shall be permitted to fall outwardly from structures.
   2. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.
   3. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 4500 mm (15 feet) of fire hydrants.

G. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the USFS; any damaged items shall be repaired or replaced as approved by the COR. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by demolition or removal works. Repairs, reinforcement, or structural replacement must have Resident Engineer’s approval.

H. The work shall comply with the requirements of Section 01 60 00, PRODUCT REQUIREMENTS.

I. The work shall comply with the requirements of Section 01 30 00, ADMINISTRATIVE REQUIREMENTS.

1.4 UTILITY SERVICES:

A. Demolish and remove outside utility service lines shown to be removed.

B. Remove abandoned outside utility lines that would interfere with installation of new utility lines and new construction.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 DEMOLITION:

A. Completely demolish and remove buildings and structures, including all appurtenances related or connected thereto, as noted below:
   1. As required for installation of new utility service lines.
   2. To full depth within an area defined by hypothetical lines located 1500 mm (5 feet) outside building lines of new structures.

B. Debris, including brick, concrete, stone, metals and similar materials shall become property of Contractor and shall be disposed of by him daily, off the USFS property to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the COR. Break up concrete slabs below grade that do not require removal from present location into pieces not exceeding 600 mm (24 inches) square to permit drainage. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.

C. Remove and legally dispose of all materials, other than earth to remain as part of project work.. Materials removed shall become property of contractor and shall be disposed of in compliance with applicable federal, state or local permits, rules and/or regulations. All materials including above surrounding grade and extending to a depth of 1500mm (5feet) below surrounding grade, shall be included as part of the lump sum compensation for the work of this section. Materials that are located beneath the surface of the surrounding ground more than 1500 mm (5 feet), or materials that are discovered to be hazardous, shall be handled as unforeseen. The removal of hazardous material shall be referred to Hazardous Materials specifications.

D. Remove existing utilities as indicated or uncovered by work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the COR. When Utility lines are encountered that are not indicated on the drawings, the COR shall be notified prior to further work in that area.

3.2 CLEAN-UP:

On completion of work of this section and after removal of all debris, leave site in clean condition satisfactory to COR. Clean-up shall include off the USFS property disposal of all items and materials not

required to remain property of the Government as well as all debris and rubbish resulting from demolition operations.

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SECTION 03 30 53
(SHORT FORM) CAST-IN-PLACE CONCRETE

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place structural concrete.
2. Slab on grade infill.
3. Foundation wall infill.
4. Footings.
5. Preparation of existing surfaces to receive concrete.
6. Preparation of existing surface to received concrete topping.

1.2 RELATED WORK

A. Section 01 45 29, TESTING LABORATORY SERVICES: Materials Testing and Inspection During Construction.

B. Section 01 60 00, PRODUCTREQUIREMENTS

C. Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS: Concrete Roads, Walks, and Similar Exterior Site Work.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this Section.

B. American Concrete Institute (ACI):

117-10(R2015).....Specification for Tolerances for Concrete Construction and Materials and Commentary

211.1-91(R2009).....Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.

211.2-98(R2004).....Standard Practice for Selecting Proportions for Structural Lightweight Concrete.

301/301M-16.....Specifications for Structural Concrete.

305.1-14 - .....Hot Weather Concreting.

306.1-90(R2002).....Cold Weather Concreting.

318/318M-19.....Building Code Requirements for Structural Concrete and Commentary

347R-14 - .....Guide to Formwork for Concrete.

SP-66-04-.....ACI Detailing Manual.

C. ASTM International(ASTM):

A615/A615M-20.....Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement

A996/A996M-16.....Standard Specification for Rail Steel and Axle Steel Deformed Bars for Concrete Reinforcement

A1064/A1064M-18a.....Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

C33/C33M-18.....Standard Specification for Concrete Aggregates.

C39/C39M-20.....Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

C94/C94M-20.....Standard Specification for Ready-Mixed Concrete.

C143/C143M-20.....Standard Test Method for Slump of Hydraulic Cement Concrete.

C150/C150M-20.....Standard Specification for Portland Cement.

C171-16.....Standard Specification for Sheet Materials for Curing Concrete.

C192/C192M-19.....Standard practice for Making and Curing Concrete Test Specimens in the Laboratory.

C219-20a.....Standard Terminology Relating to Hydraulic and Other Inorganic Cements.

C260/C260M-10a(2016)....Standard Specification for Air-Entraining Admixtures for Concrete.

C330/C330M-17a.....Standard Specification for Lightweight Aggregates for Structural Concrete.

C494/C494M-19.....Standard Specification for Chemical Admixtures for Concrete.

C618-19 .....Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

C881/C881M-20 .....Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

C989/C989M-18a .....Standard Specification for Slag Cement for Use in Concrete and Mortars.

C1240-20 .....Standard Specification for Silica Fume Used in Cementitious Mixtures.

D1751-18 .....Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).

E1155-20.....Determining FF Floor Flatness and FL Floor Levelness Numbers.

E1745-17 .....Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

D. International Concrete Repair Institute:

310.2R-2013 -.....Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.

1.4 SUBMITTALS

A. Submittal Procedures: Refer to Section 01 30 00 ADMINISTRATIVE REQUIREMENTS. All items indicated below are required submittals requiring Contracting Officer’s Representative (COR) review and approval.

B. Submittal Drawings:

1. Submit large scale drawings of reinforcing steel, including all resident
2. reinforcing bend diagrams and reinforcing details, to the COR for review and approval.

C. Manufacturer's Literature and Data:

1. Concrete Mix Design.
2. Air-entraining admixture, chemical admixtures, and curing compounds.
3. Indicate manufacturer's recommendation for each application.

D. Sustainable Construction Submittals:

1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.

E. Certificates: Certify products comply with specifications.

1. Each ready mix concrete batch delivered to site.

1.5 DELIVERY

A. Deliver each ready-mixed concrete batch with mix certification in duplicate according to ASTM International(ASTM) C94/C94M.

1.6 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II.

B. Pozzolans:

1. Fly Ash: ASTM International(ASTM) C618, Class C or F including supplementary optional physical requirements. Pozzolans shall not exceed 25 percent of total cementitious materials by weight.
2. Slag: ASTM International(ASTM) C989/C989M; Grade 80, Grade 100 or Grade 120.
3. Silica Fume: ASTM International(ASTM) C1240.

C. Coarse Aggregate: ASTM International(ASTM) C33/C33M.
   1. Size 467 for footings and walls over 300 mm (12 inches) thick.
   2. Size 7 for coarse aggregate for applied topping and metal pan stair fill.
   3. Size 67 for other applications.
D. Fine Aggregate: ASTM International(ASTM) C33/C33M.
E. Lightweight Aggregate for Structural Concrete: ASTM International(ASTM) C330/C330M, Table 1.
F. Mixing Water: Fresh, clean, and potable.
G. Air-Entraining Admixture: ASTM International(ASTM) C260/C260M.
H. Chemical Admixtures: ASTM International(ASTM) C494/C494M.
I. Vapor Barrier: ASTM International(ASTM) E1745, Class A with a minimum puncture resistance of 2200 g (3000 pounds); minimum 0.38 mm (15 mil) thick.

J. Reinforcing Steel: ASTM International(ASTM) A615/A615M or ASTM International(ASTM) A996/A996M, deformed. See Structural Drawings for grade.
K. Forms: Wood, plywood, metal, or other materials, approved by COR, of grade or type suitable to obtain type of finish specified.
   1. Plywood: Exterior grade, free of defects and patches on contact surface.
   2. Lumber: Sound, grade-marked, S4S stress graded softwood.
   3. Form coating: As recommended by Contractor.
L. Welded Wire Fabric: ASTM International(ASTM) A1064/A1064M, sized as indicated.
M. Expansion Joint Filler: ASTM International(ASTM) D1751.
N. Sheet Materials for Curing Concrete: ASTM International(ASTM) C171.
O. Abrasive Aggregates: Aluminum oxide grains or emery grits.
P. Liquid Densifier/Sealer: 100 percent active colorless aqueous siliconate solution.

Q. Grout, Non-Shrinking: Premixed ferrous or non-ferrous. Grout to show no settlement or vertical drying shrinkage at 3 days. Compressive strength for grout, at least 18 MPa (2500 psi) at 3 days and 35 MPa (5000 psi) at 28 days.

2.2 ACCESSORIES

A. Bonding Agent: ASTM International (ASTM) C 1059/C 1059M, Type II.

B. Structural Adhesive: ASTM International (ASTM) C881, 2-component material suitable for use on dry or damp surfaces. Provide material Type, Grade, and Class to suit Project requirements.

C. Water Stops: Rubber base with self-healing properties. Expanding clay based products not acceptable.

D. Weeps: Geotextile type as recommended by Contractor and approved by the COR.

2.3 CONCRETE MIXES

A. Design concrete mixes according to ASTM International (ASTM) C94/C94M, Option C.

B. Compressive strength at 28 days: minimum 30 MPa (4,000 psi).

C. Submit mix design and results of compression tests to the COR for his evaluation. Identify all materials, including admixtures, making-up the concrete.

D. Maximum Slump for Vibrated Concrete: 100 mm (4 inches) tested according to ASTM International (ASTM) C143.

E. Cement and Water Factor (See Table I):

TABLE I - CEMENT AND WATER FACTORS FOR CONCRETE				
Concrete: Strength	Non-Air-Entrained		Air-Entrained	
Min. 28 Day Comp. Str. MPa (psi)	Min. Cement kg/cu. m (lbs./cu. yd.)	Max. Water Cement Ratio	Min. Cement kg/cu. m (lbs./cu. yd.)	Max. Water Cement Ratio
35 (5000)1,3	375 (630)	0.45	385 (650)	0.40
30 (4000)1,3	325 (550)	0.55	340 (570)	0.50
25 (3000)1,3	280 (470)	0.65	290 (490)	0.55
25 (3000)1,2	300 (500)	See 4 Below	310 (520)	See 4 Below

TABLE I - CEMENT AND WATER FACTORS FOR CONCRETE				
Concrete: Strength	Non-Air-Entrained		Air-Entrained	
Min. 28 Day Comp. Str. MPa (psi)	Min. Cement kg/cu. m (lbs./cu. yd.)	Max. Water Cement Ratio	Min. Cement kg/cu. m (lbs./cu. yd.)	Max. Water Cement Ratio

Notes:

1. If trial mixes are used, achieve a compressive strength 8.3 MPa (1 200 psi) in excess of f'c. For concrete strengths greater than 35 MPa (5,000 psi), achieve a compressive strength 9.7 MPa (1,400 psi) in excess of f’c.
2. Lightweight Structural Concrete: Pump mixes may require higher cement values as specified in ACI 318/318M.
3. For Concrete Exposed to High Sulfate Content Soils: Maximum water cement ratio is 0.44.
4. Laboratory Determined according to ACI 211.1 for normal weight concrete or ACI 211.2 for lightweight structural concrete.

F. Air-entrainment as specified, and conform with the following for air content table:

TABLE II - TOTAL AIR CONTENT FOR VARIOUS SIZES OF COARSE AGGREGATES	
Nominal Maximum Size of Coarse Aggregate	Total Air Content, percent
10 mm (3/8 inches)	6 Moderate exposure; 7.5 severe exposure
13 mm (1/2 inches)	5.5 Moderate exposure; 7 severe exposure
19 mm (3/4 inches)	5 Moderate exposure; 6 severe exposure
25 mm (1 inches)	4.5 Moderate exposure; 6 severe exposure
40 mm (1 1/2 inches)	4.5 Moderate exposure; 5.5 severe exposure

2.4 BATCHING AND MIXING

A. Store, batch, and mix materials according to ASTM C94/C94M.

1. Job-Mixed: Batch mix concrete in stationary mixers as specified in ASTM International(ASTM) C94/C94M.
2. Ready-Mixed Concrete: Comply with ASTM International(ASTM) C94/C94M, except use of non-agitating equipment for transporting concrete to Site is not acceptable.
3. EXECUTION Mixing Structural Lightweight Concrete: Charge mixer with 2/3 of total mixing water and total aggregate for each batch. Mix ingredients minimum 30 seconds in stationary mixer or minimum 10 revolutions at mixing speed in truck mixer. Add remaining mixing

water and other ingredients and continue mixing. Above procedure may be modified as recommended by aggregate producer.

4. When aggregate producer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

PART 3 - EXECUTION

3.1 FORMWORK

A. Installation: Conform to ACI 347. Construct forms to obtain concrete of the shapes, dimensions and profiles indicated, with tight joints.

B. Design and construct forms to prevent bowing-out of forms between supports and to be removable without prying against or otherwise damaging fresh concrete.

C. When patching formed concrete, seal form edges against existing surface to prevent leakage; set forms so that patch is flush with adjacent surfaces.

D. Treating and Wetting: Treat or wet concrete contact surfaces:

1. Coat plywood and lumber forms with non-staining form sealer.
2. Wet wood forms thoroughly when they are not treated with form release agent.
3. Prevent water from accumulating and remaining within forms.
4. Clean and coat removable metal forms with light form oil before reinforcement is placed.
5. In hot weather, cool metal forms by thoroughly wetting with water just before placing concrete.
6. Prevent water from accumulating and remaining within forms.

E. Inserts, Sleeves, and Similar Items: Install flashing reglets, masonry ties, anchors, inserts, wires, hangers, sleeves, boxes for floor hinges, and other cast-in items specified in other Sections. Place where indicated, square, flush and secured to formwork.

F. Construction Tolerances - General: Install and maintain concrete formwork to assure completion of work within specified tolerances.

G. Adjust or replace completed work exceeding specified tolerances before placing concrete.

3.2 REINFORCEMENT

A. Install concrete reinforcement according to ACI 318 and ACI SP-66.

B. Support and securely tie reinforcing steel to prevent displacement during placing of concrete.

C. Drilling for Dowels in Existing Concrete: Use sharp bits, drill hole slightly oversize, fill with epoxy grout, inset the dowel, and remove excess epoxy.

3.3 VAPOR BARRIER

A. Except where membrane waterproofing is required, place interior concrete slabs on a continuous vapor barrier.

B. Lap joints 150 mm (6 inches) and seal with a compatible pressure-sensitive tape.

C. Patch punctures and tears.

3.4 PLACING CONCRETE

A. Remove water from excavations before concrete is placed. Remove hardened concrete, debris and other foreign materials from interior of forms, and from inside of mixing and conveying equipment. Obtain approval from Contracting Officer's Representative before placing concrete.

B. Install screeds at required elevations for concrete slabs.

C. Roughen and clean free from laitance, foreign matter, and loose particles before placing new concrete on existing concrete.

1. Blow-out areas with compressed air and immediately coat contact areas with adhesive in compliance with manufacturer's instructions.

D. Place structural concrete according to ACI 301 and ACI 318.

E. Convey concrete from mixer to final place of deposit by method that will prevent segregation or loss of ingredients. Do not deposit, in Work, concrete that has attained its initial set or has contained its water or cement more than 1 1/2 hours. Do not allow concrete to drop freely more than 1500 mm (5 feet) in unexposed work nor more than 900 mm (3 feet) in exposed work.

F. Place and consolidate concrete in horizontal layers not exceeding 300 mm (12 inches) in thickness. Consolidate concrete by spading, rodding, and mechanical vibrator. Do not secure vibrator to forms or reinforcement. Continuously vibrate during placement of concrete.

G. Concrete Fill in Stair Tread and Landing Pans: Coat steel with bonding agent and fill pans with concrete. Reinforce with 2 inch by 2 inch by 1.6 mm (0.06 inch) welded wire mesh at midpoint.

H. Hot Weather Concrete Placement: As recommended by ACI 305.1 to prevent adversely affecting properties and serviceability of hardened concrete.

I. Cold Weather Concrete Placement: As recommended by ACI 306.1, to prevent freezing of thin sections less than 300 mm (12 inches) and to permit concrete to gain strength properly.
   1. Do not use calcium chloride without written approval from Contracting Officer's Representative.

3.5 TOLERANCES

A. Slab on Grade Finish Tolerance: Comply with ACI 117, FF-number and FL-number method.
   1. Paragraph 4.8.3, Class A 3 mm (1/8 inches) for offset in form-work.
   2. Table R4.8.4, "Flat" 6 mm (1/4 inch) in 3 m (10 feet) for slabs.

3.6 PROTECTION AND CURING

A. Protect exposed surfaces of concrete from premature drying, wash by rain or running water, wind, mechanical damage, and excessive hot or cold temperatures.

B. Curing Methods: Cure concrete with curing compound using wet method with sheets.

C. Formed Concrete Curing: Wet the tops and exposed portions of formed concrete and keep moist until forms are removed.
   1. If forms are removed before 14 days after concrete is cast, install sheet curing materials as specified above.

D. Concrete Flatwork Curing:
   1. Install sheet materials according to the manufacturer's instructions.
      a. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

3.7 FORM REMOVAL

A. Maintain forms in place until concrete is self-supporting, with construction operation loads.

B. Remove fins, laitance and loose material from concrete surfaces when forms are removed. Repair honeycombs, rock pockets, sand runs, spalls, or otherwise damaged surfaces by patching with the same mix as concrete minus the coarse aggregates.

C. Finish to match adjacent surfaces.

3.8 FINISHES

A. Slab Finishes:
   1. Allow bleed water to evaporate before surface is finished. Do not sprinkle dry cement on surface to absorb water.

2. Scratch Finish: Rake or wire broom after partial setting slab surfaces to received bonded applied cementitious application, within 2 hours after placing, to roughen surface and provide permanent bond between base slab and applied cementitious materials.
3. Broom Finish: Finish exterior slabs, ramps, and stair treads with bristle brush moistened with clear water after surfaces have been floated.
4. Finished Slab Flatness (FF) and Levelness (FL):
   a. Slab on Grade: Specified overall value FF 25/FL 20. Minimum local value FF 17/FL 15.
   b. Test flatness and levelness according to ASTM E1155.

3.9 SURFACE TREATMENTS

A. Mix and apply the following surface treatments according to manufacturer's instructions.
   1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
B. Slip Resistant Finish:
   1. Except where safety nosing and tread coverings are shown, apply abrasive aggregate to treads and platforms of concrete steps and stairs, and to surfaces of exterior concrete ramps and platforms.
      a. Broadcast aggregate uniformly over concrete surface. Trowel concrete surface to smooth dense finish. After curing, rub treated surface with abrasive brick and water sufficiently to slightly expose abrasive aggregate.

3.10 APPLIED TOPPING

A. Install concrete topping with thickness and strength shown with only enough water to ensure stiff, workable, plastic mix.
B. Continuously place applied topping until entire area is complete, struck off with straightedge, compact by rolling or tamping, float and steel trowel to hard smooth finish.

3.11 RESURFACING FLOORS

A. Remove existing flooring by abrasive blasting or grinding, in areas to receive resurfacing, to expose existing structural slab. Achieve a surface profile of 2 to 4 according to ICRI 310.2R for the condition found at Site.

B. Prepare exposed structural slab surface by cleaning, wetting, and applying adhesive according to manufacturer's instructions as specified in the flooring section.

3.12 FOUNDATION WALL INFILL

A. Install air-entrained concrete at foundation wall infill, as indicated.

B. Install expansion and contraction joints, waterstops, weep holes, reinforcement and railing sleeves, as indicated.

C. Finish exposed surfaces to match adjacent concrete surfaces, new or existing.

D. Place porous backfill, as indicated on Drawings.

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SECTION 04 01 00
MAINTENANCE OF MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Repointing existing or damaged masonry joints.
2. Replacing existing or damaged masonry units.

1.2 RELATED WORK

A. Section 04 05 13, MASONRY MORTARING: Mortars for new masonry.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. ASTM International (ASTM):

C144-18.....Aggregate for Masonry Mortar.

C150/C150M-20.....Specification for Portland Cement.

C207-18 - .....Hydrated Lime for Masonry Purposes

C270-19ae1.....Mortar for Unit Masonry

C295/C295M-19.....Petrographic Examination of Aggregates for Concrete

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 30 00 ADMINISTRATIVE REQUIREMENTS.

B. Manufacturer's Literature and Data:

1. Description of each product.
2. Replacement units indicating manufacturer recommendation for each application.

C. Samples:

1. Pointing Mortar: Molded, 150 mm (6 inches) long for each type, texture, and color.

D. Test reports:

1. Preconstruction test results of existing masonry mortar and units.
2. Recommended mortar mix and mortar materials sources.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Documented experience in completion of work, similar in design, material, and extent specified.

B. Preconstruction Testing:

1. Existing Brick: according to ASTM C67.

2. Existing Mortar: according to ASTM C295/C295M.
   a. Recommend mortar mix compatible with existing and mortar material sources required to match existing color and texture.

C. Mockups: Prepare mockup in size indicated on Drawings, demonstrating quality and aesthetics of masonry unit replacement and cleaning .

1.6 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Store materials covered, protected from weather, and elevated above grade.
   1. Prevent contamination of aggregates.

B. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

A. Environment:
   1. Cold Weather Requirements: Maintain mortar ingredients and substrate within temperature range between 4 degrees C (40 degrees F) and 49 degrees C (120 degrees F) when outside temperature is less than 4 degrees C (40 degrees F).
   2. Hot Weather Requirements: Protect mortar-joint from evaporation of moisture from mortar material. When required, provide adequately shaded work area.

1.9 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Mortar Components:
   1. Hydrated Lime: ASTM C207, Type S.
   2. Aggregate: ASTM C144.
   3. Portland Cement: ASTM C150/C150M, Type I.
   4. Water: Potable, free of substances that are detrimental to grout, masonry, and metal.

2.2 PRODUCTS - GENERAL

A. Basis of Design: FINISH SCHEDULE in drawings.

B. Provide each product from one manufacturer and from one production run .

2.3 REPLACEMENT MASONRY UNITS

A. Other Masonry Units: Match existing.

2.4 MIXES

A. Tuck Pointing Mortar: ASTM C270.

1. Type N.

2.5 ACCESSORIES

A. Cleaning Agent: Soapless, non-acidic, detergent, specially prepared for cleaning stone and concrete masonry.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

1. Protect from mortar droppings and cleaning operations.

C. Remove existing fixtures and fittings concealing masonry joints to permit repointing and repair.

3.2 EXISTING MORTAR JOINTS

A. Cut out existing bed and head mortar joints, to uniform depth of 19 mm (3/4 inches), or to sound mortar without damaging edges and faces of existing masonry units to remain.

B. Remove dust and debris from joints.

1. Do not rinse when temperature is below freezing.

3.3 TUCK POINTING

A. Dampen joints immediately before tuck pointing. Allow masonry units to absorb surface water.

B. Tightly pack tuck pointing mortar into joints in thin layers, 6 mm (1/4 inch) thick, maximum.

C. Allow layer to become slightly hardened before applying next layer.

D. Pack final layer flush with surfaces of masonry units.

3.4 MASONRY UNIT REPLACEMENT

A. Cut out mortar joints surrounding masonry units requiring replacement.

1. Remove existing masonry units creating opening for replacement masonry unit installation.

2. Remove mortar, dust, and debris from opening perimeter surfaces.

3. Prevent debris from falling into cavity.

B. Dampen surfaces of surrounding existing masonry before installing replacement masonry units.
   1. Allow existing masonry to absorb surface moisture before installing replacement units.
   2. Butter contact surfaces of existing masonry and replacement masonry units with mortar.
   3. Center replacement masonry units in opening and press into position.
   4. Remove excess mortar.
   5. Tuck point replacement masonry units to ensure full head and bed joints.

3.5 JOINT TOOLING

A. Tool repointed and replaced masonry joints when mortar becomes slightly hardened.
B. Produce joint matching existing.

3.6 CLEANING

A. Remove mortar splatter from exposed surfaces immediately.
B. Clean exposed masonry surfaces on completion.
C. Remove mortar droppings and other foreign substances from wall surfaces.
D. Wet surfaces with clean water.
E. Wash with cleaning agent.
F. Brush masonry surfaces with stiff fiber brushes while washing.
G. Immediately after washing, rinse with clean water.
   1. Remove traces of detergent, foreign streaks or stains.

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SECTION 04 05 13
MASONRY MORTARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Masonry mortar installed by other concrete and masonry sections.

1.2 RELATED REQUIREMENTS

A. Mortar used in Section:

1. Section 04 01 00, MAINTENANCE OF MASONRY.
2. Section 04 05 16, MASONRY GROUTING.
3. Section 04 20 00, UNIT MASONRY.
4. Section 04 72 00, CAST STONE MASONRY.

B. Mortar Color: See SCHEDULE FOR FINISHES.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. ASTM International (ASTM):

1. C40/C40M-11 - Organic Impurities in Fine Aggregates for Concrete.
2. C91/C91M-12 - Masonry Cement.
3. C144-11 -Aggregate for Masonry Mortar.
4. C150/C150M-15 - Portland Cement.
5. C207-06(2011) - Hydrated Lime for Masonry Purposes.
6. C270-14a - Mortar of Unit Masonry.
7. C595/C595M-15e1 - Blended Hydraulic Cements.
8. C780-15 - Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
9. C979/C979M-10 - Pigments for Integrally Colored Concrete.
10. C1329/C1329M-15 - Mortar Cement.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 30 00 ADMINISTRATIVE REQUIREMENTS.

B. Manufacturer's Literature and Data:

1. Description of each product.

C. Test Reports: Certify each product complies with specifications.

1. Mortar.
2. Admixtures.

D. Certificates: Certify each product complies with specifications.

1. Portland cement.
2. Masonry cement.

3. Mortar cement.
4. Hydrated lime.
5. Fine aggregate.
6. Color admixture.

E. Qualifications: Substantiate qualifications comply with specifications.
1. Testing laboratory.

1.5 QUALITY ASSURANCE

A. Preconstruction Testing:
1. Engage independent testing laboratory to tests and submit reports.
a. Deliver samples to laboratory in number and quantity required for testing.
2. Test mortar and materials specified.
3. Mortar:
a. Test for compressive strength and water retention according to ASTM C270.
b. Minimum Mortar compressive strengths 28 days:
1) Type M: 17.2 MPa (2,500 psi).
2) Type S: 12.4 MPa (1,800 psi).
3) Type N: 5.1 MPa (750 psi).
4. Non Staining Cement: Test for water soluble alkali.
a. Water Soluble Alkali: Maximum 0.03 percent.
5. Sand: Test for deleterious substances, organic impurities, soundness and grading.

1.6 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.
B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.
C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Store masonry materials under waterproof covers on planking clear of ground.
1. Protect loose, bulk materials from contamination.
B. Protect products from damage during handling and construction operations.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Hydrated Lime: ASTM C207, Type S.

B. Aggregate for Masonry Mortar: ASTM C144 and as follows:

1. Light colored sand for mortar for laying face brick.
2. White plastering sand meeting sieve analysis for mortar joints for pointing and laying of structural facing tile units except that 100 percent passes No. 8 sieve, and maximum 5 percent retained on No. 16 sieve.
3. Test sand for color value according to ASTM C40/C40M. Sand producing color darker than specified standard is unacceptable.

C. Blended Hydraulic Cement: ASTM C595/C595M, Type IS, IP.

D. Masonry Cement: ASTM C91/C91M. Type N, S, Or M.

1. Use white masonry cement whenever white mortar is specified.

E. Mortar Cement: ASTM C1329/C1329M, Type N, S or M.

F. Portland Cement: ASTM C150/C150M, Type I.

1. Use white Portland cement wherever white mortar is specified.

G. Pigments: ASTM C979/C979M; inorganic, inert, mineral pigments only, unaffected by atmospheric conditions, nonfading, alkali resistant, and water insoluble.

H. Water: Potable, free of substances that are detrimental to mortar, masonry, and metal.

2.2 PRODUCTS - GENERAL

A. Basis of Design: See SCHEDULE FOR FINISHES.

B. Provide each product from one manufacturer and from one production run.

2.3 MIXES

A. Pointing Mortar for New Work:

1. For Cast Stone or Precast Concrete: Proportion by volume; one part white Portland cement, two parts white sand, and 1/5 part hydrated lime.
2. Pointing Mortar for Glazed Structural Facing Tile:

a. Proportion by volume: One part white Portland cement, two parts of graded white sand passing Number 50 sieve, and 1/8 part hydrated lime.

B. Tuck Pointing Mortar for Repair Work: Tuck pointing mortar specified in Section 04 01 00, MAINTENANCE OF MASONRY.

C. Masonry Mortar: ASTM C270.

1. Admixtures:

a. Do not use mortar admixtures, and color admixtures unless approved by Contracting Officer's Representative.

b. Do not use antifreeze compounds.

D. Colored Mortar:

1. Maintain uniform mortar color for exposed work, throughout.

2. Match mortar color to match existing.

3. Alteration Work Mortar Color: Match existing mortar unless specified otherwise in SCHEDULE FOR FINISHES.

E. Color Admixtures:

1. Proportion as specified by manufacturer.

2. For color, Match existing.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

3.2 MIXING

A. Measure ingredients by volume using known capacity container.

B. Mix for 3 to 5 minutes in a mechanically operated mortar mixer.

C. Mix water with dry ingredients in sufficient amount to provide a workable mixture which will adhere to vertical surfaces of masonry units.

D. Mortar Stiffened Because of Water Loss Through Evaporation:

1. Re-temper by adding water to restore to proper consistency and workability.

2. Discard mortar reaching initial set or unused within two hours of mixing.

E. Pointing Mortar:

1. Mix dry ingredients with enough water to produce damp mixture of workable consistency retaining shape when formed into ball.

2. Allow mortar to stand in dampened condition for 60 to 90 minutes.

3. Add water to bring mortar to a workable consistency before use.

3.3 MORTARING

A. Type M Mortar: Use for precast concrete panels and parging below grade.

B. Type S Mortar: Use for masonry containing vertical reinforcing bars (non-engineered), masonry below grade and setting cast stone and engineered reinforced unit masonry work.

C. Type N Mortar: Use for other masonry work.

D. Type N Mortar: Use for pointing items and tuck pointing specified.

3.4 FIELD QUALITY CONTROL

A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.

1. Take and test samples during progress of work according to ASTM C780.

- - E N D - -

SECTION 04 05 16
MASONRY GROUTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Grout for filling hollow concrete masonry cores.

1.2 RELATED WORK

A. Section 04 20 00, UNIT MASONRY: Grout

B. Section 04 72 00, CAST STONE MASONRY: Grout

C. See SCHEDULE FOR FINISHES: Grout Color

D. Section 09 30 13, CERAMIC/PORCELAIN TILING: Ready-Mixed Grout.

E. Section 09 91 00, PAINTING

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section

American National Standards Institute (ANSI):

A118.6-19 - .....Standard Cement Grouts for Tile Installation.

B. ASTM International (ASTM):

C40/C40M-20 - .....Organic Impurities in Fine Aggregates for Concrete.

C150/C150M-20 - .....Portland Cement.

C207-18 - .....Hydrated Lime for Masonry Purposes.

C404-18 - .....Aggregates for Masonry Grout.

C476-20 - .....Grout for Masonry.

C595/C595M-20 - .....Blended Hydraulic Cement.

C979/C979M-16 - .....Pigments for Integrally Colored Concrete.

C1019-19 - .....Sampling and Testing Grout.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 30 00 ADMINISTRATIVE REQUIREMENTS. All items indicated below are required submittals requiring Contracting Officer’s Representative (COR) review and approval.

B. Manufacturer's Literature and Data:

1. Description of each product.

C. Test Reports: Certify each product complies with specifications.

1. Grout, each type.
2. Cement.
3. Aggregate.

D. Certificates: Certify each product complies with specifications.

1. Blended hydraulic cement.
2. Portland cement.

3. Grout.
4. Hydrated lime.
5. Aggregate.
6. Color admixture.

1.5 QUALITY ASSURANCE

A. Preconstruction Testing:
1. Engage independent testing laboratory to perform tests and submit reports.
a. Deliver samples to laboratory in number and quantity required for testing.
2. Grout:
a. Test compressive strength according to ASTM C1019 standard.
3. Cement:
a. Test for water soluble alkali (nonstaining) when nonstaining cement is specified.
b. Nonstaining cement containing more than 0.03 percent water soluble alkali.
4. Aggregate:
a. Test for deleterious substances, organic impurities, soundness and grading.

1.6 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.
B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.

1.7 STORAGE AND HANDLING

A. Store masonry materials under waterproof covers on planking clear of ground, and protect damage from handling, dirt, stain, water and wind.
B. Protect products from damage during handling and construction operations.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Grout Components:
1. Hydrated Lime: ASTM C207, Type S.
2. Aggregate For Masonry Grout: ASTM C404, Size 8.
3. Blended Hydraulic Cement: ASTM C595, Type IS, IP.

4. Portland Cement: ASTM C150, Type I.
5. Liquid Acrylic Resin:
   a. A formulation of acrylic polymers and modifiers in liquid form designed for use as an additive for mortar to improve physical properties.
6. Water: Potable, free of substances that are detrimental to grout, masonry, and metal.

2.2 PRODUCTS - GENERAL

A. Provide each product from one manufacturer and from one production run.

2.3 MIXES

A. Grout: ASTM C476; fine grout and coarse grout.
   1. Color Admixture:
      a. Pigments: ASTM C979, inert, stable to atmospheric conditions, nonfading, alkali resistant, and water insoluble.
      b. Use mineral pigments only. Organic pigments are not acceptable.
B. Ready-Mixed Grout: ANSI A118.8.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.
B. Protect existing construction and completed work from damage.
C. Clean mortar from masonry cells protruding more than 13 mm (1/2 inch) to permit grout flow.
D. Remove debris from grout spaces.
E. Verify reinforcement is correctly placed before placing grout.

3.2 MIXING

A. Mix grout in mechanically operated mixer.
   1. Mix grout for five minutes, minimum.
B. Measure ingredients by volume using container of known capacity.
C. Mix water with grout dry ingredients.
   1. Slump Range: 200 to 275 mm (8 to 11 inches).

3.3 GROUTING

A. Install grout according to Section 04 20 00, UNIT MASONRY.
B. Use fine grout for filling wall cavities and hollow concrete masonry units where smallest cell dimension is 50 mm (2 inches) or less.
C. Use either fine grout or coarse grout for filling wall cavities and hollow concrete masonry units where smallest cell dimension is greater than 50 mm (2 inches).
D. Use grout for filling bond beam or lintel units.

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SECTION 04 20 00
UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Concrete masonry unit (CMU) assemblies for:
   1. Exterior walls.
   2. Interior walls and partitions.

1.2 RELATED REQUIREMENTS

A. Sealants and Sealant Installation: Section 07 92 00, JOINT SEALANTS.
B. Color and Texture of Masonry Units: See SCHEDULE FOR FINISHES.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.
B. American Concrete Institute (ACI):
   1. 315-99 - Details and Detailing of Concrete Reinforcement.
   2. 530.1/ASCE 6/TMS 602-13 - Specification for Masonry Structures.
C. ASTM International (ASTM):
   1. A615/A615M-15ae1 - Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   2. A951/A951M-14 - Steel Wire for Masonry Joint Reinforcement.
   3. A1064/A1064M-15 - Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
   4. C34-13 - Structural Clay Load-Bearing Wall tile.
   5. C55-14a - Concrete Building Brick.
   6. C56-13 - Structural Clay Nonloadbearing Tile.
   7. C62-13a - Building Brick (Solid Masonry Units Made from Clay or Shale).
   8. C67-14 - Sampling and Testing Brick and Structural Clay Tile.
   9. C90-14 - Load-Bearing Concrete Masonry Units.
   10. C126-15 - Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units.
   11. C216-15 - Facing Brick (Solid Masonry Units Made From Clay or Shale).
   12. C612-14 - Mineral Fiber Block and Board Thermal Insulation.
   13. C744-14 - Prefaced Concrete and Calcium Silicate Masonry Units.
   14. D1056-14 - Flexible Cellular Materials - Sponge or Expanded Rubber.
   15. D2240-05(2010) - Rubber Property-Durometer Hardness.
   16. F1667-15 - Driven Fasteners: Nails, Spikes, and Staples.

D. American Welding Society (AWS):
   1. D1.4/D1.4M-11 - Structural Welding Code - Reinforcing Steel.
E. Brick Industry Association (BIA):
   1. TN 11B-88 - Guide Specifications for Brick Masonry, Part 3.
F. Federal Specifications (Fed. Spec.):
   1. FF-S-107C(2) - Screws, Tapping and Drive.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 30 00 ADMINISTRATIVE REQUIREMENTS.
B. Submittal Drawings:
   1. Fabrication, bending, and placement of reinforcing bars. Comply with ACI 315. Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies.
   2. Special masonry shapes, profiles, and placement.
   3. Masonry units for typical window and door openings, and, for special conditions as affected by structural conditions.
C. Manufacturer's Literature and Data:
   1. Description of each product.
   2. Installation instructions.
D. Samples:
   1. Face brick: Sample panel, 200 mm by 400 mm (8 inches by 16 inches,) showing full color range and texture of bricks, bond, and proposed mortar joints.
   2. Ceramic Glazed Facing Brick: Sample panel, 200 mm by 400 mm (8 inches by 16 inches,) showing full color range and texture of bricks, bond, and proposed mortar joints.
   3. Concrete masonry units, when exposed in finish work.
   4. Anchors and Ties: Each type.
   5. Joint Reinforcing: 1200 mm (48 inches) long each type.
   6. Glazed Structural Facing Tile: Clipped panels (triplicate) of four wall units with base units, showing color range, each color and texture.
E. Test reports: Certify products comply with specifications.
   1. Ceramic glazed facing brick.
F. Certificates: Certify products comply with specifications.
   1. Face brick.
   2. Solid and load-bearing concrete masonry units, including fire-resistant rated units.
   3. Ceramic glazed facing brick.

4. Glazed structural clay facing tile.
5. Structural clay tile units.

G. Delegated Design Drawings and Calculations: Signed and sealed by responsible design professional.

1.5 QUALITY ASSURANCE

A. Welders and Welding Procedures Qualifications: AWS D1.4/D1.4M.

B. Mockups:

1. Before starting masonry, build a mockup panel minimum 1800 mm by 1800 mm (6 feet by 6 feet) with 600 mm (24 inch) 90 degree return for outside corner.
   a. Use masonry units from random cubes of units delivered on site.
   b. Include structural backup, reinforcing, ties, and anchors.
2. Mockup panel approved by Contracting Officer's Representative set workmanship and aesthetic quality for masonry work.
3. Clean sample panel to test cleaning methods.
4. Remove mockup panel when directed by Contracting Officer's Representative.

1.6 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Store products above grade, protected from contamination.

B. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

A. Hot and Cold Weather Requirements: Comply with ACI 530.1/ASCE 6/TMS 602.

1.9 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Delegated Design: Prepare submittal documents including design calculations and drawings signed and sealed by registered design professional, licensed in state where work is located.

2.2 PRODUCTS - GENERAL

A. Basis of Design: See SCHEDULE FOR FINISHES.

B. Provide each product from one manufacturer and from one production run.

2.3 UNIT MASONRY PRODUCTS

A. Brick: - NOT USED

B. Concrete Masonry Units (CMU):

1. Hollow and Solid Load-Bearing Concrete Masonry Units: ASTM C90.
   a. Unit Weight: Normal weight.
2. Sizes: Modular, 200 mm by 400 mm (8 inches by 16 inches) nominal face dimension; thickness as indicated on drawings.
3. For molded faces used as a finished surface, use concrete masonry units with uniform fine to medium surface texture unless specified otherwise.
4. Use bullnose concrete masonry units at corners exposed in finished work with 25 mm (1 inch) minimum radius rounded vertical exterior corners (bullnose units).
5. Customized Units:
   a. Glazed Face Units: Facing conform to ASTM C744.

C. Clay Tile Units: - Not Used

D. Structural Clay Load-Bearing Wall Tile: - Not Used.

E. Structural Clay Non-Load-Bearing Tile: - Not Used.

2.4 ANCHORS, TIES, AND REINFORCEMENT

A. Steel Reinforcing Bars: ASTM A615/A615M; Grade 60, deformed bars.

B. Joint Reinforcement:

1. Form from wire complying with ASTM A951/A951M.
2. Hot dipped galvanized after fabrication.
3. Width of joint reinforcement 40 mm (1.6 inches) less than nominal thickness of masonry wall or partition.
4. Cross wires welded to longitudinal wires.
5. Joint reinforcement minimum 3000 mm (10 feet) long, factory cut.
6. Joint reinforcement with crimp formed drip is not acceptable.

7. Maximum spacing of cross wires 400 mm (16 inch) to longitudinal wires.
8. Ladder Design:
   a. Longitudinal wires deformed 4 mm (0.16 inch).
   b. Cross wires 4 mm (0.16 inch) diameter.
9. Trussed Design:
   a. Longitudinal and cross wires minimum 4 mm (0.16 inch nominal) diameter.
   b. Longitudinal wires deformed.
10. Multiple Wythes and Cavity Wall Ties:
   a. Longitudinal wires 4 mm (0.16 inch), two in each wythe with ladder truss wires 4 mm (0.16 inch) overlay, welded to each longitudinal wire.
   b. Longitudinal wires 4 mm (0.16 inch) with U shape 4 mm (0.16 inch) rectangular ties extending into other wythe minimum 75 mm (3 inches) spaced 400 mm on center (16 inches). Adjustable type with U shape tie designed to receive 4 mm (0.16 inch) pintle projecting into other wythe 75 mm (3 inches min.).

C. Adjustable Veneer Anchor for Framed Walls:
1. Two piece, adjustable anchor and tie.
2. Anchor and tie may be either loop or angle type; provide only one type throughout.
3. Loop Type:
   a. Anchor: Screw-on galvanized steel anchor strap 2.75 mm (0.11 inch) by 19 mm (3/4 inch) wide by 225 mm (9 inches) long, with 9 mm (0.35 inch) offset and 100 mm (4 inch) adjustment. Provide 5 mm (0.20 inch) hole at each end for fasteners.
   b. Ties: Triangular tie, fabricated of 5 mm (0.20 inch) diameter galvanized cold drawn steel wire. Ties long enough to engage anchor and be embedded minimum 50 mm (2 inches) into bed joint of masonry veneer.
4. Angle Type:
   a. Anchor: Minimum 2 mm (16 gage) thick galvanized steel angle shaped anchor strap. Provide hole in vertical leg for fastener. Provide hole near end of outstanding leg to suit upstanding portion of tie.
   b. Tie: Fabricate from 5 mm (0.20 inch) diameter galvanized cold drawn steel wire. Form "L" shape to be embedded minimum 50 mm

(2 inches) into the bed joint of masonry veneer and provide upstanding leg to fit through hole in anchor and be long enough to allow 50 mm (2 inches) of vertical adjustment.

D. Dovetail Anchors:
   1. Corrugated steel dovetail anchors formed of 1.5 mm (0.06 inch) thick by 25 mm (1 inch) wide galvanized steel, 90 mm (3-1/2 inches) long where used to anchor 100 mm (4 inch) nominal thick masonry units, 140 mm (5-1/2 inches) long for masonry units more than 100 mm (4 inches) thick.
   2. Triangular wire dovetail anchor 100 mm (4 inch) wide formed of 4 mm (9 gage) steel wire with galvanized steel dovetail insert. Anchor length to extend minimum 75 mm (3 inches) into masonry, 25 mm (1 inch) into 40 mm (1-1/2 inch) thick units.
   3. Form dovetail anchor slots from 0.6 mm (0.02 inch) thick galvanized steel (with felt or fiber filler).

E. Individual Ties:
   1. Rectangular ties: Form from 5 mm (3/16 inch) diameter galvanized steel rod to rectangular shape minimum 50 mm (2 inches) wide by sufficient length for ends of ties to extend within 25 mm (1 inch) of each face of wall. Ties that are crimped to form drip are not acceptable.
   2. Adjustable Cavity Wall Ties:
      a. Adjustable wall ties may be furnished at Contractor's option.
      b. Two piece type permitting up to 40 mm (1-1/2 inch) adjustment.
      c. Form ties from 5 mm (3/16 inch) diameter galvanized steel wire.
      d. Form one piece to rectangular shape 105 mm (4-1/8 inches) wide by length required to extend into bed joint 50 mm (2 inches).
      e. Form other piece to 75 mm (3 inch) long by 75 mm (3 inch) wide shape, having 75 mm (3 inch) long bent section for engaging 105 mm (4-1/8 inch) wide piece to form adjustable connection.

F. Wall Ties, (Mesh or Wire):
   1. Mesh wall ties formed of ASTM A1064/A1064M, W0.5, 2 mm, (0.08 inch) galvanized steel wire 13 mm by 13 mm (1/2 inch by 1/2 inch) mesh, 75 mm (3 inches) wide by 200 mm (8 inches) long.
   2. Rectangular wire wall ties formed of W1.4, 3 mm, (0.12 inch) galvanized steel wire 50 mm (2 inches) wide by 200 mm (8 inches) long.

G. Corrugated Wall Tie:

1. Form from 1.5 mm (0.06 inch) thick corrugated, galvanized steel 30 mm (1-1/4 inches) wide by lengths to extend minimum 100 mm (4 inches) into joints of masonry plus 38 mm (1-1/2 inch) turn-up.
2. Provide 5 mm (3/16 inch) hole in turn-up for fastener attachment.

H. Adjustable Steel Column Anchor:
1. Two piece anchor consisting of a 6 mm (1/4 inch) diameter steel rod to be welded to steel with offset ends, rod to permit 100 mm (4 inch) vertical adjustment of wire anchor.
2. Triangular shaped wire anchor 100 mm (4 inches) wide formed from 5 (3/16 inch) diameter galvanized wire, to extend minimum 75 mm (3 inches) into joints of masonry.

I. Adjustable Steel Beam Anchor:
1. Z or C type steel strap, 30 mm (1 1/4 inches) wide, 3 mm (1/8 inch) thick.
2. Flange hook minimum 38 mm (1 1/2 inches) long.
3. Length to embed in masonry minimum 50 mm (2 inches) in 100 mm (4 inch) nominal thick masonry and 100 mm (4 inches) in thicker masonry.
4. Bend masonry end minimum 40 mm (1 1/2 inches).

J. Ridge Wall Anchors:
1. Form from galvanized steel minimum 25 mm (1 inch) wide by 5 mm (3/16 inch) thick by 600 mm (24 inches) long, plus 50 mm (2 inch) bends.
2. Other lengths as indicated on drawings.

2.5 ACCESSORIES

A. Shear Keys:
1. Solid extruded cross-shaped section of rubber, neoprene, or polyvinyl chloride, with durometer hardness of approximately 80 when tested according to ASTM D2240, and minimum shear strength of 3.5 MPa (500 psi).
2. Shear Key Dimensions: Nominal 70 mm by 8 mm for long flange and 38 mm by 16 mm for short flange (2-3/4 inches by 5/16 inch for long flange, and 1-1/2 inches by 5/8 inch for short flange).

B. Weeps:
1. Weep Hole Wicks: Glass fiber ropes, 10 mm (3/8 inch) minimum diameter, 300 mm (12 inches) long.
2. Weep Tubing: Round, polyethylene, 9 mm (3/8 inch) diameter, 100 mm (4 inches) long.

3. Weep Hole: Flexible PVC louvered configuration with rectangular closure strip at top.

C. Cavity Drain Material: Open mesh polyester sheets or strips to prevent mortar droppings from clogging the cavity.

D. Preformed Compressible Joint Filler:
1. Thickness and depth to fill joint.
2. Closed Cell Neoprene: ASTM D1056, Type 2, Class A, Grade 1, B2F1.
3. Non-Combustible Type: ASTM C612, Type 5, Max. Temp.1800 degrees F.

E. Box Board:
1. Mineral Fiber Board: ASTM C612, Type 1.
2. 25 mm (1 inch) thickness.
3. Other spacing material having similar characteristics is acceptable subject to Contracting Officer's Representative's approval.

F. Masonry Cleaner:
1. Detergent type cleaner selected for each type masonry.
2. Acid cleaners are not acceptable.
3. Use soapless type specially prepared for cleaning brick or concrete masonry as appropriate.

G. Fasteners:
1. Concrete Nails: ASTM F1667, Type I, Style 11, 19 mm (3/4 inch) minimum length.
2. Masonry Nails: ASTM F1667, Type I, Style 17, 19 mm (3/4 inch) minimum length.
3. Screws: FS-FF-S-107, Type A, AB, SF thread forming or cutting.

H. Welding Materials: AWS D1.4/D1.4M, type to suit application.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions.
1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

B. Keep finish work free from mortar smears or spatters, and leave neat and clean.

C. Wall Openings:
1. Fill hollow metal frames built into masonry walls and partitions solid with mortar as laying of masonry progresses.

2. When items are not available when walls are built, prepare openings for subsequent installation.

D. Tooling Joints:
1. Do not tool until mortar has stiffened enough to retain thumb print when thumb is pressed against mortar.
2. Tool while mortar is soft enough to be compressed into joints and not raked out.
3. Finish joints in exterior face masonry work with jointing tool, and provide smooth, water-tight concave joint unless specified otherwise.
4. Tool Exposed interior joints in finish work concave unless specified otherwise.

E. Partition Height:
1. Extend partitions minimum 100 mm (4 inches) above suspended ceiling or to overhead construction where no ceiling occurs.
2. Extend following partitions to overhead construction.
   a. Full height partitions, and fire partitions and smoke partitions indicated on drawings.
   b. Both walls at expansion joints.
   c. Corridor walls.
   d. Walls at stairway and stair halls, elevators, dumbwaiters, trash and laundry chute shafts, and other vertical shafts.
   e. Walls at refrigerator space.
   f. Reinforced masonry partitions.
3. Extend finished masonry partitions minimum 100 mm (4 inches) above suspended ceiling and continue with concrete masonry units or structural clay tile to overhead construction:

F. Lintels:
1. Lintels are not required for openings less than 1000 mm (40 inches) wide that have hollow metal frames.
2. Openings 1025 mm (41 inches) wide to 1600 m (63 inches) wide without structural steel lintel or frames, require lintel formed of concrete masonry lintel or bond beam units or structural facing tile lintel units filled with grout and reinforced with one No. 16 (No. 5) rod top and bottom for each 100 mm (4 inches) of nominal thickness unless shown otherwise.
3. Precast concrete lintels of 25 MPa (3,000 psi) concrete, same thickness as partition, and with one No. 16 (No. 5) deformed bar top

and bottom for each 100 mm (4 inches) of nominal thickness, is acceptable in lieu of reinforced CMU masonry lintels.

4. Use steel lintels, for openings greater than 1600 m (63 inches) wide, brick masonry openings, and elevator openings unless shown otherwise.
5. Doors having overhead concealed door closers require steel lintel, and pocket for closer box.
6. Lintel Bearing Length: Minimum 100 mm (4 inches) at both ends.
7. Build masonry openings or arches over wood or metal centering and supports when steel lintels are not used.

G. Wall, Furring, and Partition Units:

1. Lay out field units to provide one-half running bond, unless indicated otherwise.
2. Align head joints of alternate vertical courses.
3. At sides of openings, balance head joints in each course on vertical center lines of openings.
4. Minimum Masonry Unit Length: 100 mm (4 inches).
5. On interior partitions provide 6 mm (1/4 inch) open joint for caulking between existing construction, exterior walls, concrete work, and abutting masonry partitions.
6. Use minimum 100 mm (4 inches) nominal thick masonry for free standing furring, unless indicated otherwise.
7. Do not abut existing plastered surfaces except suspended ceilings with new masonry partitions.

H. Use minimum 100 mm (4 inches) nominal thick masonry for fireproofing steel columns unless indicated otherwise.

I. Before connecting new masonry with previously laid masonry, remove loosened masonry or mortar, and clean and wet work in place as specified under wetting.

J. When new masonry partitions start on existing floors, machine cut existing floor finish material down to concrete surface.

K. Structural Steel Encased in Masonry:

1. Where structural steel is encased in masonry and voids between steel and masonry are filled with mortar, provide minimum 25 mm (1 inch) mortar free expansion space between masonry and steel by applying box board material to steel before masonry is laid.
2. Do not install spacing material where steel is bearing on masonry or masonry is bearing on steel.

L. Chases:
   1. Do not install chases in masonry walls and partitions exposed to view in finished work, including painted or coated finishes on masonry.
   2. Masonry 100 mm (4 inch) nominal thick may have electrical conduits 25 mm (1 inch) or less in diameter when covered with soaps, or other finishes.
   3. Fill recess chases after installation of conduit, with mortar and finish flush.
   4. When pipes or conduits, or both occur in hollow masonry unit partitions retain minimum one web of hollow masonry units.

M. Wetting and Wetting Test:
   1. Test and wet brick and clay tile according to BIA TN 11B.
   2. Do not wet concrete masonry units or glazed structural facing tile before laying.

N. Temporary Formwork: Provide formwork and shores as required for temporary support of reinforced masonry elements.

O. Construct formwork to conform to shape, line and dimensions indicated on drawings. Make sufficiently tight to prevent mortar, grout, or concrete leakage. Brace, tie and support formwork as required to maintain position and shape during construction and curing of reinforced masonry.

P. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other reasonable temporary construction loads.

Q. Minimum Curing Times Before Removing Shores and Forms:
   1. Girders and Beams: 10 days.
   2. Slabs: 7 days.
   3. Reinforced Masonry Soffits: 7 days.

3.2 INSTALLATION - ANCHORAGE

A. Veneer to Framed Walls:
   1. Install adjustable veneer anchors.
   2. Fasten anchor to stud through sheathing with self-drilling and tapping screw, one at both ends of loop type anchor.
   3. Space anchors maximum 400 mm (16 inches) on center vertically at each stud.

B. Veneer to Concrete Walls:

1. Install dovetail slots in concrete vertically at 400 mm (16 inches) on centers.
2. Locate dovetail anchors at 400 mm (16 inch) maximum vertical intervals.
3. Anchor new masonry facing to existing concrete with adjustable cavity wall ties spaced at 400 mm, (16 inches) maximum vertical intervals, and at 400 mm (16 inches) maximum horizontal intervals. Fasten ties to concrete with power actuated fasteners or concrete nails.

C. Masonry Facing to Backup and Cavity Wall Ties:
1. Use individual ties for new work.
2. Stagger ties in alternate courses, and space at 400 mm (16 inches) maximum vertically, and 400 mm (16 inches) horizontally.
3. At openings, provide additional ties spaced maximum 900 mm (36 inches) apart vertically around perimeter of opening, and within 300 mm (12 inches) from edge of opening.
4. Anchor new masonry facing to existing masonry with adjustable cavity wall ties spaced at 400 mm (16 inch) maximum vertical intervals and at every second masonry unit horizontally. Fasten ties to masonry with masonry nails.
5. Option: Install joint reinforcing for multiple wythes and cavity wall ties spaced maximum 400 mm (16 inches) vertically.
6. Tie interior and exterior wythes of reinforced masonry walls together with individual ties. Provide ties at intervals maximum 400 mm (16 inches) on center horizontally, and 400 mm (16 inches) on center vertically. Lay ties in the same line vertically in order to facilitate vibrating of the grout pours.

D. Anchorage of Abutting Masonry:
1. Anchor interior 100 mm (4 inch) thick masonry partitions to exterior masonry walls with wall ties. Space ties at 600 mm (24 inches) maximum vertical intervals. Extend ties 100 mm (4 inches) minimum into masonry.
2. Anchor interior masonry bearing walls or interior masonry partitions over 100 mm (4 inches) thick to masonry walls with rigid wall anchors spaced at 400 mm (16 inch) maximum vertical intervals.
3. Anchor abutting masonry walls and partitions to concrete with dovetail anchors. Install dovetail slots vertically in concrete at centerline of abutting wall or partition. Locate dovetail anchors at

400 mm (16 inch) maximum vertical intervals. Secure anchors to existing wall with two 9 mm (3/8 inch) by 75 mm (3 inch) expansion bolts or two power-driven fasteners.

4. Anchor abutting interior masonry partitions to existing concrete and existing masonry construction, with adjustable wall ties. Extend ties minimum 100 mm (4 inches) into joints of new masonry. Fasten ties to existing concrete and masonry construction, with powder actuated drive pins, nail or other means that provides rigid anchorage. Install anchors at 400 mm (16 inch) maximum vertical intervals.

E. Masonry Furring:
1. Anchor masonry furring less than 100 mm (4 inches) nominal thick to masonry walls or to concrete with adjustable wall ties or dovetail anchors.
2. Space at maximum 400 mm (16 inches) on center in both directions.

F. Anchorage to Steel Beams or Columns:
1. Use adjustable beam anchors on each flange.
2. At columns weld steel rod to steel columns at 300 mm (12 inch) intervals, and place wire ties in masonry courses at 400 mm (16 inches) maximum vertically.

3.3 INSTALLATION - REINFORCEMENT

A. Joint Reinforcement:
1. Install joint reinforcement in CMU wythe of combination brick and CMU, cavity walls, and single wythe concrete masonry unit walls or partitions.
2. Reinforcing is acceptable in lieu of individual ties for anchoring brick facing to CMU backup in exterior masonry walls.
3. Locate joint reinforcement in mortar joints at 400 mm (16 inch) maximum vertical intervals.
4. Additional joint reinforcement is required in mortar joints at both 200 mm (8 inches) and 400 (16 inches) above and below windows, doors, louvers and similar openings in masonry.

B. Steel Reinforcing Bars:
1. Install reinforcing bars in cells of hollow masonry units where required for vertical reinforcement and in bond beam units for horizontal reinforcement. Install in wall cavities of reinforced masonry walls where indicated on drawings.
2. Bond Beams:

a. Form Bond beams of load-bearing concrete masonry units filled with grout and reinforced with two No. 15m (No. 5) reinforcing bars unless shown otherwise. Do not cut reinforcement.
b. Brake bond beams only at expansion joints and at control joints, if shown.

3. Stack Bond:
   a. Locate additional joint reinforcement in vertical and horizontal joints as indicated on drawings.
   b. Anchor vertical reinforcement into foundation or wall or bond beam below.
   c. Provide temporary bracing for walls over 8 feet tall until permanent horizontal bracing is completed.
4. Grout openings:
   a. Leave cleanout holes in double wythe walls during construction by omitting units at base of one side of wall.
   b. Locate 75 mm by 75 mm (3 inches. by 3 inches.) min. cleanout holes at location of vertical reinforcement.
   c. Keep grout space clean of mortar accumulation and debris. Clean as work progresses and immediately before grouting.

3.4 INSTALLATION - CMU CONTROL JOINTS

A. Provide CMU control joints (CJ) where indicated on drawings.
B. Keep joint free of mortar and other debris.
C. Joints Occur In Masonry Walls:
   1. Install preformed compressible joint filler in brick wythe.
   2. Install cross shaped shear keys in concrete masonry unit wythe with preformed compressible joint filler on both sides of shear key.
D. Use standard notched concrete masonry units (sash blocks) made in full and half-length units where shear keys are used to create a continuous vertical joint.
E. Interrupt joint reinforcement at expansion and control joints.
F. Fill opening in exposed face of expansion and control joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.

3.5 INSTALLATION - BUILDING EXPANSION AND SEISMIC JOINTS

A. Keep expansion and seismic joints open and free of mortar. Remove mortar and other debris.

B. Install non-combustible, compressible type joint filler to fill space completely except where sealant is shown on joints in exposed finish work.

C. Fill opening in exposed face of expansion and seismic joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.

3.6 INSTALLATION - ISOLATION JOINT

A. Where full height walls and partitions lie parallel or perpendicular to and under structural beams and shelf angles, provide minimum 9 mm (3/8 inch) separation between walls and partitions and bottom of beams and shelf angles.

B. Insert continuous full width strip of non-combustible type compressible joint filler.

C. Fill opening in exposed face of isolation joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.

3.7 INSTALLATION – BRICKWORK – N/A

3.8 INSTALLATION - CONCRETE MASONRY UNITS

A. Types and Uses:

1. Provide special concrete masonry shapes as required, including lintel and bond beam units, sash units, and corner units. Provide solid concrete masonry units, where full units cannot be installed, or where needed for anchorage of accessories.
2. Provide solid load-bearing concrete masonry units or grout cell of hollow units at jambs of openings in walls, where structural members impose loads directly on concrete masonry, and where shown.
3. Provide rounded corner (bullnose) shapes at opening jambs in exposed work and at exterior corners.

B. Laying:

1. Lay concrete masonry units with 9 mm (3/8 inch) joints, with a bond overlap of minimum 1/4 of unit length, except where stack bond is indicated on drawings.
2. Do not wet concrete masonry units before laying.
3. Bond external corners of partitions by overlapping alternate courses.
4. Lay first course in a full mortar bed.
5. Set anchorage items as work progress.
6. Where ends of anchors, bolts, and other embedded items, project into voids of units, completely fill voids with mortar or grout.

7. Provide 6 mm (1/4 inch) open joint for sealant between existing construction, exterior walls, concrete work, and abutting masonry partitions.
8. Lay concrete masonry units with full face shell mortar beds and fill head joint beds for depth equivalent to face shell thickness.
9. Lay concrete masonry units so cores of units, that are to be filled with grout, are vertically continuous with joints of cross webs of such cores completely filled with mortar. Unobstructed core openings minimum 50 mm (2 inches) by 75 mm (3 inches).
10. Do not wedge masonry against steel reinforcing. Minimum 13 mm (1/2 inch) clear distance between reinforcing and masonry units.
11. Install deformed reinforcing bars of sizes indicated on drawings.
12. At time of placement, ensure steel reinforcement is free of loose rust, mud, oil, and other contamination capable of affecting bond.
13. Place steel reinforcement at spacing indicated on drawings before grouting.
14. Minimum clear distance between parallel bars: One bar diameter.
15. Hold vertical steel reinforcement in place vertically by centering clips, caging devices, tie wire, or other approved methods.
16. Support vertical bars near each end and at maximum 192 bar diameter on center.
17. Splice reinforcement or attach reinforcement to dowels by placing in contact and securing with wire ties.
18. Stagger splices in adjacent horizontal reinforcing bars. Lap reinforcing bars at splices a minimum of 40 bar diameters.
19. Grout cells of concrete masonry units, containing reinforcing bars, solid as specified.
20. Install cavity and joint reinforcement as masonry work progresses.
21. Rake joints 6 to 10 mm (1/4 to 3/8 inch) deep for pointing with colored mortar when colored mortar is not full depth.

3.9 INSTALLATION - GLAZED STRUCTURAL FACING TILE

A. Lay facing tile in running bond unless indicated otherwise.

B. Laying:

1. Set facing tile units in full bed of mortar with ends buttered, and units shoved into place. Fill joints with mortar, and rake out 9 mm (3/8 inch) deep for pointing.
2. Install clean units when set.

3. Perform cutting and grinding with power-driven cutting saws and grinders.
4. Cut or drill units to accommodate electrical outlets, plumbing fixtures, grab-bars, fittings, and equipment.
5. Cove Base Units:
   a. Set base flush with finish floor.
   b. Form base course of two-face partitions of two units to required thickness.
6. Lay out partitions enclosing pipes or conduits with thickness to provide 50 mm (2 inch) minimum coverage of pipes or conduits.
7. Joints:
   a. 6 mm (1/4 inch) nominal width for new work, match existing for alteration work.
   b. Maximum variations in joint width 2 mm (1/16 inch).
   c. Reinforce Two-Face partitions of 100 mm (4 inch) nominal thickness with continuous joint reinforcement, or wire mesh ties in joints at top of base, at top of glazed structural facing tile, and at three-course intervals.

3.10 POINTING

A. Fill joints with pointing mortar using rubber float trowel to apply mortar solidly into raked joints.
B. Wipe off excess mortar from joints of glazed masonry units with dry cloth.
C. Tool exposed joints to smooth concave joint.
D. At joints with existing work, match existing joint.

3.11 GROUTING

A. Preparation:
   1. Clean grout space of mortar droppings before placing grout.
   2. Close cleanouts.
   3. Install vertical solid masonry dams across grout space for full height of wall at intervals of maximum 9000 mm (30 feet). Do not bond dam units into wythes as masonry headers.
   4. Verify reinforcing bars are installed as indicated on drawings.
B. Placing:
   1. Place grout in grout space in lifts as specified.
   2. Consolidate each grout lift after free water has disappeared but before plasticity is lost.

3. Do not slush with mortar or use mortar with grout.
4. Interruptions:
   a. When grouting must be stopped for more than an hour, top off grout 40 mm (1-1/2 inches) below top of last masonry course.
   b. Grout from dam to dam on high lift method.
   c. Longitudinal run of masonry may be stopped off only by raking back one-half masonry unit length in each course and stopping grout 100 mm (4 inches) back of rake on low lift method.

C. Puddling Method:
1. Consolidate by puddling with grout stick during and immediately after placing.
2. Grout cores of concrete masonry units containing reinforcing bars solid as masonry work progresses.

D. Low Lift Method:
1. Construct masonry to 1.5 m (5 feet) maximum height before grouting.
2. Grout in one continuous operation and consolidate grout by mechanical vibration and reconsolidate after initial water loss and settlement has occurred.

E. High Lift Method:
1. Do not pour grout until masonry wall has cured minimum of 4 hours.
2. Place grout in 1.5 m (5 feet) maximum lifts.
3. Exception:
   a. Where following conditions are met, place grout in 3.86 m (12.67 feet) maximum lifts.
   b. Masonry has cured minimum of 4 hours.
   c. Grout slump is maintained between 250 and 275 mm (10 and 11 inches).
   d. No intermediate reinforced bond beams are placed between top and bottom of grout lift.
4. When vibrating succeeding lifts, extend vibrator 300 to 450 mm (12 to 18 inches) into preceding lift.

3.12 PLACING REINFORCEMENT

A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on drawings or approved submittal drawings, or bars with reduced cross-section due to excessive rusting or other causes.

B. Position reinforcement accurately at spacing indicated on drawings. Support and secure vertical bars against displacement. Install horizontal reinforcement as masonry work progresses. Where vertical bars are shown in close proximity, provide clear distance between bars of minimum one bar diameter or 25 mm (1 inch), whichever is greater.

C. For columns, piers and pilasters, maintain clear distance between vertical bars as indicated on drawings, minimum 1.5 bar diameters or 38 mm (1-1/2 inches), whichever is greater. Provide lateral ties as indicated on drawings.

D. Splice reinforcement bars only where indicated on drawings, unless approved by Contracting Officer's Representative. Provide lapped splices. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.

E. Provide minimum lap as indicated on approved submittal drawings, or if not indicated, minimum 48 bar diameters.

F. Weld splices where indicated on drawings according to AWS D1.4/D1.4M.

G. Embed metal ties in mortar joints as work progresses, with minimum mortar cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations.

H. Embed prefabricated horizontal joint reinforcement as work progresses, with minimum cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations. Lap joint reinforcement minimum 150 mm (6 inches) at ends. Use prefabricated “L” and “T” sections to provide continuity at corners and intersections. Cut and bend joint reinforcement for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.

I. Anchoring: Anchor reinforced masonry work to supporting structure as indicated on drawings.

J. Anchor reinforced masonry walls at intersections with non-reinforced masonry.

3.13 INSTALLATION OF REINFORCED BRICK MASONRY – NOT USED

3.14 CONSTRUCTION TOLERANCES

A. Lay masonry units plumb, level and true to line within tolerances according to ACI 530.1/ASCE 6/TMS 602 and as follows:

B. Maximum variation from plumb:

1. In 3000 mm (10 feet) - 6 mm (1/4 inch).
2. In 6000 mm (20 feet) - 9 mm (3/8 inch).

3. In 12,000 mm (40 feet) or more - 13 mm (1/2 inch).

C. Maximum variation from level:

1. In any bay or up to 6000 mm (20 feet) - 6 mm (1/4 inch).
2. In 12,000 mm (40 feet) or more - 13 mm (1/2 inch).

D. Maximum variation from linear building lines:

1. In any bay or up to 6000 mm (20 feet) - 13 mm (1/2 inch).
2. In 12,000 mm (40 feet) or more - 19 mm (3/4 inch).

E. Maximum variation in cross-sectional dimensions of columns and thickness of walls from dimensions shown:

1. Minus 6 mm (1/4 inch).
2. Plus 13 mm (1/2 inch).

F. Maximum variation in prepared opening dimensions:

1. Accurate to minus 0 mm (0 inch).
2. Plus 6 mm (1/4 inch).

3.15 CLEANING AND REPAIR

A. General:

1. Clean exposed masonry surfaces on completion.
2. Protect adjoining construction materials and landscaping during cleaning operations.
3. Cut out defective exposed new joints to depth of approximately 19 mm (3/4 inch) and repoint.
4. Remove mortar droppings and other foreign substances from wall surfaces.

B. Concrete Masonry Units:

1. Immediately following setting, brush exposed surfaces free of mortar or other foreign matter.
2. Allow mud to dry before brushing.

C. Glazed Structural Facing Tile or Brick Units:

1. Clean as recommended manufacturer. Protect light colored mortar joints from discoloration during cleaning.
2. Use on solid masonry walls.
3. Prepare schedule of test locations.

3.16 FIELD QUALITY CONTROL

A. Water Penetration Testing:

1. Seven days before plastering or painting, in presence of Contracting Officer's Representative, test solid exterior masonry walls for water penetration.

2. Direct water on masonry for a period of one hour when wind velocity is less than five miles per hour.
3. Should moisture appear on inside of walls tested, make additional tests at other areas as directed by Contracting Officer's Representative.
4. Correct areas showing moisture on inside of walls, and repeat test at repaired areas, to ensure moisture penetration has been stopped.
5. Make water test at following locations:
   a. Eight places on buildings.

- - E N D - -

SECTION 04 72 00
CAST STONE MASONRY

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies manufactured concrete units to simulate a natural stone.

B. Installation of cast stone units.

1.2 RELATED WORK

A. Section 01 60 00, PRODUCT REQUIREMENTS

B. Section 04 05 13, MASONRY MORTARING, Setting and pointing mortar.

C. Section 04 05 16, MASONRY GROUTING, Setting and pointing mortar.

D. Section 07 92 00, JOINT SEALANTS, Joint sealant and application.

E. See SCHEDULE FOR FINISHES, Color and texture.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 30 00, ADMINISTRATIVE REQUIREMENTS. All items indicated below are required submittals requiring COR’s review and approval.

B. Samples:

1. Cast stone, sample panel, size 100 by 300 by 300 mm (4 by 12 by 12 inches) each color and finish.
2. Show finish on two 100 mm (4-inch) edges and 300 by 300 mm (12 by 12 inch) surface.

C. Shop Drawings:

1. Cast stone showing exposed faces, profiles, cross sections, anchorage, reinforcing, jointing and sizes.
2. Setting drawings with setting mark.

D. Certificates: Test results indicating that the cast stone meets specification requirements and proof of plant certification.

E. Submit manufacturers test results of cast stone previously made by manufacturer.

F. Laboratory Data: Description of testing laboratories facilities and qualifications of its principals and key personnel.

G. List of jobs furnished by the manufacturer, which were similar in scope and at least three (3) years of age.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Store cast stone under waterproof covers on planking clear of ground.

B. Protect from handling, dirt, stain, and water damage.

C. Mark production units with the identification marks as shown on the shop drawings.

D. Package units and protect them from staining or damage during shipping and storage.

E. Provide an itemized list of product to support the bill of lading.

1.5 WARRANTY

A. Warranty exterior masonry walls against moisture leaks, any defects and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be two years.

1.6 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

B. Cast Stone Institute Technical Manual and Cast Stone Institute standard specifications.

C. ASTM International(ASTM):

A167-99(R2009).....Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

A615/A615M-20.....Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement

A1064/A1064M-18a.....Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

C33/C33M-18.....Standard Specification for Concrete Aggregates

C150/C150M-20.....Standard Specification for Portland Cement

C503/C503M-15.....Standard Specification for Marble Dimension Stone (Exterior)

C568/C568M-15.....Standard Specification for Limestone Dimension Stone

C615/C615M-18e1.....Standard Specification for Granite Dimension Stone

C616/C616M-15.....Standard Specification for Quartz-Based Dimension Stone

C979/C979M-16.....Standard Specification for Pigments for Integrally Colored Concrete

C1194-19.....Standard Test Method for Compressive Strength of Architectural Cast Stone

C1195-19a.....Standard Test Method for Absorption of Architectural Cast Stone

C1364-19.....Standard Specification for Architectural Cast Stone.

D2244-16.....Standard Practice for Calculation of Color Differences from Instrumentally Measured Color Coordinates.

1.7 QUALITY ASSURANCE

A. The Manufacturer:

1. Must have 5 years minimum continuous operating experience and have facilities for manufacturing cast stone as described herein. Manufacturer shall have sufficient plant facilities to produce the shapes, quantities and size of cast stone required in accordance with the project schedule.
2. Must be a member of the Cast Stone Institute.
3. Must have a certified plant (certification by the Cast Stone Institute).

B. Stone setter: Must have 5 years' experience setting cast or natural building stone.

C. Testing: One (1) sample from production units may be selected at random from the field for each 500 cubic feet (14 meters squared) delivered to the job:

1. Three (3) field cut cube specimens from each of these sample shall have an average minimum compressive strength of not less than 85 percent with no single specimen testing less than 75 percent of design strength as specified.
2. Three (3) field cut cube specimens from each of these samples shall have an average maximum cold-water absorption of 6 percent.
3. Field specimens shall be tested in accordance with ASTMC 1194 and C 1195.
4. Manufacturer shall submit a written list of projects similar and at least three (3) years of age, along with owner, architect and contractor references.

1.8 MANUFACTURING TOLERANCES

A. Cross section dimensions shall not deviate by more than + 1/8 inch (3 mm) from approved dimension.

B. Length of units shall not deviate by more than length /360 or + 1/8 inch (3mm), whichever is greater, not to exceed + 1/4 inch (6 mm).

Maximum length of any unit shall not exceed 15 times the average thickness of such unit unless otherwise agreed by the manufacturer.

C. Warp bow or twist of units shall not exceed length/360 or + 1/8 inch (3 mm), whichever is greater.

D. Location of dowel holes, anchor slots, flashing grooves, false joints and similar features – On formed sides of unit, 1/8 inch (3 mm), on unformed sides of unit, 3/8 inch (9 mm) maximum deviation.

1.9 MOCK-UP

A. Provide full size unit(s) for use in construction of sample wall. The mock-up becomes the standard of workmanship for the project.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL CAST STONE

A. Comply with ASTM C 1364

B. Physical properties: Provide the following:

1. Compressive Strength – ASTM C 1194: 6,500 psi (45 Mpa) minimum for products at 28 days.
2. Absorption – ASTM C 1195: 6 percent maximum by the cold water method, or 10 percent maximum by the boiling method for products as 28 days.
3. Air Content – ASTM C173 or C231, for wet cast product shall be 4-8 percent for units exposed to freeze-thaw environments. Air entrainment is not required for vibrant dry tamp (VDT) products.
4. Freeze thaw - ASTM C 1364L The cumulative percent weight loss (CPWL) shall be less than 5 percent after 300 cycles of freezing and thawing.
5. Linear Shrinkage - ASTM C 426L Shrinkage shall not exceed 0.065 percent.

C. Job site testing – One (1) sample from production units may be selected at random from the field for each 500 cubic feet (14 cubic meters) delivered to the job site:

1. Three (3) field cut cube specimens from each of these samples shall have an average minimum compressive strength of not less than 85 percent with no single specimen testing less than 75 percent of design strength as allowed by ACI 318.
2. Three (3) field cut cube specimens from each of these samples shall have an average maximum cold-water absorption of 6 percent.
3. Field specimens shall be tested in accordance with ASTM C 1194 and C 1195.

2.2 RAW MATERIALS

A. Portland cement – Type I or Type III, white and/or grey, ASTM C 150.

B. Coarse aggregates – Granite, quartz or limestone, ASTM C 33, except for gradation, and are optional for the vibrant dry tamp (VDT) casting method.

C. Fine aggregates – Manufactured or natural sands, ASTM C 33, except for gradation.

D. Colors – Inorganic iron oxide pigments, ASTM C 979 except that carbon black pigments shall not be used.

E. Admixtures- Comply with the following:

1. ASTM C 260 for air-entraining admixtures.
2. ASTM C 494/C 495 M Types A-G for water reducing, retarding, accelerating and high range admixtures.
3. Other admixtures: integral water repellents and other chemicals, for which no ASTM Standard exists, shall be previously established as suitable for use in concrete by proven field performance or through laboratory testing.
4. ASTM C 618 mineral admixtures of dark and variable colors shall not be used in surfaces intended to be exposed to view.
5. ASTM C 989 granulated blast furnace slag may be used to improve physical properties. Tests are required to verify these features.

F. Water – Potable

G. Reinforcing bars:

1. ASTM A 615/A 615M. Grade 40 or 60 steel galvanized or epoxy coated when cover is less than 1.5 inch (37 mm).
2. Welded Wire Fabric: ASTM A 1064 where applicable for wet cast units.

H. All anchors, dowels and other anchoring devices and shims shall be standard building stone anchors commercially available in a non-corrosive material such as zinc plated, galvanized steel, brass, or stainless steel Type 302 or 304.

2.3 COLOR AND FINISH

A. Match existing.

B. All surfaces intended to be exposed to view shall have a fine-grained texture similar to natural stone, with no air voids in excess of 1/32 inch (0.8 mm) and the density of such voids shall be less than 3 occurrences per any 1 inch (25 mm) and not obvious under direct daylight illumination at a 5 feet (1.5 meters) distance.

C. Units shall exhibit a texture approximately equal to the approved sample when viewed under direct daylight illumination at a 10 feet (3 meters) distance.

D. ASTM D 2244 permissible variation in color between units of comparable age subjected to similar weathering exposure.

1. Total color difference – not greater than 6 units.
2. Total hue difference-not greater than 2 units.

2.4 REINFORCING

A. Reinforce the units as required by the drawings and for safe handling and structural stress.

1. Minimum reinforcing shall be 0.25 percent of the cross section area.

B. Reinforcement shall be non-corrosive where faces exposed to weather are covered with less than 1.5inch (38 mm) of concrete material. All reinforcement shall have minimum coverage of twice the diameter of the bars.

C. Minor chipping resulting from shipment and delivery shall not be grounds for rejection. Minor chips shall not be obvious under direct daylight illumination from a 20 foot (6 meter) distance.

D. The occurrence of crazing or efflorescence shall not constitute a cause for rejection.

E. Remove cement film, if required, from exposed surface prior to packaging for shipment.

2.5 CURING

A. Cure units in a warm curing chamber 100 degrees F (37.8 degrees C) at 95 percent relative humidity for approximately 12 hours, or cure in a 95 percent moist environment at a minimum 70 degrees F (21.1 degrees C) for 16 hours after casting. Additional yard curing at 95 percent relative humidity shall be 350-degree-days (i.e. 7 days @ 50 degrees F (10.0 degrees C) or 5 days @ 70 degrees F (21.0 degrees C) prior to shipping. Form cured units shall be protected from moisture evaporation with curing blankets or curing compounds after casting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Installing contractor shall check cast stone materials for fit and finish prior to installation. Do not set unacceptable units.

3.2 SETTING TOLERANCES

A. Comply with Cast Stone Institute Technical Manual.

B. Set stones 1/8 inch (3 mm) or less, within the plane of adjacent units.

C. Joints, plus - 1/6 inch (1.5 mm), minus - 1/8 inch (3 mm).

3.3 JOINTING

A. Joint size:

1. At stone/brick joints 3/8 inch (9.5 cm).
2. At stone/stone joints in vertical position 1/4 inch (6 mm) (3/8 inch (9.5 mm) optional).
3. Stone/stone joint exposed on top 3/8 inch (.5 mm).

B. Joint Materials:

1. Mortar, Type N, ASTM C 270.
2. Use a full bed of mortar at all bed joints.
3. Flush vertical joints full with mortar.
4. Leave all joints with exposed tops or under relieving angles open for sealant.
5. Leave head joints in coping and projecting components open for sealant.

C. Location of joints:

1. As shown on shop drawings.
2. At control and expansion joints unless otherwise shown.

3.4 SETTING

A. Drench units with clean water prior to setting.

B. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

C. Set units in full bed of mortar, unless otherwise detailed.

D. Rake mortar joints 3/4 inch (18 mm) for pointing.

E. Remove excess mortar from unit faces immediately after setting.

F. Tuck point unit joints to a slight concave profile.

3.5 JOINT PROTECTION

A. Comply with requirements of Section 07 92 00, JOINT SEALANTS.

B. Prime ends of units, insert properly sized backing rod and install required sealant.

3.6 REPAIR AND CLEANING

A. Repair chips with touchup materials furnished by manufacturer.

B. Saturate units to be cleaned prior to applying an approved masonry cleaner.

C. Consult with manufacturer for appropriate cleaners.

3.7 INSPECTION AND ACCEPTANCE

A. Inspect finished installation according to Bulletin #36 published by the Cast Stone Institute.

- - - E N D - - -

SECTION 05 50 00
METAL FABRICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies items and assemblies fabricated from structural steel shapes and other materials as shown and specified.

B. Items specified.

1. Support for Wall and Ceiling Mounted Items: (SD055000-01, SD055000-02, SD102113-01, SD102600-01, SD123100-01 & SD123100-02)
2. Frames:
3. Guards
4. Covers and Frames for Pits and Trenches.
5. Gratings
6. Loose Lintels
7. Shelf Angles
9. Plate Door Sill
10. Safety Nosings
12. Railings:
18. Steel Pipe Bollards

1.2 RELATED WORK

A. Prime and finish painting: Section 09 91 00, PAINTING.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 30 00, ADMINISTRATIVE REQUIREMENTS.

B. Manufacturer's Literature and Data:

Grating, each type	Floor plate
	Wheel guards
Manhole Covers	Safety nosing

C. Shop Drawings:

1. Each item specified, showing complete detail, location in the project, material and size of components, method of joining various components and assemblies, finish, and location, size and type of anchors.
2. Mark items requiring field assembly for erection identification and furnish erection drawings and instructions.

3. Provide templates and rough-in measurements as required.

D. Manufacturer's Certificates:

1. Anodized finish as specified.
2. Live load designs as specified.

E. Design Calculations for specified live loads including dead loads.

F. Furnish setting drawings and instructions for installation of anchors to be preset into concrete and masonry work, and for the positioning of items having anchors to be built into concrete or masonry construction.

1.4 QUALITY ASSURANCE

A. Each manufactured product shall meet, as a minimum, the requirements specified, and shall be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.

B. Each product type shall be the same and be made by the same manufacturer.

C. Assembled product to the greatest extent possible before delivery to the site.

D. Include additional features, which are not specifically prohibited by this specification, but which are a part of the manufacturer's standard commercial product.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society of Mechanical Engineers (ASME):

B18.6.1-97.....Wood Screws
B18.2.2-87(R2010).....Square and Hex Nuts

C. American Society for Testing and Materials (ASTM):

A36/A36M-14.....Structural Steel
A47-99(R2014).....Malleable Iron Castings
A48-03(R2012).....Gray Iron Castings
A53-12.....Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
A123-15.....Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A240/A240M-15.....Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications.

A269-15.....Seamless and Welded Austenitic Stainless Steel Tubing for General Service

A307-14.....Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength

A391/A391M-07(R2015)....Grade 80 Alloy Steel Chain

A786/A786M-15.....Rolled Steel Floor Plate

B221-14.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

B456-11.....Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium

B632-08.....Aluminum-Alloy Rolled Tread Plate

C1107-13.....Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

D3656-13.....Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns

F436-16.....Hardened Steel Washers

F468-06(R2015).....Nonferrous Bolts, Hex Cap Screws, Socket Head Cap Screws and Studs for General Use

F593-13.....Stainless Steel Bolts, Hex Cap Screws, and Studs

F1667-15.....Driven Fasteners: Nails, Spikes and Staples

D. American Welding Society (AWS):

D1.1-15.....Structural Welding Code Steel

D1.2-14.....Structural Welding Code Aluminum

D1.3-18.....Structural Welding Code Sheet Steel

E. National Association of Architectural Metal Manufacturers (NAAMM)

AMP 521-01(R2012).....Pipe Railing Manual

AMP 500-06.....Metal Finishes Manual

MBG 531-09(R2017).....Metal Bar Grating Manual

MBG 532-09.....Heavy Duty Metal Bar Grating Manual

F. Structural Steel Painting Council (SSPC)/Society of Protective Coatings:

SP 1-15.....No. 1, Solvent Cleaning

SP 2-04.....No. 2, Hand Tool Cleaning

SP 3-04.....No. 3, Power Tool Cleaning

G. Federal Specifications (Fed. Spec):

RR-T-650E.....Treads, Metallic and Nonmetallic, Nonskid

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

A. In addition to the dead loads, design fabrications to support the following live loads unless otherwise specified.

B. Ladders and Rungs: 120 kg (250 pounds) at any point.

C. Railings and Handrails: 900 N (200 pounds) in any direction at any point.

D. Floor Plates, Gratings, Covers, Trap Doors, Catwalks, and Platforms: 500 kg/m^2 (100 pounds per square foot). Use _135_____kg (pounds) for concentrated loads. Use 1000_____kg/m^2 (pounds per square foot) for vehicle loads.

E. Manhole Covers: 1200 kg/m^2 (250 pounds per square foot).

2.2 MATERIALS

A. Structural Steel: ASTM A36.

B. Stainless Steel: ASTM A240, Type 302 or 304.

C. Aluminum, Extruded: ASTM B221, Alloy 6063-T5 unless otherwise specified. For structural shapes use alloy 6061-T6 and alloy 6061-T4511.

D. Floor Plate:

1. Steel ASTM A786.
2. Aluminum: ASTM B632.

E. Steel Pipe (Bollard): ASTM A53.

1. Galvanized for exterior locations.
2. Type S, Grade A unless specified otherwise.

F. Cast-Iron: ASTM A48, Class 30, commercial pattern.

G. Malleable Iron Castings: A47.

H. Primer Paint: As specified in Section 09 91 00, PAINTING.

I. Stainless Steel Tubing: ASTM A269, type 302 or 304.

J. Modular Channel Units:

1. Factory fabricated, channel shaped, cold formed sheet steel shapes, complete with fittings bolts and nuts required for assembly.
2. Form channel within turned pyramid shaped clamping ridges on each side.
3. Provide case hardened steel nuts with serrated grooves in the top edges designed to be inserted in the channel at any point and be given a quarter turn so as to engage the channel clamping ridges. Provide each nut with a spring designed to hold the nut in place.

4. Factory finish channels and parts with oven baked primer when exposed to view. Channels fabricated of ASTM A525, G90 galvanized steel may have primer omitted in concealed locations. Finish screws and nuts with zinc coating.
5. Fabricate snap-in closure plates to fit and close exposed channel openings of not more than 0.3 mm (0.0125 inch) thick stainless steel.

K. Grout: ASTM C1107, pourable type.

L. Insect Screening: ASTM D3656.

2.3 HARDWARE

A. Rough Hardware:

1. Furnish rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electro-galvanizing process. Galvanized G-90 where specified.
2. Use G90 galvanized coating on ferrous metal for exterior work unless non-ferrous metal or stainless is used.

B. Fasteners:

1. Bolts with Nuts:
   a. ASME B18.2.2.
   b. ASTM A307 for 415 MPa (60,000 psi) tensile strength bolts.
   c. ASTM F468 for nonferrous bolts.
   d. ASTM F593 for stainless steel.
2. Screws: ASME B18.6.1.
3. Washers: ASTM F436, type to suit material and anchorage.
4. Nails: ASTM F1667, Type I, style 6 or 14 for finish work.

2.4 FABRICATION GENERAL

A. Material

1. Use material as specified. Use material of commercial quality and suitable for intended purpose for material that is not named or its standard of quality not specified.
2. Use material free of defects which could affect the appearance or service ability of the finished product.

B. Size:

1. Size and thickness of members as shown.
2. When size and thickness is not specified or shown for an individual part, use size and thickness not less than that used for the same

component on similar standard commercial items or in accordance with established shop methods.

C. Connections

1. Except as otherwise specified, connections may be made by welding, riveting or bolting.
2. Field riveting will not be approved.
3. Design size, number and placement of fasteners, to develop a joint strength of not less than the design value.
4. Holes, for rivets and bolts: Accurately punched or drilled and burrs removed.
5. Size and shape welds to develop the full design strength of the parts connected by welds and to transmit imposed stresses without permanent deformation or failure when subject to service loadings.
6. Use Rivets and bolts of material selected to prevent corrosion (electrolysis) at bimetallic contacts. Plated or coated material will not be approved.
7. Use stainless steel connectors for removable members machine screws or bolts.

D. Fasteners and Anchors

1. Use methods for fastening or anchoring metal fabrications to building construction as shown or specified.
2. Where fasteners and anchors are not shown, design the type, size, location and spacing to resist the loads imposed without deformation of the members or causing failure of the anchor or fastener, and suit the sequence of installation.
3. Use material and finish of the fasteners compatible with the kinds of materials which are fastened together and their location in the finished work.
4. Fasteners for securing metal fabrications to new construction only, may be by use of threaded or wedge type inserts or by anchors for welding to the metal fabrication for installation before the concrete is placed or as masonry is laid.
5. Fasteners for securing metal fabrication to existing construction or new construction may be expansion bolts, toggle bolts, power actuated drive pins, welding, self drilling and tapping screws or bolts.

E. Workmanship

1. General:

a. Fabricate items to design shown.
b. Furnish members in longest lengths commercially available within the limits shown and specified.
c. Fabricate straight, true, free from warp and twist, and where applicable square and in same plane.
d. Provide holes, sinkages and reinforcement shown and required for fasteners and anchorage items.
e. Provide openings, cut-outs, and tapped holes for attachment and clearances required for work of other trades.
f. Prepare members for the installation and fitting of hardware.
g. Cut openings in gratings and floor plates for the passage of ducts, sumps, pipes, conduits and similar items. Provide reinforcement to support cut edges.
h. Fabricate surfaces and edges free from sharp edges, burrs and projections which may cause injury.

2. Welding:
   a. Weld in accordance with AWS.
   b. Welds shall show good fusion, be free from cracks and porosity and accomplish secure and rigid joints in proper alignment.
   c. Where exposed in the finished work, continuous weld for the full length of the members joined and have depressed areas filled and protruding welds finished smooth and flush with adjacent surfaces.
   d. Finish welded joints to match finish of adjacent surface.
3. Joining:
   a. Miter or butt members at corners.
   b. Where frames members are butted at corners, cut leg of frame member perpendicular to surface, as required for clearance.
4. Anchors:
   a. Where metal fabrications are shown to be preset in concrete, weld 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 150 mm (6 inches) long with 25 mm (one inch) hooked end, to back of member at 600 mm (2 feet) on center, unless otherwise shown.
   b. Where metal fabrications are shown to be built into masonry use 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 250 mm (10 inches) long with 50 mm (2 inch) hooked end, welded to back of member at 600 mm (2 feet) on center, unless otherwise shown.
5. Cutting and Fitting:

a. Accurately cut, machine and fit joints, corners, copes, and miters.
b. Fit removable members to be easily removed.
c. Design and construct field connections in the most practical place for appearance and ease of installation.
d. Fit pieces together as required.
e. Fabricate connections for ease of assembly and disassembly without use of special tools.
f. Joints firm when assembled.
g. Conceal joining, fitting and welding on exposed work as far as practical.
h. Do not show rivets and screws prominently on the exposed face.
i. The fit of components and the alignment of holes shall eliminate the need to modify component or to use exceptional force in the assembly of item and eliminate the need to use other than common tools.

F. Finish:
1. Finish exposed surfaces in accordance with NAAMM AMP 500 Metal Finishes Manual.
2. Aluminum: NAAMM AMP 501.
   a. Mill finish, AA-M10, as fabricated, use unless specified otherwise.
   b. Clear anodic coating, AA-C22A41, chemically etched medium matte, with Architectural Class 1, 0.7 mils or thicker.
   c. Colored anodic coating, AA-C22A42, chemically etched medium matte with Architectural Class 1, 0.7 mils or thicker.
   d. Painted: AA-C22R10.
3. Steel and Iron: NAAMM AMP 504.
   a. Zinc coated (Galvanized): ASTM A123, G90 unless noted otherwise.
   b. Surfaces exposed in the finished work:
      1) Finish smooth rough surfaces and remove projections.
      2) Fill holes, dents and similar voids and depressions with epoxy type patching compound.
   c. Shop Prime Painting:
      1) Surfaces of Ferrous metal:
         a) Items not specified to have other coatings.
         b) Galvanized surfaces specified to have prime paint.

c) Remove all loose mill scale, rust, and paint, by hand or power tool cleaning as defined in SSPC-SP2 and SP3.

d) Clean of oil, grease, soil and other detrimental matter by use of solvents or cleaning compounds as defined in SSPC-SP1.

e) After cleaning and finishing apply one coat of primer as specified in Section 09 91 00, PAINTING.

2) Non ferrous metals: Comply with MAAMM-500 series.

4. Stainless Steel: NAAMM AMP-504 Finish No. 4.

5. Chromium Plating: ASTM B456, satin or bright as specified, Service Condition No. SC2.

G. Protection:

1. Insulate aluminum surfaces that will come in contact with concrete, masonry, plaster, or metals other than stainless steel, zinc or white bronze by giving a coat of heavy-bodied alkali resisting bituminous paint or other approved paint in shop.
2. Spot prime all abraded and damaged areas of zinc coating which expose the bare metal, using zinc rich paint on hot-dip zinc coat items and zinc dust primer on all other zinc coated items.

2.5 SUPPORTS

A. General:

1. Fabricate ASTM A36 structural steel shapes as shown.
2. Use clip angles or make provisions for welding hangers and braces to overhead construction.
3. Field connections may be welded or bolted.

2.6 FRAMES

B. Channel Door Frames:

1. Fabricate of structural steel channels of size shown.
2. Miter and weld frames at corners.
3. Where anchored to masonry or embedded in concrete, weld to back of frame at each jamb, 5 mm (3/16 inch) thick by 44 mm (1-3/4 inch) wide steel strap anchors with ends turned 50 mm (2 inches), and of sufficient length to extend at least 300 mm (12 inches) into wall. Space anchors 600 mm (24 inches) above bottom of frame and 600 mm (24 inches) o.c. to top of jamb. Weld clip angles to bottom of jambs and provide holes for expansion bolts.

4. Where anchored to concrete or masonry in prepared openings, drill holes at jambs for anchoring with expansion bolts. Weld clip angles to bottom of frame and provide holes for expansion bolt anchors as shown. Drill holes starting 600 mm (24 inches) above bottom of frame and 600 mm (24 inches) o.c. to top of jamb and at top of jamb. Provide pipe spacers at holes welded to channel.
5. Where closure plates are shown, continuously weld them to the channel flanges.
6. Weld continuous 19 x 19 x 3 mm (3/4 x 3/4 x 1/8 inch) thick steel angles to the interior side of each channel leg at the head and jambs to form a caulking groove.
7. Prepare frame for installation of hardware specified in Section 08 71 00, DOOR HARDWARE.
   a. Cut a slot in the lock jamb to receive the lock bolt.
   b. Where shown use continuous solid steel bar stops at perimeter of frame, weld or secure with countersunk machine screws at not more than 450 mm (18 inches) on center.

C. Frames for Breech Opening:
1. Fabricate from steel channels, or combination of steel plates and angles to size and contour shown.
2. Weld strap anchors on back of frame at not over 600 mm (2 feet) on centers for concrete or masonry openings.

2.7 GUARDS

A. Edge Guard Angles for Openings in slabs.
1. Fabricate from steel angles of sizes and with anchorage shown.
2. Where size of angle is not shown, provide 50 x 50 x 6 mm (2 x 2 x 1/4 inch) steel angle with 32 x 5 mm (1-1/4 x 3/16 inch) strap anchors, welded to back.
3. Miter or butt angles at corners and weld.
4. Use one anchor near end and three feet on centers between end anchors.

B. Wheel Guards:
1. Construct wheel guards of not less than 16 mm (5/8 inch) thick cast iron.
2. Provide corner type, with flanges for bolting to walls.

2.8 COVERS AND FRAMES FOR PITS AND TRENCHES

A. Fabricate covers to support live loads specified.

B. Galvanized steel members after fabrication in accordance with ASTM A123, G-90 coating.

C. Steel Covers:

1. Use 6 mm (1/4 inch) thick floor plate for covers unless otherwise shown. Use gratings where shown as specified in paragraph GRATINGS. Use smooth floor plate unless noted otherwise.
2. Provide clearance at all sides to permit easy removal of covers.
3. Make cutouts within 6 mm (1/4 inch) of penetration for passage of pipes and ducts.
4. Drill covers for flat head countersunk screws.
5. Make cover sections not to exceed 2.3 m^2 (25 square feet) in area and 90 kg (200 pounds) in weight.
6. Fabricate trench cover sections not be over 900 mm (3 feet) long and if width of trench is more than 900 mm (3 feet)or over, equip one end of each section with an angle or "T" bar stiffener to support adjoining plate.
7. Use two, 13 mm (1/2 inch) diameter steel bar flush drop handles for each cover section.

D. Cast Iron Covers

1. Fabricate covers to support live loads specified.
2. Fabricate from ASTM A48, cast-iron, 13 mm (1/2 inch) minimum metal thickness, cast with stiffeners as required.
3. Fabricate as flush type with frame, reasonably watertight and be equipped with flush type lifting rings. Provide seals where watertight covers noted.
4. Make covers in sections not over 90 kg (200 pounds) except round covers.

E. Steel Frames:

1. Form frame from structural steel angles as shown. Where not shown use 63 x 63 x 6 mm (2-1/2 x 2-1/2 x 1/4 inch) angles for frame openings over 1200 mm (4 feet) long and 50 x 50 x 6 mm (2 ix 2 x 1/4 inch) for frame openings less than 1200 mm (4 feet).
2. Fabricate intermediate supporting members from steel "T's" or angles; located to support cover section edges.
3. Where covers are required use steel border bars at frames so that top of cover will be flush with frame and finish floor.

4. Weld steel strap anchors to frame. Space straps not over 600 mm (24 inches) o.c., not shown otherwise between end anchors. Use 6 x 25 x 200 mm (1/4 x 1 x 8 inches) with 50 mm (2 inch) bent ends strap anchors unless shown otherwise.
5. Drill and tap frames for screw anchors where plate covers occur.

F. Cast Iron Frames:
1. Fabricate from ASTM A48 cast iron to shape shown.
2. Provide anchors for embedding in concrete, spaced near ends and not over 600 mm (24 inches) apart.

2.9 GRATINGS

A. Fabricate gratings to support live loads specified and a concentrated load as specified.
B. Provide clearance at all sides to permit easy removal of grating.
C. Make cutouts in gratings with 6 mm (1/4 inch) minimum to 25 mm (one inch) maximum clearance for penetrations or passage of pipes and ducts. Edge band cutouts.
D. Fabricate in sections not to exceed 2.3 m^2 (25 square feet) in area and 90 kg (200 pounds) in weight.
E. Fabricate sections of grating with end-banding bars.
F. Fabricate angle frames and supports, including anchorage as shown.
1. Fabricate intermediate supporting members from "T's" or angles.
2. Locate intermediate supports to support grating section edges.
3. Fabricate frame to finish flush with top of grating.
4. Locate anchors at ends and not over 600 mm (24 inches) o.c.
5. Butt or miter, and weld angle frame at corners.

2.10 LOOSE LINTELS

A. Furnish lintels of sizes shown. Where size of lintels is not shown, provide the sizes specified.
B. Fabricate lintels with not less than 150 mm (6 inch) bearing at each end for nonbearing masonry walls, and 200 mm (8 inch) bearing at each end for bearing walls.
C. Provide one angle lintel for each 100 mm (4 inches) of masonry thickness as follows except as otherwise specified or shown.

1. Openings 750 mm to 1800 mm (2-1/2 feet to 6 feet) - 100 x 90 x 8 mm (4 x 3-1/2 x 5/16 inch).
2. Openings 1800 mm to 3000 mm (6 feet to 10 feet) - 150 x 90 x 9 mm (6 x 3-1/2 x 3/8 inch).

D. For 150 mm (6 inch) thick masonry openings 750 mm to 3000 mm (2-1/2 feet to 10 feet) use one angle 150 x 90 x 9 mm (6 x 3-1/2 x 3/8 inch).

E. Provide bearing plates for lintels where shown.

F. Weld or bolt upstanding legs of double angle lintels together with 19 mm (3/4 inch bolts) spaced at 300 mm (12 inches) on centers.

G. Insert spreaders at bolt points to separate the angles for insertion of metal windows, louver, and other anchorage.

H. Where shown or specified, punch upstanding legs of single lintels to suit size and spacing of anchor bolts.

2.11 SHELF ANGLES

A. Fabricate from steel angles of size shown.

B. Fabricate angles with horizontal slotted holes for 19 mm (3/4 inch) bolts spaced at not over 900 mm (3 feet) on centers and within 300 mm (12 inches) of ends.

C. Provide adjustable malleable iron inserts for embedded in concrete framing.

2.12 PLATE DOOR SILL

A. Fabricate of checkered plate as detailed.
1. Aluminum Plate: ASTM B632, 3 mm (0.125 inch) thick.
2. Steel Plate: ASTM A786, 3 mm (0.125 inch thick), galvanized G90.

B. Fabricate for anchorage with flat head countersunk bolts at each end and not over 300 mm (12 inches), o.c.

2.13 SAFETY NOSINGS

A. Fed. Spec. RR-T-650, Type C.
1. Aluminum: Class 2, Style 2.
2. Cast iron: Class 4.

B. Fabricate nosings for exterior use from cast aluminum, and nosings for interior use from either cast aluminum or cast iron. Use one Class throughout.

C. Fabricate nosings approximately 100 mm (4 inches) wide with not more than 9 mm (3/8 inch) nose.

D. Provide nosings with integral type anchors spaced not more than 100 mm (4 inches) from each end and intermediate anchors spaced approximately 375 mm (15 inches) on center.
E. Fabricate nosings to extend within 100 mm (4 inches) of ends of concrete stair treads except where shown to extend full width.
F. Fabricate nosings to extend full width between stringers of metal stairs and full width of door openings.
G. On curved steps fabricate to terminate at point of curvature of steps having short radius curved ends.

2.14 LADDERS – NOT USED

2.15 RAILINGS – NOT USED

2.16 CATWALKS – NOT USED

2.17 TRAP DOOR AND FRAMES WITH CEILING HATCH – NOT USED

2.18 SIDEWALK DOOR – NOT USED

2.19 SCREENED ACCESS DOORS AND FRAMES – NOT USED

2.20 STEEL COUNTER OR BENCH TOP FRAME AND LEGS – NOT USED

2.21 STEEL PIPE BOLLARD

Provide bollard in accordance with ASTM A53 with dimensions as shown in standard detail SD320523-04. Anchor posts in concrete and fill solidly with concrete with a minimum compressive strength of 17 MPa 2500psi.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set work accurately, in alignment and where shown, plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
B. Items set into concrete or masonry.
   1. Provide temporary bracing for such items until concrete or masonry is set.
   2. Place in accordance with setting drawings and instructions.
   3. Build strap anchors, into masonry as work progresses.

C. Set frames of gratings, covers, corner guards, trap doors and similar items flush with finish floor or wall surface and, where applicable, flush with side of opening.

D. Field weld in accordance with AWS.

1. Design and finish as specified for shop welding.
2. Use continuous weld unless specified otherwise.

E. Install anchoring devices and fasteners as shown and as necessary for securing metal fabrications to building construction as specified. Power actuated drive pins may be used except for removable items and where members would be deformed or substrate damaged by their use.

F. Spot prime all abraded and damaged areas of zinc coating as specified and all abraded and damaged areas of shop prime coat with same kind of paint used for shop priming.

G. Isolate aluminum from dissimilar metals and from contact with concrete and masonry materials as required to prevent electrolysis and corrosion.

H. Secure escutcheon plate with set screw.

3.2 INSTALLATION OF SUPPORTS

A. Supports for Wall Mounted items:

1. Locate center of support at anchorage point of supported item.
2. Locate support at top and bottom of wall hung cabinets.
3. Locate support at top of floor cabinets and shelving installed against walls.
4. Locate supports where required for items shown.

3.3 COVERS AND FRAMES FOR PITS AND TRENCHES

A. Set frame and cover flush with finish floor.

B. Secure plates to frame with flat head countersunk screws.

C. Set gratings loose in drainage trenches or over pits unless shown anchored.

3.4 FRAMES FOR LEAD LINED DOORS – NOT USED

3.5 DOOR FRAMES

A. Secure clip angles at bottom of frames to concrete slab with expansion bolts as shown.

B. Level and plumb frame; brace in position required.

C. At masonry, set frames in walls so anchors are built-in as the work progresses unless shown otherwise.

D. Set frames in formwork for frames cast into concrete.

E. Where frames are set in prepared openings, bolt to wall with spacers and expansion bolts.

3.6 OTHER FRAMES

A. Set frame flush with surface unless shown otherwise.

B. Anchor frames at ends and not over 450 mm (18 inches) on centers unless shown otherwise.

C. Set in formwork before concrete is placed.

3.7 GUARDS

A. Channel Guard at Top Edge of Concrete Platforms:

1. Install in formwork before concrete is placed.
2. Set channel flush with top of the platform.

B. Wheel Guards:

1. Set flanges of wheel guard at least 50 mm (2 inches) into pavement.
2. Anchor to walls as shown, expansion bolt if not shown.

3.8 GRATINGS

A. Set grating flush with finish floor; top of curb, or areaway wall. Set frame so that horizontal leg of angle frame is flush with face of wall except when frame is installed on face of wall.

B. Set frame in formwork before concrete is placed.

C. Where grating terminates at a wall bolt frame to concrete or masonry with expansion bolts unless shown otherwise.

D. Secure removable supporting members in place with stainless steel bolts.

E. Bolt gratings to supports.

3.9 STEEL LINTELS

A. Use lintel sizes and combinations shown or specified.

B. Install lintels with longest leg upstanding, except for openings in 150 mm (6 inch) masonry walls install lintels with longest leg horizontal.

C. Install lintels to have not less than 150 mm (6 inch) bearing at each end for nonbearing walls, and 200 mm (8 inch) bearing at each end for bearing walls.

3.10 SHELF ANGLES

A. Anchor shelf angles with 19 mm (3/4 inch) bolts unless shown otherwise in adjustable malleable iron inserts, set level at elevation shown.

B. Provide expansion space at end of members.

3.11 PLATE DOOR SILL

A. Install after roofing base flashing and counter flashing work is completed.

B. Set in sealant and bolt to curb.

3.12 SAFETY NOSINGS

A. Except as specified and where preformed rubber treads are shown or specified install safety nosings at the following:
   1. Exterior concrete steps.
   2. Door sills of areaway entrances curbs.
   3. Exposed edges of curbs of door sills at transformer and service rooms.
   4. Interior concrete steps, including concrete filled treads of metal stairs of service stairs.

B. Install flush with horizontal and vertical surfaces.

C. Install nosing to within 100 mm (4 inches) of ends of concrete stair treads, except where shown to extend full width.

D. Extend nosings full width of door openings.

E. Extend nosings, full width between stringers of metal stairs, and terminate at point of curvature of steps having short radius curved ends.

3.13 LADDERS – NOT USED

3.14 RAILINGS – NOT USED

3.15 CATWALK AND PLATFORMS – NOT USED

3.16 SIDEWALK DOOR, TRAP DOORS, AND FRAMES – NOT USED

3.17 SCREENED ACCESS DOOR – NOT USED

3.18 STEEL COMPONENTS FOR MILLWORK ITEMS

Coordinate and deliver to Millwork fabricator for assembly where millwork items are secured to metal fabrications.

3.19 INSTALLATION OF STEEL PIPE BOLLARD

Set bollards vertically in concrete piers. Compressive strength of concrete piers shall be 21MPa 3000psi. For dimensions of concrete piers See standard detail SD320523-04.

3.20 CLEAN AND ADJUSTING

A. Adjust movable parts including hardware to operate as designed without binding or deformation of the members centered in the opening or frame and, where applicable, contact surfaces fit tight and even without forcing or warping the components.

B. Clean after installation exposed prefinished and plated items and items fabricated from stainless steel, aluminum and copper alloys, as

recommended by the metal manufacture and protected from damage until completion of the project.

- - - E N D - - -

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies wood blocking, framing, sheathing, furring, nailers, sub-flooring, rough hardware, and light wood construction.

1.2 RELATED WORK:

A. Milled woodwork: Section 06 20 00, FINISH CARPENTRY.

B. Gypsum sheathing: Section 09 29 00, GYPSUM BOARD.

C. Cement board sheathing: Section 06 16 63, CEMENTITIOUS SHEATHING.

1.3 SUBMITTALS:

A. Submit in accordance with Section 01 30 00, ADMINISTRATIVE REQUIREMENTS.

B. Shop Drawings showing framing connection details, fasteners, connections and dimensions.

C. Manufacturer’s Literature and Data:

1. Submit data for lumber, panels, hardware and adhesives.
2. Submit data for wood-preservative treatment from chemical treatment manufacturer and certification from treating plants that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
3. Submit 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.
4. For products receiving a waterborne treatment, submit statement that moisture content of treated materials was reduced to levels specified before shipment to project site.

D. Manufacturer’s certificate for unmarked lumber.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Protect lumber and other products from dampness both during and after delivery at site.

B. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.

C. Stack plywood and other board products so as to prevent warping.

D. Locate stacks on well drained areas, supported at least 152 mm (6 inches) above grade and cover with well-ventilated sheds having firmly constructed over hanging roof with sufficient end wall to protect lumber from driving rain.

1.5 QUALITY ASSURANCE:

A. Installer: A firm with a minimum of three (3) years' experience in the type of work required by this section.

1.6 GRADING AND MARKINGS:

A. Any unmarked lumber or plywood panel for its grade and species will not be allowed on VA Construction sites for lumber and material not normally grade marked, provide manufacturer's certificates (approved by an American Lumber Standards approved agency) attesting that lumber and material meet the specified the specified requirements.

1.7 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.

B. American Forest and Paper Association (AFPA):

NDS-15.....National Design Specification for Wood Construction

WCD1-01.....Details for Conventional Wood Frame Construction

C. American Institute of Timber Construction (AITC):

A190.1-07.....Structural Glued Laminated Timber

D. American Society of Mechanical Engineers (ASME):

B18.2.1-12(R2013).....Square and Hex Bolts and Screws

B18.2.2-10.....Square and Hex Nuts

B18.6.1-81(R2008).....Wood Screws

E. American Plywood Association (APA):

E30-11.....Engineered Wood Construction Guide

F. ASTM International (ASTM):

A653/A653M-13.....Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process

C954-11.....Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.033 inch (2.24 mm) to 0.112-inch (2.84 mm) in thickness

C1002-14.....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Metal Studs

D198-14.....Test Methods of Static Tests of Lumber in Structural Sizes

D2344/D2344M-13.....Test Method for Short-Beam Strength of Polymer Matrix Composite Materials and Their Laminates

D2559-12a.....Adhesives for Structural Laminated Wood Products for Use Under Exterior (Wet Use) Exposure Conditions

D3498-03(R2011).....Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems

D6108-13.....Test Method for Compressive Properties of Plastic Lumber and Shapes

D6109-13.....Test Methods for Flexural Properties of Unreinforced and Reinforced Plastic Lumber and Related Products

D6111-13a.....Test Method for Bulk Density and Specific Gravity of Plastic Lumber and Shapes by Displacement

D6112-13.....Test Methods for Compressive and Flexural Creep and Creep-Rupture of Plastic Lumber and Shapes

F844-07a(R2013).....Washers, Steel, Plan (Flat) Unhardened for General Use

F1667-13.....Nails, Spikes, and Staples

G. American Wood Protection Association (AWPA):

AWPA Book of Standards

H. Commercial Item Description (CID):

A-A-55615.....Shield, Expansion (Wood Screw and Lag Bolt Self Threading Anchors)

I. Forest Stewardship Council (FSC):

FSC-STD-01-001(Ver. 4-0)FSC Principles and Criteria for Forest Stewardship

J. Military Specification (Mil. Spec.):

MIL-L-19140E.....Lumber and Plywood, Fire-Retardant Treated

K. Environmental Protection Agency (EPA):

40 CFR 59(2014).....National Volatile Organic Compound Emission Standards for Consumer and Commercial Products

L. Truss Plate Institute (TPI):

TPI-85.....Metal Plate Connected Wood Trusses

M. U.S. Department of Commerce Product Standard (PS)

PS 1-95.....Construction and Industrial Plywood

PS 20-10.....American Softwood Lumber Standard

N. ICC Evaluation Service (ICC ES):

AC09.....Quality Control of Wood Shakes and Shingles

AC174.....Deck Board Span Ratings and Guardrail Systems (Guards and Handrails)

PART 2 - PRODUCTS

2.1 LUMBER:

A. Unless otherwise specified, each piece of lumber must bear grade mark, stamp, or other identifying marks indicating grades of material, and rules or standards under which produced.

1. Identifying marks are to be in accordance with rule or standard under which material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.
2. Inspection agency for lumber approved by the Board of Review, American Lumber Standards Committee, to grade species used.

B. Structural Members: Species and grade as listed in the AFPA NDS having design stresses as shown.

C. Lumber Other Than Structural:

1. Unless otherwise specified, species graded under the grading rules of an inspection agency approved by Board of Review, American Lumber Standards Committee.
2. Framing lumber: Minimum extreme fiber stress in bending of 7584 kPa (1100 PSI).
3. Furring, blocking, nailers and similar items 101 mm (4 inches) and narrower Standard Grade; and, members 152 mm (6 inches) and wider, Number 2 Grade.
4. Board Sub-flooring: Shiplap edge, 25 mm (1 inch) thick, not less than 203 mm (8 inches) wide.

D. Sizes:

1. Conforming to PS 20.

2. Size references are nominal sizes, unless otherwise specified, actual sizes within manufacturing tolerances allowed by standard under which produced.

E. Moisture Content:

1. Maximum moisture content of wood products is to be as follows at the time of delivery to site.
   a. Boards and lumber 50 mm (2 inches) and less in thickness: 19 percent or less.
   b. Lumber over 50 mm (2 inches) thick: 25 percent or less.

F. Fire Retardant Treatment:

1. Comply with Mil Spec. MIL-L-19140.
2. Treatment and performance inspection, by an independent and qualified testing agency that establishes performance ratings.

G. Preservative Treatment:

1. Do not treat Heart Redwood and Western Red Cedar.
2. Treat wood members and plywood exposed to weather or in contact with plaster, masonry or concrete, including framing of open roofed structures; sills, sole plates, furring, and sleepers that are less than 610 mm (24 inches) from ground; nailers, edge strips, blocking, crickets, curbs, cant, vent strips and other members provided in connection with roofing and flashing materials.
3. Treat other members specified as preservative treated (PT).
4. Preservative treat by the pressure method complying with AWPA Book use category system standards U1 and T1, except any process involving the use of Chromated Copper Arsenate (CCA) or other agents classified as carcinogenic for pressure treating wood is not permitted.

2.2 PLASTIC LUMBER: NOT USED

2.3 PLYWOOD:

A. Comply with PS 1.

B. Bear the mark of a recognized association or independent inspection agency that maintains continuing control over quality of plywood which identifies compliance by veneer grade, group number, span rating where applicable, and glue type.

C. Sheathing:

1. APA rated Exposure 1 or Exterior; panel grade CD or better.
2. Wall sheathing:

a. Minimum 9 mm (11/32 inch) thick with supports 406 mm (16 inches) on center and 12 mm (15/32 inch) thick with supports 610 mm (24 inches) on center unless specified otherwise.
b. Minimum 1200 mm (48 inches) wide at corners without corner bracing of framing.

3. Roof sheathing:
a. Minimum 9 mm (11/32 inch) thick with span rating 24/0 or 12 mm (15/32 inch) thick with span rating for supports 406 mm (16 inches) on center unless specified otherwise.
b. Minimum 15 mm (19/32 inch) thick or span rating of 40/20 or 18 mm (23/32 inch) thick or span rating of 48/24 for supports 610 mm (24 inches) on center.

D. Subflooring: - Not Used

2.4 STRUCTURAL-USE PANELS:

A. Comply with APA E30.
B. Bearing the mark of a recognized association or independent agency that maintains continuing control over quality of panel which identifies compliance by end use, Span Rating, and exposure durability classification.
C. Wall and Roof Sheathing:
1. APA Rated sheathing panels, durability classification of Exposure 1 or Exterior Span Rating of 16/0 or greater for supports 406 mm (16 inches) on center and 24/0 or greater for supports 610 mm (24 inches) on center.
D. Subflooring: - Not Used
E. Underlayment:
1. APA rated Exposure 1.
2. Minimum 6 mm (1/4 inch) thick or greater over subfloor.
F. Wood "I" Beam Members:
1. Size and Shape as indicated in contract documents.
2. Cambered and marked "TOP UP".
3. Plywood webs: PS-1, minimum 9 mm (3/8 inch) thick, unless shown otherwise.
4. Flanges: Kiln dried stress rated dense lumber minimum 38 mm (1-1/2 inch) thick, width as indicated on contract documents.
5. Plywood web fitted into flanges and joined with ASTM D2559 adhesive to form "I" beam section unless shown otherwise.
G. Laminated Veneer Lumber (LVL):

1. Bonded jointed wood veneers with ASTM D2559 adhesive.
2. Scarf jointed wood veneers with grain of wood parallel.
3. Size as indicated on contract documents.

2.5 ROUGH HARDWARE AND ADHESIVES:

A. Anchor Bolts:
1. ASME B18.2.1 and ASME B18.2.2 galvanized, 13 mm (1/2 inch) unless shown otherwise.
2. Extend at least 203 mm (8 inches) into masonry or concrete with ends bent 50 mm (2 inches).

B. Miscellaneous Bolts: Expansion Bolts: C1D A-A-55615; lag bolt, long enough to extend at least 65 mm (2-1/2 inches) into masonry or concrete. Provide 13 mm (1/2 inch) bolt unless shown otherwise.

C. Washers
1. ASTM F844.
2. Provide zinc or cadmium coated steel or cast iron for washers exposed to weather.

D. Screws:
1. Wood to Wood: ASME B18.6.1 or ASTM C1002.
2. Wood to Steel: ASTM C954, or ASTM C1002.

E. Nails:
1. Size and type best suited for purpose unless noted otherwise. Provide aluminum-alloy nails, plated nails, or zinc-coated nails, for nailing wood work exposed to weather and on roof blocking.
2. ASTM F1667:
   a. Common: Type I, Style 10.
   b. Concrete: Type I, Style 11.
   c. Barbed: Type I, Style 26.
   d. Underlayment: Type I, Style 25.
   e. Masonry: Type I, Style 27.
   f. Provide special nails designed for use with ties, strap anchors, framing connectors, joists hangers, and similar items. Nails not less than 32 mm (1-1/4 inches) long, 8d and deformed or annular ring shank.

F. Framing and Timber Connectors:
1. Fabricate of ASTM A653/A653M, Grade A; steel sheet not less than 1.3 mm (0.052 inch) thick unless specified otherwise. Apply standard

plating to steel timber connectors after punching, forming and assembly of parts.

2. Framing Angles: Angle designed with bendable legs to provide three (3) way anchors.
3. Straps:
   a. Designed to provide wind and seismic ties with sizes as shown or specified.
   b. Strap ties not less than 32 mm (1-1/4 inches) wide.
   c. Punched for fastener.
4. Metal Bridging: - Not Used
5. Joist Hangers:
   a. Fabricated of 1.6 mm (0.063 inch) minimum thick sheet, U design unless shown otherwise.
   b. Heavy duty hangers fabricated of minimum 2.7 mm (0.108 inch) thick sheet, U design with bent top flange to lap over beam.
6. Timber Connectors: Fabricated of steel to mastch existing or as indicated on contract drawings.
7. Joist Ties: Mild steel flats, 5 mm by 32 mm (3/16 inch by 1-1/4 inch) size with ends bent about 30 degrees from horizontal, and extending at least 406 mm (16 inches) onto framing. Punch each end for three (3) spikes.
8. Wall Anchors for Joists and Rafters:
   a. Mild steel strap, 5 mm by 32 mm (3/16 inch by 1-1/4 inch) with wall ends bent 50 mm (2 inches), or provide 9 mm by 130 mm (3/8 inch by 5 inch) pin through strap end built into masonry.
   b. Strap long enough to extend onto three joists or rafters, and punched for spiking at each bearing.
   c. Strap not less than 101 mm (4 inches) embedded end.
9. Joint Plates:
   a. Steel plate punched for nails.
   b. Steel plates formed with teeth or prongs for mechanically clamping plates to wood.
   c. Size for axial eccentricity, and fastener loads.

G. Adhesives:
1. For field-gluing plywood to lumber framing floor or roof systems: ASTM D3498.
2. For structural laminated Wood: ASTM D2559.

3. Adhesives to have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, (EPA Method 24).

PART 3 - EXECUTION

3.1 INSTALLATION OF FRAMING AND MISCELLANEOUS WOOD MEMBERS:

A. Conform to applicable requirements of the following:
   1. AFPA NDS for timber connectors.
   2. AITC A190.1 Timber Construction Manual for heavy timber construction.
   3. AFPA WCD1 for nailing and framing unless specified otherwise.
   4. APA for installation of plywood or structural use panels.
   5. TPI for metal plate connected wood trusses.

B. Fasteners:
   1. Nails.
      a. Nail in accordance with the Recommended Nailing Schedule as specified in AFPA WCD1 where detailed nailing requirements are not specified in nailing schedule. Select nail size and nail spacing sufficient to develop adequate strength for the connection without splitting the members.
      b. Use special nails with framing connectors.
      c. For sheathing and subflooring, select length of nails sufficient to extend 25 mm (1 inch) into supports.
      d. Use 8d or larger nails for nailing through 25 mm (1 inch) thick lumber and for toe nailing 50 mm (2 inch) thick lumber.
      e. Use 16d or larger nails for nailing through 50 mm (2 inch) thick lumber.
      f. Select the size and number of nails in accordance with the Nailing Schedule except for special nails with framing anchors.
      g. Nailing Schedule; Using Common Nails:
         1) Joist bearing on sill or girder, toe nail three (3) 8d nails or framing anchor.
         2) Bridging to joist, toe nail each end two (2) 8d nails.
         3) Ledger strip to beam or girder three (3) 16d nails under each joint.
         4) Subflooring or Sheathing:
            a) 152 mm (6 inch) wide or less to each joist face nail two (2) 8d nails.
            b) Subflooring, more than 152 mm (6 inches) wide, to each stud or joint, face nail three (3) 8d nails.

c) Plywood or structural use panel to each stud or joist face nail 8d, at supported edges 152 mm (6 inches) on center and at intermediate supports 254 mm (10 inches) on center. When gluing plywood to joint framing increase nail spacing to 305 mm (12 inches) at supported edges and 508 mm (20 inches) o.c. at intermediate supports.

5) Sole plate to joist or blocking, through sub floor face nail 20d nails, 406 mm (16 inches) on center.
6) Top plate to stud, end nail two (2) 16d nails.
7) Stud to sole plate, toe nail or framing anchor. Four (4) 8d nails.
8) Doubled studs, face nail 16d at 610 mm (24 inches) on center.
9) Built-up corner studs 16d at 610 mm (24 inches) (24 inches) on center.
10) Doubled top plates, face nails 16d at 406 mm (16 inches) on center.
11) Top plates, laps, and intersections, face nail two (2) 16d.
12) Continuous header, two pieces 16d at 406 mm (16 inches) on center along each edge.
13) Ceiling joists to plate, toenail three (3) 8d or framing anchor.
14) Continuous header to stud, four (4) 16d.
15) Ceiling joists, laps over partitions, face nail three (3) 16d or framing anchor.
16) Ceiling joists, to parallel rafters, face nail three (3) 16d.
17) Rafter to plate, toe nail three (3) 8d or framing anchor. Brace 25 mm (1 inch) thick board to each stud and plate, face nail three (3) 8d.
18) Built-up girders and beams 20d at 812 mm (32 inches) on center along each edge.

2. Bolts:
   a. Fit bolt heads and nuts bearing on wood with washers.
   b. Countersink bolt heads flush with the surface of nailers.
   c. Embed in concrete and solid masonry or provide expansion bolts. Special bolts or screws designed for anchor to solid masonry or concrete in drilled holes may be used.
   d. Provide toggle bolts to hollow masonry or sheet metal.

e. Provide bolts to steel over 2.84 mm (0.112 inch, 11 gage) in thickness. Secure wood nailers to vertical structural steel members with bolts, placed one at ends of nailer and 610 mm (24 inch) intervals between end bolts. Provide clips to beam flanges.

3. Drill Screws to steel less than 2.84 mm (0.112 inch) thick.
   a. ASTM C1002 for steel less than 0.84 mm (0.033 inch) thick.
   b. ASTM C954 for steel over 0.84 mm (0.033 inch) thick.
4. Power actuated drive pins may be provided where practical to anchor to solid masonry, concrete, or steel.
5. Do not anchor to wood plugs or nailing blocks in masonry or concrete. Provide metal plugs, inserts or similar fastening.
6. Screws to Join Wood:
   a. Where shown or option to nails.
   b. ASTM C1002, sized to provide not less than 25 mm (1 inch) penetration into anchorage member.
   c. Spaced same as nails.
7. Installation of Timber Connectors:
   a. Conform to applicable requirements of the AFPA NDS.
   b. Fit wood to connectors and drill holes for fasteners so wood is not split.

C. Set sills or plates level in full bed of mortar on masonry or concrete walls.
   1. Space anchor bolts 1219 mm (4 feet) on centers between ends and within 152 mm (6 inches) of end. Stagger bolts from side to side on plates over 178 mm (7 inches) in width.
   2. Provide shims of slate, tile or similar approved material to level wood members resting on concrete or masonry. Do not use wood shims or wedges.
   3. Closely fit, and set to required lines.

D. Cut notch, or bore in accordance with AFPA WCD1 passage of ducts wires, bolts, pipes, conduits and to accommodate other work. Repair or replace miscut, misfit or damaged work.

E. Blocking Nailers, and Furring:
   1. Install furring, blocking, nailers, and grounds where shown.
   2. Provide longest lengths practicable.
   3. Provide fire retardant treated wood blocking where shown at openings and where shown or specified.

4. Layers of Blocking or Plates:
   a. Stagger end joints between upper and lower pieces.
   b. Nail at ends and not over 610 mm (24 inches) between ends.
   c. Stagger nails from side to side of wood member over 127 mm (5 inches) in width.

F. Ceiling Framing:
1. Set with crown edge up.
2. Keep framing at least 50 mm (2 inches) away from chimneys.
3. Bear on not less than 101 mm (4 inches) on concrete and masonry, and 38 mm (1-1/2 inches) on wood and metal unless shown otherwise.
4. Support joist, trimmer joists, headers, and beams framing into carrying members at same relative levels on joist hangers unless shown otherwise.
5. Lap and spike wood joists together at bearing, or butt end-to-end with scab ties at joint and spike to plates. Scab tie lengths not less than 203 mm (8 inches) lap on joist ends. Install wood I beam joists as indicated in contract documents.
6. Frame openings with headers and trimmer joist. Double headers carrying more than two tail joists and trimmer joists supporting headers carrying more than one tail joist unless otherwise indicated in contract documents.
7. Drive nails through headers into joists using two (2) nails for 50 mm by 152 mm (2 inch by 6 inch); three (3) nails for 50 mm by 203 mm (2 inch by 8 inch) and four (4) nails for 50 mm by 254 mm (2 inch by 10 inch) and over in size.
8. Install nearest joist to double headers and spike joist to both header members before trimmer joist is installed and secured together.
9. Doubled joists under partitions parallel with floor joists.
10. Where joists run perpendicular to masonry or concrete, anchor every third joist to masonry or concrete with one (1) metal wall anchor. Securely spike anchors with three (3) nails to side of joist near its bottom.
11. Anchor joists running parallel with masonry or concrete walls to walls with steel flats spaced not over 1828 mm (6 feet) apart. Extend steel flats over at least three (3) joists and into masonry 101 mm (4 inches) with ends turned 50 mm (2 inches); bolt to

concrete. Set top of flats flush with top of joists, and securely nail steel flats to each joist.

12. Hook ties at steel framing over top flange of steel members.
13. Nonbearing partitions running parallel with ceiling joists, install solid 50 mm (2 inch) thick bridging same depth as ceiling joists cut to fit snug between joists for securing top plate of partitions. Securely spike bridging to joists. Space 1219 mm (4 feet) on center.

G. Bridging:
1. Provide 25 mm by 75 mm (1 inch by 3 inch) lumber with ends beveled for slope.
2. Install one (1) row of bridging for joist spans over 2438 mm (8 feet), but less than 4877 mm (16 feet) long; install two (2) rows for spans over 4877 mm (16 feet) long.
3. Install an extra row of bridging between trimmer and next two (2) joists if header is more than 610 mm (2 feet) from end of trimmer or from regular row of bridging.
4. Secure with two (2) nails at ends.
5. Leave bottom ends loose until after subflooring or roof sheathing is installed.
6. Install single row of bridging at centerline of span and two (2) rows at the third points of span unless otherwise shown.

H. Roof Framing:
1. Set rafters with crown edge up.
2. Form a true plane at tops of rafters.
3. Valley, Ridge, and Hip Members:
   a. Size for depth of cut on rafters.
   b. Straight and true intersections of roof planes.
   c. Secure hip and valley rafters to wall plates by using framing connectors.
   d. Double valley rafters longer than the available lumber, with pieces lapped not less than 1219 mm (4 feet) and spiked together.
   e. Butt joint and scab hip rafters longer than the available lumber.
4. Spike to wall plate and to ceiling joists except when secured with framing connectors.
5. Frame openings in roof with headers and trimmer rafters. Double headers carrying more than one (1) rafter unless shown otherwise.

6. Install 50 mm by 101 mm (2 inch by 4 inch) strut between roof rafters and ceiling joists at 1219 mm (4 feet) on center unless shown otherwise.

I. Framing of Dormers:
1. Frame as indicated in contract documents, with top edge of ridge beveled to pitch of roof header.
2. Set studs on doubled trimmer rafters.
3. Double studs at corners of dormers.
4. Double plate on studs and notch rafters over plate and bear at least 75 mm (3 inches) on plates.
5. Frame opening to receive window frame or louver frame.

J. Partition and Wall Framing:
1. Provide 50 mm by 101 mm (2 inch by 4 inch) studs spaced 406 mm (16 inches) on centers; unless otherwise indicated on contract documents.
2. Install double studs at openings and triple studs at corners.
3. Installation of sole plate:
   a. Anchor plates of walls or partitions resting on concrete floors in place with expansion bolts, one (1) near ends of piece and at intermediate intervals of not more than 1219 mm (4 feet) or with power actuated drive pins with threaded ends of suitable type and size, spaced 610 mm (2 feet) on center unless shown otherwise.
   b. Nail plates to wood framing through subfloor as specified in nailing schedule.
4. Headers or Lintels:
   a. Make headers for openings of two (2) pieces of 50 mm (2 inch) thick lumber of size shown with plywood filler to finish flush with face of studs or solid lumber of equivalent size.
   b. Support ends of headers on top of stud cut for height of opening. Spike cut stud to adjacent stud. Spike adjacent stud to header.
5. Provide double top plates, with members lapped at least 610 mm (2-feet) spiked together.
6. Install intermediate cut studs over headers and under sills to maintain uniformity of stud spacing.
7. Provide single sill plates at bottom of opening unless otherwise indicated in contract documents. Toe nail to end stud, face nail to intermediate studs.

8. Install 50 mm (2 inch) blocking for firestopping so that maximum dimension of any concealed space is not over 2438 mm (8 feet) in accordance with AFPA WCD1.
9. Install corner bracing when plywood or structured use panel sheathing is not used.
   a. Let corner bracing into exterior surfaces of studs at an angle of approximately 45 degrees, extended completely over walls plates, and secured at bearing with two (2) nails.
   b. Provide 25 mm by 101 mm (1 inch by 4 inch) corner bracing.

K. Rough Bucks:
1. Install rough wood bucks at opening in masonry or concrete where wood frames or trim occur.
2. Brace and maintain bucks plumb and true until masonry has been built around them or concrete cast in place.
3. Cut rough bucks from 50 mm (2 inch) thick stock, of same width as partitions in which they occur and of width shown in exterior walls.
4. Extend bucks full height of openings and across head of openings; fasten securely with anchors specified.

L. Subflooring: Not Used

M. Underlayment:
1. Where finish flooring of different thickness is used in adjoining areas, provide underlayment of thickness required to bring finish-flooring surfaces into same plane.
2. Apply to dry, level, securely nailed, clean, wood subfloor without any projections.
3. Plywood and particle underlayment are to be glue-nailed to subfloor.
4. Butt underlayment panels to a light contact with a 1 mm (1/32 inch) space between plywood or hardboard underlayment panels and walls, and approximately 9 mm (3/8 inch) between particleboard underlayment panels and walls.
5. Stagger underlayment panel end joints with respect to each other and offset joints with respect to joints in the subfloor at least 50 mm (2 inches).
6. After installation, avoid traffic on underlayment and damage to the finish surface.

N. Sheathing:
1. Provide plywood or structural-use panels for sheathing.

2. Lay panels with joints staggered, with edge and ends 3 mm (1/8 inch) apart and nailed over bearings as specified.
3. Set nails not less than 9 mm (3/8 inch) from edges.
4. Install 50 mm by 101 mm (2 inch by 4 inch) blocking spiked between joists, rafters and studs to support edge or end joints of panels.
5. Match and align sheathing which is an extension of work in place to existing.

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SECTION 06 16 63
CEMENTITIOUS SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cement board sheathing at exterior framed wall construction.

1.2 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this Section.
B. American National Standards Institute (ANSI):
   1. A118.9-10 - Cementitious Backer Units.
C. ASTM International (ASTM):
   1. C954-18 - Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
   2. C1002-18 - Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
   3. C1325-14 - Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units.

1.3 SUBMITTALS

A. Submittal Procedures: Section 01 30 00 ADMINISTRATIVE REQUIREMENTS.
B. Manufacturer's Literature and Data:
   1. Description of each product.
   2. Installation instructions.
   3. Warranty.
C. Samples:
   1. Cement Board: 200 mm by 200 mm (8 inches by 8 inches), minimum size.
   2. Fasteners: One of each type used.
D. Provide Sustainable Construction Requirements-Provide in accordance with other Division 1 sections.

1.4 DELIVERY AND STORAGE

A. Deliver products in manufacturer's original sealed packaging.
B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.
C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.5 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight facility.

B. Protect products from damage during handling and construction operations.

1.6 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

B. Manufacturer's Warranty: Warrant sheathing against material and manufacturing defects.

1. Warranty Period: 10 years.

PART 2 - PRODUCTS

2.1 PRODUCTS - GENERAL

A. Provide each product from one manufacturer.

2.2 SHEATHING

A. Cement Boards: Meeting ANSI A118.9 and ASTM C1325.

1. Thickness: 13 mm (1/2 inch).
2. Width: 1219 mm (48 inches), minimum.

2.3 ACCESSORIES

A. Steel Drill Screws: Corrosion-resistant, self-drilling.

1. ASTM C1002, Type S for fastening to framing less than 0.8 mm (33 mils) thick.
2. ASTM C954 for fastening to framing 0.8 mm (33 mils) thick and greater.

B. Joint Reinforcement: Alkali resistant tape as recommended by sheathing manufacturer.

C. Bonding Material: As recommended by sheathing manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

C. Verify framing is plumb and level.

D. Correct substrate deficiencies.

3.2 SHEATHING INSTALLATION

A. Install products according to manufacturer's instructions.

1. Secure units to framing members with screws spaced maximum 200 mm (8 inches) o.c. and not closer than 13 mm (1/2 inch) from edge of unit.
2. Install screw heads without penetrating cement board surface.
3. Install sheathing with 6 mm (1/4 inch) gap where sheathing abuts masonry or similar materials to prevent wicking of moisture.
4. Install sheathing with 10 mm (3/8 inch) gap where non-load-bearing construction abuts structural elements or building expansion joints.
5. Horizontal Installation: Abut ends of boards over centers of studs. Stagger end joints minimum one stud spacing for adjacent boards. Fasten boards at perimeter and within field of board to each stud.
6. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Fasten boards at perimeter and with fin field of board to each stud.
7. Apply bonding material to imbed tape and completely fill board joints, and gaps between each panel.

3.3 PROTECTION

A. Remove loose or spalling joint finish. Patch areas missing joint finish.
B. Replace broken or damaged boards.
C. Protect boards from moisture using temporary coverings until finishes are applied.

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SECTION 06 20 00
FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior millwork.

B. Items specified:

1. Seats and benches.
2. Wall Paneling.
3. Mounting Strips, Shelves, and Rods.

1.2 RELATED REQUIREMENTS

A. Adhesive, Paint, and Finish VOC Limits: Section 01 60 00PRODUCT REQUIREMENTS.

B. Woodwork Finish and Color: See SCHEDULE FOR FINISHES in drawings set.

C. Framing, furring and blocking: Section 06 10 00, ROUGH CARPENTRY.

D. Color and texture of finish: See SCHEDULE FOR FINISHES in drawings set.

E. Electrical light fixtures and duplex outlets: Division 26, ELECTRICAL.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. ASTM International:

A36/A36M-19.....Carbon Structural Steel.

A53/A53M-20.....Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.

A240/A240M-20.....Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

B26/B26M-18e1.....Aluminum-Alloy Sand Castings.

B221-14.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

E84-20.....Surface Burning Characteristics of Building Materials.

C. American Hardboard Association (AHA):

A135.4-12.....Basic Hardboard.

D. Architectural Woodwork Institute (AWI):

AWI-14.....Architectural Woodwork Standards, 2nd ed.

E. Builders Hardware Manufacturers Association (BHMA):

A156.9-15.....Cabinet Hardware.

A156.11-14.....Cabinet Locks.

A156.16-18.....Auxiliary Hardware.

F. Federal Specifications (Fed. Spec.):

A-A-1922A.....Shield Expansion (Calking Anchors, Single Lead).

A-A-1936A.....Adhesive, Contact, Neoprene Rubber.

FF-N-836E.....Nut: Square, Hexagon, Cap, Slotted, Castle, Knurled, Welding.

FF-S-111D(1).....Screw, Wood (Notice 1 inactive for new design).

MM-L-736C(1).....Lumber, Hardwood.

G. Hardwood Plywood and Veneer Association (HPVA):

HP1-16.....Hardwood and Decorative Plywood.

H. Military Specification (Mil. Spec):

MIL-L-19140E.....Lumber and Plywood, Fire-Retardant Treated.

I. National Particleboard Association (NPA):

A208.1-09.....Wood Particleboard.

J. National Electrical Manufacturers Association (NEMA):

LD 3-05.....High-Pressure Decorative Laminates.

K. U.S. Department of Commerce, Product Standard (PS):

PS1-07.....Construction and Industrial Plywood.

PS20-10.....American Softwood Lumber Standard.

1.4 PREINSTALLATION MEETINGS – NOT REQUIRED

1.5 SUBMITTALS

A. Submittal Procedures: Section 01 30 00 ADMINISTRATIVE REQUIREMENTS.

B. Submittal Drawings:

1. Show size, configuration, and fabrication and installation details.
2. Millwork items - Half full-size scale for sections and details 1: 50 (1/4 inch) for elevations and plans.

C. Manufacturer's Literature and Data:

1. Description of each product.
   a. Finish hardware.
   b. Sinks with fittings.
   c. Electrical components.
2. List of acceptable sealers for fire retardant materials.
3. Installation instructions.

D. Samples:

1. Plastic Laminate, Finished Plywood and Particleboard: 150 mm by 300 mm (6 by 12 inches) long, each type and color.

a. Submit quantity required to show full color and texture range.

2. Approved samples may be incorporated into work.

E. Certificates: Certify each product complies with specifications.

1. Fire retardant treatment of materials.

2. Moisture content of materials.

F. Qualifications: Substantiate qualifications comply with specifications.

1. Fabricator with project experience list.

2. Installer with project experience list.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications:

1. Regularly fabricates specified products.

2. Fabricated specified products with satisfactory service on five similar installations for minimum five years.

a. Project Experience List: Provide contact names and addresses for completed projects.

B. Installer Qualifications:

1. Regularly installs specified products.

2. Installed specified products with satisfactory service on five similar installations for minimum five years.

a. Project Experience List: Provide contact names and addresses for completed projects.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

D. Store products indoors in dry, weathertight conditioned facility.

E. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

A. Environment:

1. Product Temperature: Minimum 21 degrees C (70 degrees F) for minimum 48 hours before installation.

2. Work Area Ambient Conditions: HVAC systems are complete, operational, and maintaining facility design operating conditions continuously, beginning 48 hours before installation until Government occupancy.

3. Install products when building is permanently enclosed and when wet construction is completed, dried, and cured.
4. Do not install finish lumber or millwork in any room or space where wet process systems such as concrete, masonry, or plaster work is not complete and dry.

B. Field Measurements: Verify field conditions affecting fabrication and installation. Show field measurements on Submittal Drawings.
1. Coordinate field measurement and fabrication schedule to avoid delay.

1.9 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Design acoustical panel complying with specified performance: N/A

2.2 MATERIALS

A. Grading and Marking: Factory mark with grade stamp lumber and plywood of inspection agency approved by the Board of Review, American Lumber Standard Committee.

B. Lumber:
1. Sizes:
a. Lumber Size references, unless otherwise specified, are nominal sizes, and actual sizes within manufacturing tolerances allowed by the standard under which product is produced.
b. Millwork, standing and running trim, and rails: Actual size as shown or specified.
2. Hardwood: MM-L-736, species as specified for each item.
3. Softwood: PS-20, exposed to view appearance grades:
a. Use C select or D select, vertical grain for transparent finish including stain transparent finish.
b. Use Prime for painted or opaque finish.
4. Use edge grain Wood members exposed to weather.
5. Moisture Content:
a. 32 mm (1-1/4 inches) or less nominal thickness: 12 percent on 85 percent of the pieces and 15 percent on the remainder.
b. Other materials: According to standards under which the products are produced.
6. Fire Retardant Treatment: Mil. Spec. MIL-L-19140E.

a. Treatment and performance inspection by an independent and qualified testing agency that establishes performance ratings.
b. Each piece of treated material bear identification of the testing agency and indicate performance according to such rating of flame spread and smoke developed.
c. Treat wood for maximum flame spread of 25 and smoke developed of 25.
d. Fire Resistant Softwood Plywood:
1) Grade A, Exterior, plywood for treatment.
2) Surface Burning Characteristics: When tested according to ASTM E84.
a) Flame spread: 0 to 25.
b) Smoke developed: 100 maximum.
e. Fire Resistant Hardwood Plywood:
1) Core: Fire retardant treated softwood plywood.
2) Hardwood face and back veneers untreated.
3) Factory seal panel edges.

C. Plywood:
1. Softwood Plywood: DOC PS1.
a. Plywood, 13 mm (1/2 inch) and thicker; minimum five ply construction, except 32 mm (1-1/4 inch) thick plywood minimum seven ply.
b. Plastic Laminate Plywood Cores:
1) Exterior Type, and species group.
2) Veneer Grade: A-C.
c. Shelving Plywood:
1) Interior Type, any species group.
2) Veneer Grade: A-B or B-C.
d. Other: As specified for item.
2. Hardwood Plywood: HPVA: HP.1.
a. Species of Face Veneer: As shown or as specified with each particular item.
b. Grade:
1) Transparent Finish: Type II (interior) A grade veneer.
2) Paint Finish: Type II (interior) Sound Grade veneer.
c. Species and Cut: To match existing.

D. Particleboard: Not Used

E. Building Board (Hardboard):

1. ANSI/AHA A135.4, 6 mm (1/4 inch) thick unless specified otherwise.
2. Perforated hardboard (Pegboard): Type 1, Tempered perforated 6 mm (1/4 inch) diameter holes, on 25 mm (1 inch) centers each way, smooth surface one side.

F. Plastic Laminate: NEMA LD-3.
1. Exposed Laminate Surfaces including Countertops, and Sides of Cabinet Doors: Grade HGL.
2. Cabinet Interiors including Shelving: NEMA, CLS as a minimum, with the following:
   a. Plastic laminate clad plywood or particle board.
   b. Resin impregnated decorative paper thermally fused to particle board.
3. Plastic Laminate Covered Wood Tops Backing: Grade HGP.
4. Post-formed Surfaces: Grade HGP.

G. Stainless Steel: ASTM A240, Type 302 or 304.

H. Cast Aluminum: ASTM B26.

I. Extruded Aluminum: ASTM B221.

2.3 PRODUCTS - GENERAL

A. Basis of Design: See SCHEDULE FOR FINISHES in drawings set.

B. Provide each product from one manufacturer and from one production run.
   a. Paints and coatings.
   b. Composite wood and agrifiber.

C. Acoustical Panel: Fabric-covered glass fiber panel. N/A

2.4 FABRICATION

A. General:
1. AWI Custom Grade for interior millwork.
2. Finish woodwork, free from pitch pockets.
3. Trim, standard stock molding and members of same species, except where special profiles are shown.
4. Plywood, minimum 13 mm (1/2 inch), unless otherwise shown on Drawings or specified.
5. Edges of members in contact with concrete or masonry having a square corner caulking rebate.
6. Fabricate members less than 4 m (14 feet) in length from one piece of lumber, back channeled and molded as shown.

7. Fabricate interior trim and items of millwork to be painted from jointed, built-up, or laminated members, unless otherwise shown on Drawings or specified.
8. Plastic Laminate Work: Not Used

B. Seats and Benches: To match existing based on original design

C. Mounting Strips, Shelves and Rods:
1. Cut mounting strips from softwood stocks, 25 mm by 100 mm (1 by 4 inches), exposed edge slightly rounded.
2. Cut wood shelf from softwood 1-inch stock, of width shown, exposed edge slightly rounded.

D. Wood Handrails:
1. AWI Premium Grade.
2. Species: Maple or Birch.
3. Fabricate in one piece and one length when practical.
4. Fabricate curved sections for ends of rails to return to wall and where rails change slope or direction.
5. Joints are permitted only where rail changes direction or slope, or where necessary for field erection or shipping.
6. Scarf or dowel all joints to provide a smooth and rigid connection. Glue all joints.
7. Fit joints, to produce a hair-line crack.
8. Completely shop fabricated according to approved shop drawings.

2.5 ACCESSORIES

A. Hardware:
1. Rough Hardware:
   a. Provide rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electric-galvanizing process. Galvanized where specified.
   b. Fasteners:
      1) Bolts with Nuts: FF-N-836.
      2) Expansion Bolts: A-A-1922A.
      3) Screws: Fed. Spec. FF-S-111.
2. Finish Hardware:
   a. Cabinet Hardware: ANSI A156.9.
      1) Door/Drawer Pulls: B02011. Door in seismic zones: B03182.

2) Drawer Slides: B05051 for drawers over 150 mm (6 inches) deep, B05052 for drawers 75 mm to 150 mm (3 to 6 inches) deep, and B05053 for drawers less than 75 mm (3 inches) deep.
3) Sliding Door Tracks: B07063.
4) Adjustable Shelf Standards: B4061 with shelf rest B04083.
5) Concealed Hinges: B1601, minimum 110 degree opening.
6) Butt Hinges: B01361, for flush doors, B01381 for inset lipped doors, and B01521 for overlay doors.
7) Cabinet Door Catch: B0371 or B03172.
8) Vertical Slotted Shelf Standard: B04103 with shelf brackets B04113, sized for shelf depth.

b. Cabinet Locks: ANSI A156.11.
1) Drawers and Hinged Door: E07262.
2) Sliding Door: E07162.

c. Auxiliary Hardware: ANSI A156.16.
1) Shelf Bracket: B04041, japanned or enameled finish.
2) Combination Garment rod and Shelf Support: B04051 japanned or enamel finish.
3) Closet Bar: L03131 chrome finish of required length.

d. Rubber or Vinyl molding:
1) Rubber or vinyl standard stock and in longest lengths practicable.
2) Design for closures at joints with walls and adhesive anchorage.
3) Adhesive as recommended by molding manufacturer.

e. Primers: Manufacturer's standard primer for steel providing baked enamel finish.

B. Adhesive:
1. Interior Millwork: Unextended urea resin, unextended melamine resin, phenol resin, or resorcinol resin.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.
B. Protect existing construction and completed work from damage.
C. Remove existing to permit new installation.
1. Retain existing for reuse as noted.
2. Dispose of other removed materials.

D. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.

3.2 INSTALLATION

A. Installation:
   1. Prime millwork receiving transparent finish and back-paint concealed surfaces.
   2. Fasten trim with fine finishing nails, screws, or glue as required.
   3. Set nails for putty stopping. Provide washers under bolt heads where no other bearing plate occurs.
   4. Seal cut edges of fire retardant treated wood materials with a certified acceptable sealer.
   5. Coordinate with plumbing and electrical work for installation of fixtures and service connections in millwork items.
   6. Plumb and level items unless shown otherwise.
   7. Nail finish at each blocking, lookout, or other nailer and intermediate points; toggle or expansion bolt in place where nails are not suitable.
   8. Apply adhesive uniformly for full contact with substrate.

B. Seats and Benches:
   1. Construct to match existing.

C. Wall Paneling:
   1. Solid Hardwood Boards:
      a. Install furring strips, 25 by 75 mm (1 by 3 inch) at 400 mm (16 inch) centers horizontally between top and bottom strips. Fasten each stud with two screws.
      b. Install paneling laid vertically with end joints staggered between adjacent boards.
      c. Tightly butt joints and blind nail each board at each furring strip.
   2. Plywood Paneling:
      a. Install furring strips horizontally, 25 by 75 mm (1 by 3 inch) under end joints of plywood and 300 mm (16 inches) on center between end strips. Install cross furring strips centered vertically at side joints of plywood paneling less than 13 mm (1/2 inch) thick. Fasten each stud with two screws.
      b. Install panels with long edge vertically and end joints aligned where exposed to view.

c. Align V-grooves where end joints meet and maintain continuity of pattern.
d. Apply continuous bead of adhesive to each furring strip to securely bond panel according to adhesive manufacturer's specifications.
e. Nailing:
1) Nail in V-grooves to horizontal furring strips and at panel edges and within 25 mm (1 inch) of ends except within 50 mm (2 inches) of end when panel end abutts other surfaces. Do not space nails in V-groves over 150 mm (6 inches), on center.
2) Nail ungrooved panels at 400 mm (16 inches) centers to horizontal furring strips between end or edge nails. Set nails and fill hole with filler to match wood panel.

3. Edge Trim and Base: Install solid wood as shown on Drawings, species same as wall paneling.

D. Shelves:
1. Install mounting strip at back wall and end wall for shelves in closets where shown secured with toggle bolts at each end, not over 600 mm (24 inch) centers between ends.
a. Nail Shelf to mounting strip at ends and to back wall strip at not over 900 mm (36 inches) on center.
b. Install metal bracket, ANSI A156.16, B04041, not over 1200 mm (4 feet) centers when shelves exceed 1800 mm (6 feet) in length.
c. Install metal bracket, ANSI A156.16, B04051, not over 1200 mm (4 feet) on centers where shelf length exceeds 1800 mm (6 feet) in length with metal rods, clothes hanger bars ANSI A156.16, L03131, of required length, full length of shelf.
2. Install vertical slotted shelf standards to studs with toggle bolts through each fastener opening. Double slotted shelf standards is acceptable where adjacent shelves terminate.
a. Install brackets providing supports for shelf not over 900 mm (36 inches) on center and within 13 mm (1/2 inch) of shelf end unless shown otherwise.
b. Install shelves on brackets so front edge is restrained by bracket.

E. Install with butt joints in straight runs and miter at corners.

3.3 CLEANING

A. Remove excess adhesive before adhesive sets.

B. Clean exposed surfaces. Remove contaminants and stains.

C. Touch up damaged factory finishes.

1. Repair painted surfaces with touch up primer.

3.4 PROTECTION

A. Protect finish carpentry from traffic and construction operations.

B. Cover finish carpentry with reinforced kraft paper, and plywood or hardboard.

C. Remove protective materials immediately before acceptance.

D. Repair damage.

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SECTION 06 40 23

INTERIOR ARCHITECTURAL WOODWORK

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. This Section includes the following:

1. Interior standing and running trim.
2. Interior frames and jambs.
3. Flush wood paneling.
4. Interior ornamental work.
5. Solid-surfacing-material countertops.
6. Shop finishing of interior woodwork.

B. Related Sections include the following:

1. Division 06 Section "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.

2. Division 06 Section "Finish Carpentry" for interior carpentry exposed to view that is not specified in this Section.

3. Division 06 Section "Wood Paneling."

1.3 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, **including cabinet hardware and accessories, and finishing materials and processes.**

B. Product Data: For **solid-surfacing material, fire-retardant-treated materials and finishing materials and processes.**

1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for all items installed in architectural woodwork.

4. Apply WI-certified compliance label to first page of Shop Drawings.

D. Samples for Initial Selection:

1. Shop-applied transparent finishes.
2. Solid-surfacing materials.

E. Samples for Verification:

1. Lumber with or for transparent finish, not less than **5 inches (125 mm) wide by 24 inches (600 mm) long**, for each species and cut, finished on 1 side and 1 edge.
2. Lumber and panel products with shop-applied opaque finish, 50 sq. in. (300 sq. cm) for lumber and 8 by 10 inches (200 by 250 mm) for panels, for each finish system and color, with **1/2 of** exposed surface finished.
3. Solid-surfacing materials, 6 inches (150 mm) square.

F. LEED Submittals:

1. Credit EQ 4.1: Manufacturers' product data for installation adhesives, including printed statement of VOC content.

2. Credit EQ 4.4:

a. Composite wood manufacturer's product data for each composite wood product used indicating that the bonding agent contains no urea formaldehyde.
b. Adhesive manufacturer's product data for each adhesive used indicating that the adhesive contains no urea formaldehyde.

3. Credit(s) MR 4.1[**and MR 4.2**]: Product Data indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content.

a. Include statement indicating costs for each product having recycled content.

4. Credit MR 7: Certificates of chain-of-custody signed by manufacturers certifying that products specified to be made from certified wood were made from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and

5. Criteria." Include evidence that mill is certified for chain-of-custody by an FSC-accredited certification body.

G. Product Certificates: For each type of product, signed by product manufacturer.

H. Woodwork Quality Standard Compliance Certificates: [**AWI Quality Certification Program certificates**] [**WI-certified compliance certificates**].

I. Qualification Data: For **Installer** and **fabricator**

1.5 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 AWI's Quality Certification Program and/or Shop is a licensee of WI's Certified Compliance Program.**

B. Installer Qualifications: **Fabricator of products**, **Certified participant in AWI's Quality Certification Program** and/or **Licensee of WI's Certified Compliance Program.**

C. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork. .

D. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. Provide AWI Quality Certification Program **labels and certificates** indicating that woodwork, **including installation**, complies with requirements of grades specified.

E. Quality Standard: Unless otherwise indicated, comply with WI's "Manual of Millwork" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. Provide WI-certified compliance **labels and certificates** 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 such selections and requirements in addition to the quality standard.

F. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and

inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdic

G. tion, imprint on surfaces of materials that will be concealed from view after installation.

H. Forest Certification: Provide interior architectural woodwork produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria."

I. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

J. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork 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. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between [**25 and 55**] [**43 and 70**] [**17 and 50**] <**Insert humidity range**> percent during the remainder of the construction period.

C. Field Measurements: Where woodwork is 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 woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

B. Hardware Coordination: Distribute copies of approved hardware schedule specified in Division 08 Section "Door Hardware (Scheduled by Describing Products)" to fabricator of architectural woodwork; coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.1 WOODWORK FABRICATORS

A. Available Fabricators: Subject to compliance with requirements, fabricators offering interior architectural woodwork that may be incorporated into the Work include, but are not limited to, the following:

B. Fabricators: Subject to compliance with requirements, provide interior architectural woodwork by one of the following:

2.2 MATERIALS

A. General: Provide materials that comply with requirements of **AWI's** or **WI's** quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Species and Cut for Transparent Finish: to match existing wood species, grain and finish.

C. Wood Species for Opaque Finish: Match existing.

D. Wood Products: Comply with the following:

1. Hardboard: AHA A135.4.

2. Medium-Density Fiberboard: ANSI A208.2, Grade MD, **made with binder containing no urea formaldehyde**.

3. Particleboard: ANSI A208.1, Grade [**M-2**] [**M-2-Exterior Glue**].

4. Particleboard: Straw-based particleboard complying with requirements in ANSI A208.1, Grade M-2, except for density.
5. Softwood Plywood: DOC PS 1[, **Medium Density Overlay**].

6. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, **made with adhesive containing no urea formaldehyde.**

E. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.

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. ABA Industries.
b. Avonite, Inc.
c. E. I. du Pont de Nemours and Company.
d. Formica Corporation.
e. LG Chemical, Ltd.
f. Meganite Inc.; a division of the Pyrochem Group.
g. Nevamar Company, LLC; Decorative Products Div.
h. Samsung; Cheil Industries Inc.
i. Swan Corporation (The).
j. Transolid, Inc.
k. Wilsonart International; Div. of Premark International, Inc.
l. Durasein (BASIS OF DESIGN: see Finish Schedule in Drawings.)

3. Type: Standard type.
4. Colors and Patterns: **As selected by Architect/Interior Designer from manufacturer's full range.**

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this Article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified.

1. Do not use treated materials that do not comply with requirements of referenced woodworking standard or that are warped, discolored, or otherwise defective.
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 untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of UL, U.S. Testing, Timber Products

Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Comply with performance requirements of AWPA C20 (lumber) and AWPA C27 (plywood). Use the following treatment type:

1. Exterior Type: Organic-resin-based formulation thermally set in wood by kiln drying.

2. Interior Type A: Low-hygroscopic formulation.
3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking plant certified by testing and inspecting agency.

4. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
5. Kiln-dry materials before and after treatment to levels required for untreated materials.

C. Fire-Retardant Particleboard: Panels complying with the following requirements, made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25

D. or less and smoke-developed index of 25 or less per ASTM E 84.

1. For panels 3/4 inch (19 mm) thick and less, comply with ANSI A208.1 for Grade M-2 except for the following minimum properties: modulus of rupture, 1600 psi (11 MPa); modulus of elasticity, 300,000 psi (2070 MPa); internal bond, 80 psi (550 kPa); and screw-holding capacity on face and edge, 250 and 225 lbf (1100 and 1000 N), respectively.
2. For panels 13/16 to 1-1/4 inches (20 to 32 mm) thick, comply with ANSI A208.1 for Grade M-1 except for the following minimum properties: modulus of rupture, 1300 psi (9 MPa); modulus of elasticity, 250,000 psi (1720 MPa); linear expansion, 0.50 percent; and screw-holding capacity on face and edge, 250 and 175 lbf (1100 and 780 N), respectively.
3. Product: Subject to compliance with requirements, provide "Duraflake FR" by Weyerhaeuser.

E. Fire-Retardant Fiberboard: Medium-density fiberboard panels complying with ANSI A208.2, 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 E 84.

1. Product: Subject to compliance with requirements, provide "Medite FR" by SierraPine Ltd.; Medite Div.

2.4 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 08 Section "Door Hardware (Scheduled by Describing Products)."

B. Butt Hinges: 2-3/4-inch (70-mm), 5-knuckle steel hinges made from 0.095-inch- (2.4-mm-) thick metal, and as follows:

1. Semiconcealed Hinges for Flush Doors: BHMA A156.9, B01361.
2. Semiconcealed Hinges for Overlay Doors: BHMA A156.9, B01521.

C. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, [**100**] [**135**] [**170**] degrees of opening[, **self-closing**].

D. Back-Mounted Pulls: BHMA A156.9, B02011.

E. Wire Pulls: Back mounted, solid [**metal**] [**plastic**], [**4 inches (100 mm) long, 5/16 inch (8 mm) in diameter**] [**5 inches (127 mm) long, 2-1/2 inches (63.5 mm) deep, and 5/16 inch (8 mm) in diameter**].

F. Catches: [**Magnetic catches, BHMA A156.9, B03141**] [**Push-in magnetic catches, BHMA A156.9, B03131**] [**Roller catches, BHMA A156.9, B03071**] [**Ball friction catches, BHMA A156.9, B03013**].

G. Door Locks: BHMA A156.11, E07121.

H. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Match Architect's sample.

I. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.5 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.

C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

D. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

E. VOC Limits for Installation Adhesives and Glues: Use installation adhesives 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. Contact Adhesive: 250 g/L.

2.6 FABRICATION, GENERAL

A. Interior Woodwork Grade: Match existing woodwork.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

D. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Edges of Solid-Wood (Lumber) Members 3/4 Inch (19 mm) Thick or Less: 1/16 inch (1.5 mm).

E. Complete fabrication, including **finishing**,, 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 indicated on Shop Drawings before disassembling for shipment.

F. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate ope

G. nings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

2.7 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. Grade: Match existing.

B. Wood Species and Cut: Match **species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building, unless otherwise indicated..**

1. Provide split species on trim that faces areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.

C. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.

2.8 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

A. Grade: Match existing.

B. Wood Species: Match existing.

C. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.

D. Assemble casings in plant except where limitations of access to place of installation require field assembly.

E. Assemble moldings in plant to maximum extent possible. Miter corners in plant and prepare for field assembly with bolted fittings designed to pull connections together.

2.9 INTERIOR FRAMES AND JAMBS FOR TRANSPARENT FINISH

A. Grade: Match existing.

B. Wood Species and Cut: **Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building, unless otherwise indicated.**

C. Fire-Rated Interior Frames and Jambs: Products fabricated from fire-retardant particleboard or fire-retardant medium-density fiberboard with veneered, exposed surfaces and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

1. Fire Rating: 20 minutes.

2.10 INTERIOR FRAMES AND JAMBS FOR OPAQUE FINISH

A. Grade: Match existing.

B. Wood Species: Match existing.

2.11 STAIRWORK NOT USED

2.12 FLUSH WOOD PANELING

A. Grade: Match existing.

B. Wood Species and Cut: Match existing.

1. Lumber Trim and Edges: At fabricator's option, trim and edges indicated as solid wood (except moldings) may be either lumber or veneered construction compatible with grain and color of veneered panels.

C. Panel-Matching Method: No matching between panels is required. Select and arrange panels for similarity of grain pattern and color between adjacent panels.

D. Fire-Retardant-Treated Paneling: Provide panels consisting of wood veneer and fire-retardant particleboard or fire-retardant medium-density fiberboard. Panels shall have flame-spread index of [**75**] [**25**] or less and smoke-developed index of 450 or less per ASTM E 84.

2.13 INTERIOR ORNAMENTAL WORK FOR TRANSPARENT FINISH

A. Interior ornamental work for transparent finish includes the following:

1. **Wall and window trim work**
2. **Wood tongue-in groove paneling**

B. Grade: Match existing.

C. Wood Species and Cut: **Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building, unless otherwise indicated.**

2.14 INTERIOR ORNAMENTAL WORK FOR OPAQUE FINISH

A. Interior ornamental work for opaque finish includes the following:

1. Wood tongue-in-groove paneling.

B. Grade: Match existing.

C. Wood Species: Match existing.

2.15 WOOD CABINETS FOR TRANSPARENT FINISH - NOT USED.

A.

2.16 WOOD CABINETS FOR OPAQUE FINISH - NOT USED.

2.17 PLASTIC-LAMINATE CABINETS - NOT USED.

2.18 WOOD COUNTERTOPS - NOT USED.

2.19 PLASTIC-LAMINATE COUNTERTOPS - NOT USED.

2.20 SOLID-SURFACING-MATERIAL COUNTERTOPS

A. Grade: Custom.

B. Solid-Surfacing-Material Thickness: **1/2 inch (13 mm)**.

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:

1. **As indicated by manufacturer's designations and as selected by Architect from manufacturer's full range. See Finish Schedule in drawings set.**

D. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

1. Fabricate tops with shop-applied edges of materials and configuration indicated.
2. Fabricate tops with **loose backsplashes for field application**.

E. Install integral sink bowls in countertops in shop.

F. Drill holes in countertops for plumbing fittings and soap dispensers in shop.

2.21 LAMINATED-PLASTIC LABORATORY TOPS - NOT USED.

2.22 CLOSET AND UTILITY SHELVING - NOT USED.

2.23 SHOP FINISHING

A. Grade: Provide finishes of same grades as items to be finished.

B. General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

C. General: Shop finish transparent-finished interior architectural woodwork at fabrication shop as specified in this Section. Refer to Division 09 painting Sections for finishing opaque-finished architectural woodwork.

D. General: Drawings indicate items that are required to be shop finished. Finish such items at fabrication shop as specified in this

Section. Refer to Division 09 painting Sections for finishing architectural woodwork not indicated to be shop finished.

E. Shop Priming: Shop apply the prime coat including backpriming, if any, for **transparent-finished** items specified to be field finished. Refer to Division 09 painting Sections for material and application requirements.

F. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.

1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces.

G. Transparent Finish:

1. Grade: **Premium.**

2. Staining: **Match approved sample for color.**

3. Wash Coat for Stained Finish: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
4. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.

5. Filled Finish for Open-Grain Woods: After staining (if any), apply paste wood filler to open-grain woods and wipe off excess. Tint filler to match stained wood.

a. Apply wash-coat sealer after staining and before filling.

6. Sheen: **Flat, 15-30** gloss units measured on 60-degree gloss meter per ASTM D 523.

H. Opaque Finish:

1. Grade: **Premium.**
2. WI Finish System 7a.: Synthetic enamel.

3. Color: **As selected by Architect from manufacturer's full range.**

4. Sheen: **Semigloss, 46-60** gloss units measured on 60-degree gloss meter per ASTM D 523.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition 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 backpriming.

3.2 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

F. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use **finishing screws** for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

G. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than **60 inches (1500 mm)**] long, except where shorter single-length pieces are necessary.

1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.
2. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches (3 mm in 2400 mm).

H. Paneling: Anchor paneling to supporting substrate to match existing method.

I. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
2. 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.

3. Secure backsplashes **to tops with concealed metal brackets at 16 inches (400 mm) o.c. and**]**to walls with adhesive.**
4. Caulk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."

J. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

K. Refer to Division 09 Sections for final finishing of installed architectural woodwork **not indicated to be shop finished.**

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective 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 woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

- - - END - - -

SECTION 07 01 50.19
PREPARATION FOR RE-ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Partial roof removal for new roof system installation.
   2. Roofing membrane and selective roofing system component removal for new roof membrane installation.
   3. Existing roofing membrane preparation for new roofing installation.

B. Existing Roofing System: Wood shakes. System components include:
   1. Roof insulation.
   2. Roofing membrane.
   3. Vapor retarder.

1.2 RELATED WORK

A. Section 06 10 00, ROUGH CARPENTRY: Replacement Roof Deck and Parapet Sheathing.

B. Section 07 60 00, FLASHING AND SHEET METAL: Sheet Metal Counterflashing.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American Society for Nondestructive Testing (ASNT):
   SNT-TC-1A (2019).....Personnel Qualification and Certification for Nondestructive Testing.

C. ASTM International (ASTM):
   C208-12(2017)e2.....Cellulosic Fiber Insulating Board.
   C578-19.....Rigid, Cellular Polystyrene Thermal Insulation.
   C1153-10(2015).....Location of Wet Insulation in Roofing Systems Using Infrared Imaging.

D. U.S. Department of Commerce National Institute of Standards and Technology (NIST):
   DOC PS 1-19.....Structural Plywood.
   DOC PS 2-18.....Performance Standard for Wood-Based Structural-Use Panels.

1.4 PREINSTALLATION MEETINGS

A. Conduct preinstallation meeting minimum 30 days before beginning Work of this section.

1. Required Participants:
   a. Contracting Officer's Representative.
   b. Architect/Engineer.
   c. Contractor.
   d. Installer.
   e. Manufacturer's field representative.
   f. Other installers responsible for adjacent and intersecting work, including mechanical and electrical equipment installers.
2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
   a. Removal and installation schedule.
   b. Removal and installation sequence.
   c. Preparatory work.
   d. Protection before, during, and after installation.
   e. Removal and installation.
   f. Temporary roofing including daily terminations.
   g. Transitions and connections to other work.
   h. Inspecting and testing.
   i. Other items affecting successful completion.
3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.5 SUBMITTALS

A. Submittal Procedures: Section 01 30 00 ADMINISTRATIVE REQUIREMENTS.

B. Submittal Drawings:
   1. Show size, configuration, and installation details.

C. Manufacturer's Literature and Data:
   1. Description of each product.
   2. Description of temporary roof system and components.
   3. List of patching materials.
   4. Temporary roofing installation instructions and removal instructions. Preparation instructions to receive new roofing.
   5. Existing roofing warrantor's instructions.

D. Photographs: Document existing conditions potentially affected by roofing operations before work begins.

E. Field Inspection Reports:
   1. Certify warrantor inspected completed roofing and existing warranty remains in effect.

F. Infrared Roof Moisture Survey Report.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Approved by existing roofing system warrantor when work affects existing roofing system under warranty.

1.7 FIELD CONDITIONS

A. Building Occupancy: Perform work to minimize disruption to normal building operations.
   1. Verify occupants are evacuated from affected building areas when working on structurally impaired roof decking above occupied areas.
   2. Provide notice minimum 72 hours before beginning activities affecting normal building operations.
B. Existing Roofing Available Information:
   1. The following are available for Contractor reference:
      a. Roof moisture survey.
      b. Construction drawings and project manual.
   2. Examine available information before beginning work of this section.
C. Weather Limitations: Proceed with reroofing preparation only during dry weather conditions as specified for new roofing installation.
   1. Remove only as much roofing in one day as can be made watertight in same day.
D. Hazardous materials are not expected in existing roofing system.
   1. Do not disturb suspected hazardous materials. When discovered, notify Contracting Officer's Representative.
   2. Hazardous materials discovered during execution of the work will be removed by Government as work of a separate contract.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."
B. Existing Warranties: Perform work to maintain existing roofing warranty in effect.
   1. Notify warrantor before beginning, and upon completion of reroofing.
   2. Obtain warrantor's instructions for maintaining existing warranty.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Patching Materials: Match existing roofing system materials.

B. Plywood Sheathing: See Section 06 10 00, ROUGH CARPENTRY.

C. Metal Flashing: See Section 07 60 00, FLASHING AND SHEET METAL.

D. Temporary Protection Materials:

1. Plywood: NIST DOC PS 1-19, Grade CD Exposure 1-18.
2. Oriented Strand Board (OSB): NIST DOC PS 2-18, Exposure 1.

E. Temporary Roofing System Materials: Contractor's option.

F. Fasteners: Type and size required by roof membrane manufacturer to resist wind uplift.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Infrared Roof Moisture Survey: Ground-based, walk-over type performed according to ASTM C1153-10(2015).

1. Record the entire survey on Flash Drive and provide one copy to Contracting Officer's Representative with report.
2. Mark out roof areas determined to be wet to indicate minimum areas to be removed.

3.2 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing roofing system indicated to remain.

1. Cover roof membrane with temporary protection materials without impeding drainage.
2. Limit traffic and material storage to protected areas.
3. Maintain temporary protection until replacement roofing is completed.

C. Protect existing construction and completed work from damage.

D. Protect landscaping from damage.

E. Maintain access to existing walkways and adjacent occupied facilities.

F. Ensure temporary protection materials are available for immediate use in case of unexpected rain.

G. Ensure roof drainage remains functional.

1. Keep drainage systems clear of debris.
2. Prevent water from entering building and existing roofing system.

H. Coordinate rooftop utilities remaining active during roofing work with Contacting Officer's Representative.

3.3 RE-ROOFING PREPARATION - GENERAL

A. Notify Contacting Officer's Representative of planned operations, daily.

1. Identify location and extent of roofing removal.
2. Request authorization to proceed.

3.4 OVERBURDEN REMOVAL

A. Remove insulation and drainage board from protected roofing membrane.
   1. Store insulation and drainage board for reuse.

3.5 COMPLETE ROOFING SYSTEM REMOVAL (NOT USED)

3.6 PARTIAL ROOFING SYSTEM REMOVAL

A. Remove existing roofing completely, exposing structural roof deck at locations and to extent indicated on drawings.
   1. Remove roof insulation, vapor retarder, and substrate board.
   2. Remove or cut-off roofing system fasteners.

3.7 ROOFING MEMBRANE AND SELECTIVE ROOFING SYSTEM COMPONENT REMOVAL

A. Remove existing roofing membrane, only, in locations and to extent indicated on drawings.
B. Visually inspect roof insulation, vapor retarder, and substrate board for moisture immediately after roof membrane removal.
   1. Coordinate with Contracting Officer's Representative to observe inspections.
   2. Identify wet roofing system components required to be removed.
   3. Mark roofing system removal locations and extents.
C. Remove wet roofing system components.
   1. Remove or cut-off roofing system fasteners when removals expose structural roof deck.
D. Patch selective roofing system removals immediately after inspection and repair.
E. Install patching materials to match existing roofing system.
F. Patch roofing membrane to maintain building watertight, unless new roofing membrane is installed same day as removal and repair.

3.8 DECK PREPARATION

A. Inspect structural roof deck after roofing system removal.
   1. Secure roof deck with additional fastenings as required.
   2. Replace roof deck as determined by Contracting Officer's Representative.
      a. Replacement Roof Deck: See Section 06 10 00, ROUGH CARPENTRY.

3.9 TEMPORARY ROOFING

A. Install temporary roofing to maintain building watertight.
B. Remove temporary roofing before installing new roofing.

C. Prepare temporary roofing to receive new roofing.

3.10 EXISTING MEMBRANE PREPARATION FOR NEW ROOFING

A. Remove existing roofing surface projections and irregularities.

1. Broom clean existing surface.

3.11 BASE FLASHING REMOVAL

A. Expose base flashings to permit removal.

1. Two-Piece Counterflashings: Remove cap flashing and store for reuse.
2. Single Piece Counterflashings: Carefully bend counterflashing.
3. Metal Copings: Remove decorative cap and store for reuse.

B. Remove existing base flashings.

1. Clean substrates to receive new flashings.

C. Replace counterflashings damaged during removal.

1. Counterflashings: See Section 07 60 00 FLASHING AND SHEET METAL.

D. Install plywood sheathing, 15 mm (19/32 inch) thick.

3.12 RECOVER BOARD INSTALLATION (NOT USED)

3.13 FIELD QUALITY CONTROL

A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.

1. Fastener Pull Out Tests: ANSI/SPRI FX-1(2016).

B. Existing Roofing System Warrantor Services:

1. Inspect reroofing preparation and roofing installation to verify compliance with existing warranty conditions.
2. Submit reports of field inspections, and supplemental instructions issued during inspections.

3.14 DISPOSAL

A. Collect waste materials in containers.

B. Remove waste materials from project site, regularly, to prevent accumulation.

C. Legally dispose of waste materials.

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SECTION 07 13 00
SHEET WATERPROOFING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies sheet waterproofing materials used for shower pan waterproofing in public showers.

1.2 QUALITY CONTROL

A. Approval by the COR is required of products of proposed manufacturers.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 30 00 ADMINISTRATIVE REQUIREMENTS.

B. Manufacturer's Literature and Data:

1. Sheet waterproofing.
2. Printed installation instructions.

C. Certificates:

1. Sheet waterproofing manufacturer's approval of adhesive used.
2. Waterproofing tests report indicating that water test as specified has been made for each shower area and that each area was found to be watertight.

D. Samples:

1. Sheet waterproofing, 150 mm (6 inches) square.
2. Waterproofed building paper, 150 square mm (6 inches square).
3. Adhesive, 0.24 L (1/2 pint).

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Deliver materials to job in manufacturer's original unopened containers with brand name marked thereon.

B. Unload and store to prevent injury to materials.

1. Do not store material in areas where temperature is lower than 10 degrees C (50 degrees F), or where prolonged temperature is above 32 degrees C (90 degrees F).

1.5 WARRANTY

A. Shower pan waterproofing is subject to the terms of Article titled "Warranty of Construction”, FAR clause 52.246-21, except that warranty period is extended to two years.

1.6 APPLICABLE PUBLICATIONS:

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced by basic designation only.

B. Federal Specification (Fed. Spec.):
UU-B-790A INT AMD 1.....Building Paper, Vegetable Fiber: (Kraft, Waterproof, Water Repellent and Fire Resistant)

PART 2 - PRODUCTS

2.1 SHOWER PAN WATERPROOFING SHEET:

A. Rubber type sheet formed of non-reinforced, homogeneous, impermeable, sheeting compound reduced to thermoplastic state, resistant to fungus, mildew and bacteria, not less than 1.5 mm (60 mils) thick.

B. Asphaltic sheet formed with a laminated asphalt construction consisting of eight plies of Kraft paper bonded and saturated by seven layers of asphalt, reinforced with three layers of glass fibers and faced with polyethylene sheet; total weight 1.9 kilogram/square meter (0.40 pounds per square foot).

2.2 ADHESIVES:

A. As furnished by the manufacturer of the sheet waterproofing.

B. Compatible with adjacent materials where contact occurs.

2.3 WATERPROOFED BUILDING PAPER:

A. Fed. Spec. UU-B-790, Type I, Grade C.

2.4 CONCRETE PATCHING COMPOUND:

A. Portland cement base, acrylic polymer compound, manufactured specifically for resurfacing and leveling concrete floors.

B. Have not less than the following physical properties:
   1. Compressive strength - 25 mPa (3500 psi).
   2. Tensile strength - 7 mPa (1000 psi).
   3. Flexural strength - 7 mPa (1000 psi).
   4. Density - 1.9.

C. Capable of being applied in layers up to 50 mm (two inches) thick, being brought to a feather edge, and being troweled to a smooth finish.

D. Ready for use in 48 hours after application.

PART 3 - EXECUTION

3.1 PREPARATION:

A. Before installing shower pan waterproofing, adjoining surfaces shall be clean, smooth, firm and dry.

B. Concrete surfaces shall be cured a minimum of seven days and be free from release agents, concrete curing agents, and other contaminates.

C. Remove all high spots and loose and foreign particles and fill all voids, depressions joints and cracks with concrete patching compound.

D. Ensure vertical surfaces have a continuous supportive back substrate for waterproofing.

3.2 INSTALLATION:

A. Coat entire surfaces to receive shower pan waterproofing with adhesive spread at rate of 1 liter/square meter (one gallon per 40 square feet).

B. Butt joints and cover with a strip of the waterproofing sheeting material eight inches in width and seal with adhesive.

C. Carry sheeting up vertical surfaces not less than 4 inches above surface of shower floor. Carry over tops of curbs.

D. Roll entire horizontal surfaces with 23 to 45 kg (50 to 100 pounds) roller and roll corners and vertical sections with a rubber roller to insure solid anchorage.

E. Make cut out for floor drains and fit to drain for watertight assembly, coordinating with drain installation.

3.3 PROTECTION:

A. When finish floor will not be immediately installed, protect waterproofing pan.

B. Cover with 2 inches of sand or waterproofed building paper.

C. Maintain protection until finished floor is placed.

3.4 WATER TEST:

A. Test in presence of COR for leaks before permanent finish is applied over shower pan waterproofing.

B. Seal floor drain watertight and fill waterproofing pan with water to within approximately 25 mm (1 inch) of top of its vertical surfaces.

C. When leakage occurs, repair waterproofing and repeat testing until no leakage occurs.

D. Submit certificate to COR of test results.

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SECTION 07 21 13
THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermal insulation.

a. Batt or blanket insulation at exterior framed and furred walls.

b. Board or block insulation at masonry cavity walls.

c. Loose fill insulation at exterior hollow masonry walls.

1.2 RELATED WORK

A. Section 04 20 00, UNIT MASONRY: Insulation for Cavity Face of Masonry.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. ASTM International (ASTM):

C516-19.....Vermiculite Loose Fill Thermal Insulation.

C549-18.....Perlite Loose Fill Insulation.

C552-17e1 .....Cellular Glass Thermal Insulation.

C553-13(2019).....Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

C578-19.....Rigid, Cellular Polystyrene Thermal Insulation.

C591-20.....Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.

C612-14(2019).....Mineral Fiber Block and Board Thermal Insulation.

C665-17.....Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

C728-17a.....Perlite Thermal Insulation Board.

C954-18.....Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Base to Steel Studs From 0.033 (0.84 mm) inch to 0.112 inch (2.84 mm) in thickness.

C1002-18.....Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

D312/D312M-16a.....Asphalt Used in Roofing.

E84-20.....Surface Burning Characteristics of Building Materials.

F1667-18a.....Driven Fasteners: Nails, Spikes, and Staples.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 30 00 ADMINISTRATIVE REQUIREMENTS.

B. Submittal Drawings:

1. Show insulation type, thickness, and R-value for each location.

C. Manufacturer's Literature and Data:

1. Description of each product.
2. Adhesive indicating manufacturer recommendation for each application.

1.5 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.6 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight facility.

B. Protect products from damage during handling and construction operations.

C. Protect foam plastic insulation from UV exposure.

1.7 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 INSULATION - GENERAL

A. Insulation Thickness:

1. Provide thickness required by R-value as required by building code.
2. Provide thickness indicated when R-value is not shown on drawings.

B. Insulation Types:

1. Provide one insulation type for each application.

2.2 THERMAL INSULATION

A. Exterior Framing or Furring Insulation:

1. Mineral Fiber: ASTM C665, Type II, Class C, Category I where concealed by thermal barrier.
2. Mineral Fiber: ASTM C665, Type III, Class A at other locations.

B. Inside Face of Exterior Wall Insulation:
   1. Mineral Fiber Board: ASTM C612, Type IB or II.
   2. Perlite Board: ASTM C728.
C. Masonry Cavity Wall Insulation:
   1. Mineral Fiber Board: ASTM C612, Type II, with vapor retarder facing; maximum permeance 29 ng/Pa/s/sq. m (0.5 perms).
   2. Polystyrene Board: ASTM C578, Type X.
   3. Perlite Board: ASTM C728.
   4. Cellular Glass Block: ASTM C552, Type IV.
D. Masonry Fill Insulation:
   1. Vermiculite Insulation: ASTM C516, Type II.
   2. Perlite Insulation: ASTM C549, Type IV.

2.3 ACOUSTICAL INSULATION (NOT USED)

2.4 ACCESSORIES

A. Fasteners:
   1. Staples or Nails: ASTM F1667, zinc-coated, size and type to suit application.
   2. Screws: ASTM C954 or ASTM C1002, size and length to suit application with washer minimum 50 mm (2 inches) diameter.
   3. Impaling Pins: Steel pins with head minimum 50 mm (2 inches) diameter.
      a. Length: As required to extend beyond insulation and retain cap washer when washer is placed on pin.
      b. Adhesive: Type recommended by manufacturer to suit application.
B. Insulation Adhesive: Nonflammable type recommended by insulation manufacturer to suit application.
C. Tape: Pressure sensitive adhesive on one face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.
B. Protect existing construction and completed work from damage.
C. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.

3.2 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions and approved submittal drawings.

1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

B. Install insulation with vapor barrier facing the heated side, unless indicated otherwise.

C. Install board and block insulation with joints close and flush, in regular courses, and with end joints staggered.

D. Install batt and blanket insulation with joints tight. Fill framing voids completely. Seal penetrations, terminations, facing joints, facing cuts, tears, and unlapped joints with tape.

E. Fit insulation tight against adjoining construction and penetrations, unless indicated otherwise.

3.3 THERMAL INSULATION

A. Perimeter Insulation In Contact with Soil:

1. Vertical insulation:

a. Fill joints of insulation with same material used for bonding.

b. Bond polystyrene board to surfaces with adhesive.

c. Bond cellular glass insulation to surfaces with hot asphalt or adhesive cement.

2. Horizontal insulation under concrete floor slab:

a. Lay insulation boards and blocks horizontally on level, compacted and drained fill.

b. Extend insulation from foundation walls towards center of building minimum 600 mm (24 inches).

B. Exterior Framing or Furring Insulation:

1. General:

a. Open voids are not acceptable.

b. Pack insulation around door frames and windows, in building expansion joints, door soffits, and other voids.

c. Pack behind outlets, around pipes, ducts, and services encased in walls.

d. Hold insulation in place with pressure sensitive tape.

e. Lap facing flanges together over framing for continuous surface. Seal penetrations through insulation and facings.

2. Metal Studs: Fasten insulation between metal studs, framing, and furring with pressure sensitive tape continuous along flanged edges.

3. Wood Studs:

a. Fasten insulation between wood studs or framing with nails or staples through flanged edges on face of stud.
b. Space fastenings maximum 150 mm (six inches) apart.

4. Roof Rafters and Floor Joists: Friction fit insulation between framing to provide minimum 50 mm (2 inch) air space between insulation and roof sheathing and subfloor.
5. Ceilings and Soffits:
   a. Wood Framing:
      1) Fasten blanket insulation between wood framing and joists with nails or staples through flanged edges of insulation.
      2) Space fastenings maximum 150 mm (6 inches) on center.

C. Inside Face of Exterior Wall Insulation:
1. Location: On interior face of solid masonry and concrete walls, beams, beam soffits, underside of floors, and to face of studs to support interior wall finish where indicated.
2. Bond insulation to solid vertical surfaces with adhesive. Fill joints with adhesive cement.
3. Fasten board insulation to face of studs with screws, nails or staples. Space fastenings maximum 300 mm (12 inches) on center. Stagger fasteners at board joints. Install fasteners at each corner.

D. Masonry Cavity Wall Insulation:
1. Install insulation on exterior faces of concrete and masonry inner wythes of cavity walls.
2. Bond polystyrene board to surfaces with adhesive.
3. Bond polyurethane or polyisocyanurate board, and perlite board to surfaces with adhesive.
4. Bond cellular glass insulation to surfaces with hot asphalt or adhesive cement.
5. Fill insulation joints with same material used for bonding.

E. Masonry Fill Insulation:
1. Pour fill insulation in masonry unit hollow cores from tops of walls, or from sill where windows or other openings occur.
2. Pour in lifts of maximum 6 m (20 feet).

3.4 ACOUSTICAL INSULATION (NOT USED)

3.5 CLEANING

A. Remove excess adhesive before adhesive sets.

3.6 PROTECTION

A. Protect insulation from construction operations.

B. Repair damage.

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SECTION 07 22 00
ROOF AND DECK INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

B. Roof and deck insulation and vapor retarder on new and existing substrates ready to receive roofing or waterproofing membrane.

C. Repairs and alteration work to existing roof insulation.

1.2 RELATED WORK

A. Section 06 10 00, ROUGH CARPENTRY: Wood Cants, Blocking, and Edge Strips.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American Society of Civil Engineers

ASCE 7-16.....Minimum Design Loads and Associated Criteria for Buildings and Other Structures

C. American Society of Heating, Refrigeration and Air Conditioning (ASHRAE):

Standard 90.1-13.....Energy Standard for Buildings Except Low-Rise Residential Buildings.

D. ASTM International (ASTM):

C208-12(2017)e2.....Cellulosic Fiber Insulating Board.

C552-17e1.....Cellular Glass Thermal Insulation.

C726-17.....Mineral Fiber Roof Insulation Board.

C728-17a.....Perlite Thermal Insulation Board.

C1177/C1177M-17.....Glass Mat Gypsum Substrate for Use as Sheathing.

C1278/C1278M-17.....Fiber-Reinforced Gypsum Panel.

C1289-19.....Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

C1396/C1396M-17.....Gypsum Board.

D41/D41M-11 (2016).....Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.

D312/D312M-16a.....Asphalt Used in Roofing.

D1970/D1970M-20.....Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

D2178/D2178M-15a.....Asphalt Glass Felt Used in Roofing and Waterproofing.

D2822/D2822M-05(2011)e1.Asphalt Roof Cement, Asbestos Containing.

D4586/D4586M-07(2018)...Asphalt Roof Cement, Asbestos-Free.

E84-20.....Surface Burning Characteristics of Building Materials.

F1667-18a.....Driven Fasteners: Nails, Spikes, and Staples.

E. National Roofing Contractors Association (NRCA):

Manual-15.....The NRCA Roofing Manual: Membrane Roof Systems-2019.

F. UL LLC (UL):

Listed Online Certifications Directory.

G. U.S. Department of Agriculture (USDA):

USDA BioPreferred Program Catalog.

H. U.S. Department of Commerce National Institute of Standards and Technology (NIST):

DOC PS 1-19.....Structural Plywood.

DOC PS 2-18.....Performance Standard for Wood-Based Structural-Use Panels.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 30 00 ADMINISTRATIVE REQUIREMENTS.

B. Submittal Drawings:

1. Show size, configuration, and installation details.

a. Nailers, cants, and terminations.

b. Layout of insulation showing slopes, tapers, penetrations, and edge conditions.

C. Manufacturer's Literature and Data:

1. Description of each product.

D. Samples:

1. Roof insulation, each type.

2. Fasteners, each type.

E. Qualifications: Substantiate qualifications meet specifications.

1. Installer.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Same installer as Division 07 roofing section installer.

1.6 DELIVERY

A. Comply with recommendations of NRCA Manual.

B. Deliver products in manufacturer's original sealed packaging.

C. Mark packaging, legibly. Indicate manufacturer's name or brand, type, and manufacture date.

D. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Comply with recommendations of NRCA Manual.

B. Store products indoors in dry, weathertight facility.

C. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

A. Environment: Install products when existing and forecasted weather permit installation according to manufacturer's instructions.

1.9 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

B. Manufacturer's Warranty: Warrant substrate board, vapor retarder, insulation, and cover board against material and manufacturing defects as part of Division 07 roofing system warranty.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. On existing roofs confirm available insulation thickness and modify as required.

B. Insulation Thermal Performance:

1. Overall Average R-Value: RSI-57 (R-33), minimum.
2. Any Location R-Value: RSI-17 (R-10), minimum.

C. Fire and Wind Uplift Resistance: Provide roof insulation complying with requirements specified in Division 07 roofing section.

D. Insulation on Combustible Decking: UL labeled indicating compliance with one of the following:

1. UL Listed.
2. Insulation Surface Burning Characteristics: When tested according to ASTM E84.
   a. Flame Spread Rating: 75 maximum.
   b. Smoke Developed Rating: 150 maximum.

2.2 PRODUCTS - GENERAL

A. Provide each product from one manufacturer.

2.3 ADHESIVES

A. Primer: ASTM D41/D41M.

B. Asphalt: ASTM D312, Type III or IV for vapor retarders and insulation.

C. Modified Asphaltic Insulation Adhesive: Insulation manufacturer's recommended modified asphaltic, asbestos-free, cold-applied adhesive formulated to adhere roof insulation to substrate or to another insulation layer.

D. Bead-Applied Urethane Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, one- or multicomponent urethane adhesive formulated to adhere roof insulation to substrate or to another insulation layer.

E. Full-Spread Applied Urethane Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to adhere roof insulation to substrate or to another insulation layer.

F. Roof Cement: Asbestos free, ASTM D2822/D2822M, Type I or Type II; or, ASTM D4586/D4586M, Type I or Type II.

2.4 ROOF AND DECK INSULATION

A. Roof and Deck Insulation, General: Preformed roof insulation boards approved by roofing manufacturer.

B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, faced with glass fiber reinforced cellulosic felt facers on both major surfaces of the core foam.

C. Tapered Roof Insulation System:

1. Fabricate of mineral fiberboard, polyisocyanurate, perlite board, or cellular glass. Use only one insulation material for tapered sections. Use only factory-tapered insulation.
2. Cut to provide high and low points with crickets and slopes as shown.
3. Minimum thickness of tapered sections; 38 mm (1-1/2 inch).
4. Minimum slope 1/48 (1/4 inch per 12 inches).

2.5 INSULATION ACCESSORIES

A. Glass (Felt): ASTM D2178/D2178M, Type VI, heavy duty ply sheet.

B. Cants and Tapered Edge Strips:

1. Wood Cant Strips: Refer to Section 06 10 00, ROUGH CARPENTRY.

2. Insulation Cant Strips: ASTM C208, Type II, Grade 1, cellulosic-fiber insulation board.
3. Tapered Edge Strips: 1/12 (1 inch per 12 inches), from 0 mm (0 inches), 300 mm to 450 mm (12 inches to 18 inches) wide.
   a. Cellulosic Fiberboard: ASTM C208.
   b. Mineral Fiberboard: ASTM C726.
   c. Perlite Board: ASTM C728.

C. Vapor Retarder:
1. Glass-Fiber Felts: ASTM D2178/D2178M, Type IV, asphalt impregnated.
2. Self-Adhering Sheet Vapor Retarder: ASTM D1970/D1970M, minimum 1.0 mm (40 mils) thick membrane of HDPE film fully coated with asphalt adhesive, or 0.76 to 1.0 mm (30 to 40 mils) thick membrane of butyl rubber based adhesive backed by a layer of high density cross-laminated polyethylene; maximum permeance rating of 6 ng/Pa/s/sq. m (0.1 perms).

2.6 ACCESSORIES

A. Fasteners: Corrosion-resistant carbon steel fasteners and galvalume-coated steel or plastic round plates for fastening substrate board and insulation to roof deck.

B. Nails: ASTM F1667; type to suit application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Comply with requirements of Division 07 roofing section.

3.2 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

3.3 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions.
1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

B. Comply with requirements of UL for insulated steel roof deck.

C. Attach substrate board and other products to meet requirements of Division 07 roofing section.

3.4 VAPOR RETARDER INSTALLATION

A. Vapor Retarder Installation, General:
1. Install continuous vapor retarder on roof decks where indicated.

2. At vertical surfaces, turn up vapor retarder to top of insulation or base flashing.
3. Seal penetrations through vapor retarder with roof cement to prevent moisture entry from below.

B. Cast in Place Concrete Decks, Except Insulating Concrete:
1. Prime deck as specified.
2. Apply two plies of asphalt saturated felt mopped down to deck.

C. Precast Concrete Unit Decks Without Concrete Topping:
1. Prime deck as specified.
2. Apply two plies of asphalt saturated felt.
3. Mop to deck, keeping bitumen 100 mm (4 inches) away from joints of precast units. Bridge joints with felt. Mop between plies as specified.

3.5 INSULATION INSTALLATION

A. Insulation Installation, General:
1. Base Sheet: Where required by roofing system, install one lapped base sheet specified in Division 07 roofing section by mechanically fastening to roofing substrate before installation of insulation.
2. Cant Strips: Install wood cant strips specified in Section 06 10 00 ROUGH CARPENTRY at junctures of roofing system with vertical construction.
3. Use same insulation as existing for roof repair and alterations unless specified otherwise.

B. Insulation Thickness:
1. Thickness of roof insulation shown on drawings is nominal. Provide thickness required to comply with specified thermal performance.
2. When actual insulation thickness differs from drawings, coordinate alignment and location of roof drains, flashing, gravel stops, fascias and similar items.
3. Where tapered insulation is used, maintain insulation thickness at high points and roof edges shown on drawings.
   a. Low Point Thickness: Minimum 38 mm (1-1/2 inches).
4. Use minimum two layers of insulation when required thickness is 68 mm (2.7 inch) or greater.

C. Lay insulating units with close joints, in regular courses and with end joints staggered.
1. Stagger joints between layers minimum 150 mm (6 inches).

D. Lay units with long dimension perpendicular to the rolled (longitudinal) direction of the roofing felt.
E. Seal cut edges at penetrations and at edges against blocking with bitumen or roof cement.
F. Cut to fit tightly against blocking or penetrations.
G. Cover all insulation installed on the same day; comply with temporary protection requirements of Division 07 roofing section.
H. Installation Method:
   1. Adhered Insulation:
      a. Prime substrate as required.
      b. Set each layer of insulation firmly in solid mopping of hot asphalt.
      c. Set each layer of insulation firmly in ribbons of bead-applied insulation adhesive.
      d. Set each layer of insulation firmly in uniform application of full-spread insulation adhesive.
   2. Mechanically Fastened Insulation:
      a. Fasten insulation according to requirements in Division 07 roofing section.
      b. Fasten insulation to resist uplift pressures specified in Division 07 roofing section and ASCE-7.
   3. Mechanically Fastened and Adhered Insulation:
      a. Fasten first layer of insulation according to "Mechanically Fastened Insulation" requirements.
      b. Fasten each subsequent layer of insulation according to "Adhered Insulation" requirements.

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SECTION 07 31 34
COMPOSITE SHAKE ROOFING

BASIS OF DESIGN: ENVIROSHAKE® Systems LP

PART 1 - GENERAL

1.01 SUMMARY OF WORK

A. This Section specifies composite emulated cedar roof shakes.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 – Rough Carpentry

B. Section 07 13 00 – Sheet Waterproofing: low-slope waterproof roofing membrane.

C. Section [07 60 00 FLASHING & SHEET METAL.

D. Section 07 71 00 – Roof Specialties

E. Section 07 72 00 – Roof Accessories

F. Section 07 92 00 – Joint Sealants

1.03 REFERENCE STANDARDS

A. ASTM International (ASTM).

1. ASTM D7349/D7349M-[2011], Standard Test Method for Determining the Capability of Roofing and Waterproofing Materials to Seal around Fasteners.
2. ASTM E108-[2010a], Standard Test Methods for Fire Tests of Roof Coverings.
3. ASTM F1667-[2011], Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

B. Underwriter’s Laboratories (UL)

1. UL 2218-[2010], Standard for Impact Resistance of Prepared Roof Covering Materials.

C. US Green Building Council (USGBC).

1. LEED® NC Version 2.2-[2009], LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Co-ordination: Co-ordinate work of this Section with work of other trades for proper time and sequence to avoid construction delays.

B. Pre-installation Meeting: Convene pre-installation meeting after Award of Contract and one week prior to commencing work of this Section to

verify project requirements, substrate conditions and coordination with other building sub-trades, and to review manufacturer=s written installation instructions.

1. Comply with Section 01 30 00 - Project Meetings and co-ordinate with other similar pre-installation meetings.
2. Notify attendees 2 weeks prior to meeting and ensure meeting attendees include as minimum:
   a. Owner;
   b. Consultant;
   c. Composite shake roofing installer; Enviroshake must be installed by a Factory Trained Enviroshake installer so it is important that the roofing contractor meets this criteria.
   d. Manufacturer's Technical Representative.
3. Ensure meeting agenda includes review of methods and procedures related to composite roof shake installation including co-ordination with related work.
4. Record meeting proceedings including corrective measures and other actions required to ensure successful completion of work and distribute to each attendee within 1 week of meeting.

1.05 ACTION AND INFORMATIONAL SUBMITTALS

A. Make submittals in accordance with Contract Conditions and Section 01 30 00 – Administrative Requirements.

B. Product Data: Submit product data including manufacturer's literature for composite roof shake components and accessories, indicating compliance with specified requirements and material characteristics.
   1. Submit list on composite roof shake manufacturer's letterhead of materials, components and accessories to be incorporated into Work.
   2. Include product names, types and series numbers.
   3. Include contact information for manufacturer and their representative for this Project.

C. Samples:
   1. Submit duplicate full-size samples of composite roof shake used.

D. Test Reports:
   1. Submit test reports showing compliance with specified

performance characteristics and physical properties.

E. Field Reports: Submit manufacturer's field reports within 3 days of each manufacturer representative's site visit and inspection.

F. Sustainable Design (LEED).

1. LEED Submittals: In accordance with Section [01 90 00 COMISSIONING].

G. Installer Qualifications:

.1 Submit [verification of manufacturer's certification of installer] [letter verifying installer's experience with work similar to work of this Section].

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Supply maintenance data for composite roof shake materials for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

B. Record Documentation: In accordance with Section 01 78 00 - Closeout Submittals.

1. List materials used in composite roof shake work.
2. Warranty: Submit warranty documents specified.

1.07 QUALITY ASSURANCE

A. Mock-up: Construct full size 10 x 10 ft. mock-up of roof showing composite roof shakes using proposed procedures, materials and quality of work where directed by Consultant [and in accordance with Section 01 43 00 - Quality Assurance].

1. Include valley, ridge cap, edge, roof vent or penetration, dormer window and, parapet details.
2. Purpose: To judge quality of work and material installation.
3. Allow Consultant [24] hours minimum prior to inspection of mock-up.
4. Do not proceed with work prior to receipt of written acceptance of mock-up by Consultant.
5. When accepted, mock-up will demonstrate minimum standard of quality required for work of this Section.
6. Approved mock-up will [not] remain part of finished work.

B. Installer Qualifications: Manufacturer's Factory Training for installation of composite shake roofing.

1.08 DELIVERY STORAGE AND HANDLING

A. Delivery and Requirements:
   1. Deliver material in accordance with Section 01 61 00 - Common Product Requirements.
   2. Deliver materials and components in manufacturer's original packaging with identification labels intact.

B. Storage and Handling Requirements: Store materials off ground and protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
   1. Exercise care to avoid damage during unloading and storing.
   2. Do not stack material or other skids on top of ridge caps.
   3. SC shakes are bundled with white wrapping/strapping, and AC shakes are bundles with green wrapping and yellow strapping.

C. Packaging Waste Management:
   1. Separate and recycle waste packaging materials in accordance with Section 01 74 19 - Construction Waste Management and Disposal.
   2. Remove waste packaging materials from site and dispose of packaging materials at appropriate recycling facilities.
   3. Collect and separate for disposal paper and plastic material in appropriate on-site storage containers for recycling [in accordance with Waste Management Plan].

1.09 WARRANTY

A. Project Warranty: Refer to Contract Conditions for project warranty provisions.

B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to and not intended to limit other rights Owner may have under Contract Conditions.

C. Gold Level Warranty period (If Enviroshield Synthetic Underlayment is used):
   1. Commercial installations: [50] years commencing on Date of Purchase.

   Standard Level Warranty period (If Enviroshield Synthetic Underlayment is NOT used):
   1. Commercial installations: [25] years commencing on Date of

Purchase.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. BASIS OF DESIGN: Manufacturer: Enviroshake, 650 Riverview Drive, Chatham, Ontario, N7M 5W8, Canada, Phone: (519) 380-9265, Toll Free: (866) 423-3302, FAX: (519) 380-0689, e-mail: info@enviroshake.com , URL: http://www.enviroshake.com .

2.02 DESCRIPTION

A. Cedar style composite roofing shake.

B. Acceptable Material: Enviroshake. (BASIS OF DESIGN)

2.03 DESIGN CRITERIA

A. Roof Slope: 2:12 minimum.

B. Ensure roof design load includes shingle weight of 260 lbs per 100 square feet minimum.

C. Fire Resistance: To ASTM E108

1. UBC Standard 15-2 Rating: Class C.
2. A Class A roof system rating can be achieved by using a Class A rated underlayment

D. Water Infiltration Resistance: To Miami-Dade PA 100.

E. Impact Resistance: To UL 2218, Class 4.

F. Accelerated Weathering: To UBC Standard 26-6 and 26-7. G Stability Testing: To CGSB-37.58.

G. Wind Uplift Resistance: To Miami-Dade TAS-125 Class 90.

H. Wind Driven Rain: To Miami-Dade TAS-10

2.04 MATERIALS

A. Composite Roofing Shake: Blend of post industrial plastic, elastomers and cellulosic fiber materials

1. Recycled content: [95] %.
2. Appearance: Hand sawn taper-split cedar shake style [20] inches long x [12] inches wide, varying profiles, exposed surface striated for first 9 inches, from butt end and flat and smooth to tapered end; Aged Cedar color.
3. Color: Aged Cedar

2.05 ACCESSORIES

A. Ridge Caps: Purpose made from same material as composite roofing shake 12 inches wide one piece shake, custom formed to angle of roof slope

from 2:12-20:12.

B. Eaves Protection: To ASTM D7349/D7349M, self adhesive, self sealing rubberized asphalt bonded to polyethylene film composite sheet material [40] mil minimum thickness.

C. Drip Edges: [26] ga minimum thick [copper] [galvanized steel] [aluminum], purpose made and preformed.

D. Flashing: [26] ga minimum thick [copper] [galvanized steel] [prefinished aluminum], 24 inches wide "W" flashing

E. Enviroshield Synthetic Underlayment: synthetic underlay to ASTM E108, [48] inches wide minimum.

F. Sheathing Paper: [single ply] [laminated] type [perforated] sheathing paper.

G. Roofing Nails: To ASTM F1667, 1 ½" [stainless] [hot-dipped galvanized] steel roofing nails, four per field shake, and 2 ½" [stainless] [hot-dipped galvanized] steel roofing nails, 2 per ridge cap.

H. Roof Ventilators: In accordance with Section [07 72 00 – Roof Accessories].

I. Flashing Sealant: In accordance with Section [07 92 00 – Joint Sealants].

J. Soffits and Facia: In accordance with Section [07 62 00 – Sheet Metal Flashing and Trim].

2.06 PRODUCT SUBSTITUTIONS

A. Substitutions: In accordance with Section [01 30 00 - Product Substitution Procedures].

PART 3 EXECUTION

3.01 INSTALLERS

A. Use only [Factory Trained Enviroshake installers for] [installers with 2 years' minimum experience in work similar to] work of this Section.

3.02 EXAMINATION

A. Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for composite roof shake installation in accordance with manufacturer's written recommendations.

1. Visually inspect substrate in presence of Consultant.
   a. Verify roof slope.
2. Inform Consultant of unacceptable conditions immediately upon

discovery.

3. Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.03 PREPARATION

A. Removal of Existing Roofing:

1. Remove existing roofing, flashings and underlay to expose sheathing.

B. Remove existing shingle and flashing nails and set nails which break off.

1. Leave surfaces free from dirt and loose material.

C. Proceed with work only after receipt of written approval from Consultant.

1. Remove unsuitable portions of sheathing boards, including areas affected by fungal or insect attack as directed by Consultant.

D. Replace cut out portions of sheathing boards or lath with boards of equal sectional dimensions and grade.

1. Seat each end of board on [rafter] [roof truss], with 1 inch minimum bearing and secure with mechanical fasteners.

3.04 COMPOSITE SHAKE ROOFING INSTALLATION

A. Do composite shake roofing in accordance with shake roofing manufacturer’s written recommendations.

B. Nail drip edge along roof deck edges at 16 inch maximum on center before installation of eaves protection.

1. Ensure drip edge overhangs facia ½ inch minimum with 2 inch flange extending on to roof deck.

C. Install self-adhesive eaves protection from bottom edge of roof deck to 3 feet minimum from roof edge.

1. Install eaves protection over ridges, valleys and at projections or penetrations through roof.

2. Lap seams 4 inches minimum.

D. Install roof ventilators and other accessories over eaves protection material in accordance with Section [07 72 00 - Roof Accessories].

E. Install sheet metal valley flashings where required over eaves protection material, 24 inches wide minimum centered down valleys in

accordance with [Section 07 60 00 – Flashing & Sheet Metal] [manufacturer`s written recommendations].

1. Include step and apron flashings at ridge cap, dormer windows.
2. Nail flashings in accordance with composite shake manufacturer`s written recommendations.
3. Apply bead of sealant to flashing edges and joints in accordance with Section [07 92 00 – Joint Sealants].

F. Nail synthetic underlay horizontally to roof slope above eaves protection.

1. Overlap eaves protection 4 inches minimum.
2. Ensure roof deck is completely covered by a synthetic underlayment.
3. Overlap synthetic underlay 2 inches minimum at top edges and 4 inches minimum at side edges.
4. Use synthetic underlay of weight meeting requirements of authority having jurisdiction.
5. Nail drip edges along rakes after underlayment is laid.
6. Nail top edges of synthetic underlay strips into sheathing at 6 feet on center.

G. Install composite roofing shakes in accordance with manufacturer’s written recommendations.

1. Use double starter course at bottom edges, including vertical and high slope roof surfaces.
2. Install course straight and plumb.
    1. Exposure: 9 inches maximum.
    2. Avoid keyway on keyway pattern.
    3. Avoid “staircase” pattern.
3. Fasten each shake with 4 nails minimum regardless of shake width.
    1. Space nails in accordance with shake manufacturer’s written recommendations.
    2. Drive nails flush with surface of shake.
    3. Ensure shake surface is not crushed.
4. Shake spacing: 3/8 inch.
5. Overlap between shake joints: 1-1/2 inches minimum.
6. Lay each consecutive row of shakes in accordance with manufacturer’s written recommendations.
7. Cut shakes to fit accurately around roof projections.

1. Allow 1 inch clearance around roof projections, in valleys and beside flashings.
2. Use only uncut factory edges kept flush along rake and gable ends and where ends are exposed.

8. Install ridge caps over eaves protection at ridges.
   1. Exposure: 9 inches maximum.
   2. Fasten each ridge cap with 2 nails minimum.
   3. Space nails in accordance with shake manufacturer’s written recommendations.
   4. Drive nails flush with surface ridge cap.
   5. Ensure ridge cap surface is not crushed.
9. At valleys saw shakes parallel to valley center line.
   1. Do not break joints into valley.

3.05 SOFFITS AND FACIA

A. Install prefinished aluminum soffits and facia material where indicated and in accordance with Section [07 60 00 FLASHING & SHEET METAL].

3.06 ROOF VENTILATORS

A. Install roof ventilators and other roofing accessories in accordance with Section [07 72 00 – Roof Accessories].

3.08 FIELD QUALITY CONTROL

A. Field Inspection: Coordinate field inspection in accordance with Section [01 40 00 Quality Requirements].

B. Manufacturer’s Services:
   1. Coordinate manufacturer=s services with Section [01 40 00 - Quality Requirements].
      a. Have manufacturer review work involved in handling, installation, protection, and cleaning of composite roof shake and components, and submit written reports in acceptable format to verify compliance of Work with Contract conditions.
   2. Manufacturer’s Field Services: Provide manufacturer’s field services consisting of product use recommendations and periodic site visits for product installation review in accordance with manufacturer’s instructions.
      a. Report any inconsistencies from manufacturer’s recommendations immediately to Consultant.
   3. Schedule site visits to review work at stages listed:

a. After delivery and storage of composite roof shake and components, and when preparatory work on which Work of this Section depends is complete, but before installation begins.

b. Twice during progress of work at 25% and 60% complete.

c. Upon completion of Work, after cleaning is carried out.

d. Obtain reports within three days of review and submit immediately to Consultant.

3.09 CLEANING

A. Progress Cleaning: Perform cleanup as work progresses.

1. Leave work area clean end of each day.

B. Final cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.

C. Waste Management:

1. Co-ordinate recycling and disposal of waste materials.

2. Collect recyclable waste and dispose of or recycle field generated construction waste created during construction or final cleaning related to work of this Section.

3. Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.10 PROTECTION

A. Protect installed products and components from damage during construction.

B. Repair damage to adjacent materials caused by composite roof shake installation.

- - END - -

SECTION 07 60 00
FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Formed sheet metal work for wall and roof flashing, copings, roof edge metal, fasciae, drainage specialties, and formed expansion joint covers are specified in this section.

1.2 RELATED WORK

A. Section 07 71 00 ROOF SPECIALTIES: Manufactured flashing, copings, roof edge metal, and fasciae.

B. Section 07 92 00, JOINT SEALANTS: Joint Sealants.

C. Section 09 91 00, PAINTING: Paint materials and application.

D. Division 22, PLUMBING: Integral flashing components of manufactured roof specialties and accessories or equipment.

E. Division 23 HVAC: Integral flashing components of manufactured roof specialties and accessories or equipment.

1.3 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only. Editions of applicable publications current on date of issue of bidding documents apply unless otherwise indicated.

B. Aluminum Association (AA):

AA-C22A41.....Aluminum Chemically etched medium matte, with clear anodic coating, Class I Architectural, 0.7-mil thick

AA-C22A42.....Chemically etched medium matte, with integrally colored anodic coating, Class I Architectural, 0.7 mils thick

AA-C22A44.....Chemically etched medium matte with electrolytically deposited metallic compound, integrally colored coating Class I Architectural, 0.7-mil thick finish

C. American National Standards Institute/Single-Ply Roofing Institute/Factory Mutual (ANSI/SPRI/FM):

4435/ES-1-11.....Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems

D. American Architectural Manufacturers Association (AAMA):

AAMA 620-02.....Voluntary Specification for High Performance Organic Coatings on Coil Coated Architectural Aluminum

AAMA 621-02.....Voluntary Specification for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates

E. ASTM International (ASTM):

A240/A240M-20.....Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications.

A653/A653M-20.....Steel Sheet Zinc-Coated (Galvanized) or Zinc Alloy Coated (Galvanized) by the Hot- Dip Process

B32-08(2014).....Solder Metal

B209-14.....Aluminum and Aluminum-Alloy Sheet and Plate

B370-12(2019).....Copper Sheet and Strip for Building Construction

D173/D173M-03(2018).....Bitumen-Saturated Cotton Fabrics Used in Roofing and Waterproofing

D412-16.....Vulcanized Rubber and Thermoplastic Elastomers-Tension

D1187/D1187M-97(2018)...Asphalt Base Emulsions for Use as Protective Coatings for Metal

D1784-20.....Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds

D3656/D3656M-13.....Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns

D4586/D4586M-07(2018)...Asphalt Roof Cement, Asbestos Free

F. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual.

G. National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500-06.....Metal Finishes Manual

H. Federal Specification (Fed. Spec):

A-A-1925A.....Shield, Expansion; (Nail Anchors)

UU-B-790A.....Building Paper, Vegetable Fiber

I. International Code Commission (ICC): International Building Code, Current Edition

1.4 PERFORMANCE REQUIREMENTS

A. Wind Uplift Forces: Resist the following forces per FM Approvals 1-49:

1. Wind Zone 3: 2.20 to 4.98 kPa (46 to 104 pound force/square foot): 9.96-kPa (208 pound force/square foot) perimeter uplift force, 14.94-kPa (312 pound force/square foot) corner uplift force, and 4.98-kPa (104 pound force/square foot) outward force.

B. Wind Design Standard: Fabricate and install copingsand roof-edge flashings tested per ANSI/SPRI/FM ES-1 to resist design pressure.

1.5 SUBMITTALS

A. Submit in accordance with Section 01 30 00 ADMINISTRATIVE REQUIREMENTS.

B. Shop Drawings: For all specified items, including:

1. Flashings
2. Copings
3. Gravel Stop-Fascia
4. Gutter and Conductors
5. Expansion joints
6. Fascia-cant

C. Manufacturer's Literature and Data: For all specified items, including:

1. Two-piece counterflashing
2. Thru wall flashing
3. Expansion joint cover, each type
4. Nonreinforced, elastomeric sheeting
5. Polyethylene coated copper
6. Bituminous coated copper
7. Copper covered paper
8. Fascia-cant

D. Certificates: Indicating compliance with specified finishing requirements, from applicator and contractor.

PART 2 - PRODUCTS

2.1 FLASHING AND SHEET METAL MATERIALS

A. Copper ASTM B370, cold-rolled temper.
B. Bituminous Coated Copper: Minimum copper ASTM B370, weight not less than 1 kg/m² (3 oz/sf). Bituminous coating shall weigh not less than 2 kg/m² (6 oz/sf); or, copper sheets may be bonded between two layers of coarsely woven bitumen-saturated cotton fabric ASTM D173. Exposed fabric surface shall be crimped.
C. Copper Covered Paper: Fabricated of electro-deposit pure copper sheets ASTM B 370, bonded with special asphalt compound to both sides of creped, reinforced building paper, UU-B-790, Type I, style 5, or to a three ply sheet of asphalt impregnated crepe paper. Grooves running along the width of sheet.
D. Polyethylene Coated Copper: Copper sheet ASTM B370, weighing 1 Kg/m² (3 oz/sf) bonded between two layers of (two mil) thick polyethylene sheet.
E. Aluminum Sheet: ASTM B209, alloy 3003-H14 except alloy used for color anodized aluminum shall be as required to produce specified color. Alloy required to produce specified color shall have the same structural properties as alloy 3003-H14.
F. Galvanized Sheet: ASTM, A653.
G. Nonreinforced, Elastomeric Sheeting: Elastomeric substances reduced to thermoplastic state and extruded into continuous homogenous sheet (0.056 inch) thick. Sheeting shall have not less than 7 MPa (1,000 psi) tensile strength and not more than seven percent tension-set at 50 percent elongation when tested in accordance with ASTM D412. Sheeting shall show no cracking or flaking when bent through 180 degrees over a 1 mm (1/32 inch) diameter mandrel and then bent at same point over same size mandrel in opposite direction through 360 degrees at temperature of -30°C (-20 °F).

2.2 FLASHING ACCESSORIES

A. Solder: ASTM B32; flux type and alloy composition as required for use with metals to be soldered.
B. Rosin Paper: Fed-Spec. UU-B-790, Type I, Grade D, Style 1b, Rosin-sized sheathing paper, weighing approximately 3 Kg/10 m²(6 pounds/100 square feet).
C. Bituminous Paint: ASTM D1187, Type I.

D. Fasteners:
   1. Use copper, copper alloy, bronze, brass for copper. Use galvanized steel for galvanized steel.
   2. Nails:
      a. Minimum diameter for copper nails: 3 mm (0.109 inch).
      b. Minimum diameter for aluminum nails 3 mm (0.105 inch).
      c. Length to provide not less than 22 mm (7/8 inch) penetration into anchorage.
   3. Rivets: Not less than 3 mm (1/8 inch) diameter.
   4. Expansion Shields: Fed Spec A-A-1925A.
E. Sealant: As specified in Section 07 92 00, JOINT SEALANTS for exterior locations.
F. Insect Screening: ASTM D3656, 18 by 18 regular mesh.
G. Roof Cement: ASTM D4586.

2.3 SHEET METAL THICKNESS

A. Except as otherwise shown or specified use thickness or weight of sheet metal as follows:
B. Concealed Locations (Built into Construction):
   1. Copper: 30g (10 oz) minimum 0.33 mm (0.013 inch thick).
   2. Galvanized steel: 0.5 mm (0.021 inch) thick.
C. Exposed Locations:
   1. Copper: 0.4 Kg (16 oz).
D. Thickness of aluminum or galvanized steel is specified with each item.

2.4 FABRICATION, GENERAL

A. Jointing:
   1. In general, copper joints, except expansion and contraction joints, shall be locked and soldered.
   2. Jointing of copper over 0.5 Kg (20 oz) shall be done by lapping, riveting and soldering.
   3. Joints shall conform to following requirements:
      a. Flat-lock joints shall finish not less than 19 mm (3/4 inch) wide.
      b. Lap joints subject to stress shall finish not less than 25 mm (one inch) wide and shall be soldered and riveted.
      c. Unsoldered lap joints shall finish not less than 100 mm (4 inches) wide.
   4. Flat and lap joints shall be made in direction of flow.

5. Edges of bituminous coated copper, copper covered paper, nonreinforced elastomeric sheeting and polyethylene coated copper shall be jointed by lapping not less than 100 mm (4 inches) in the direction of flow and cementing with asphalt roof cement or sealant as required by the manufacturer's printed instructions.
6. Soldering:
   a. Pre tin both mating surfaces with solder for a width not less than 38 mm (1 1/2 inches) of uncoated copper.
   b. Wire brush to produce a bright surface before soldering lead coated copper.
   c. Treat in accordance with metal producers recommendations other sheet metal required to be soldered.
   d. Completely remove acid and flux after soldering is completed.

B. Expansion and Contraction Joints:
1. Fabricate in accordance with the Architectural Sheet Metal Manual recommendations for expansion and contraction of sheet metal work in continuous runs.
2. Space joints as shown or as specified.
3. Space expansion and contraction joints for copper at intervals not exceeding 7200 mm (24 feet).
4. Space expansion and contraction joints for aluminum at intervals not exceeding 5400 mm (18 feet), except do not exceed 3000 mm (10 feet) for gravel stops and fascia-cant systems.
5. Fabricate slip-type or loose locked joints and fill with sealant unless otherwise specified.
6. Fabricate joint covers of same thickness material as sheet metal served.

C. Cleats:
1. Fabricate cleats to secure flashings and sheet metal work over 300 mm (12 inches) wide and where specified.
2. Provide cleats for maximum spacing of 300 mm (12 inch) centers unless specified otherwise.
3. Form cleats of same metal and weights or thickness as the sheet metal being installed unless specified otherwise.
4. Fabricate cleats from 50 mm (2 inch) wide strip. Form end with not less than 19 mm (3/4 inch) wide loose lock to item for anchorage.

Form other end of length to receive nails free of item to be anchored and end edge to be folded over and cover nail heads.

D. Edge Strips or Continuous Cleats:
1. Fabricate continuous edge strips where shown and specified to secure loose edges of the sheet metal work.
2. Except as otherwise specified, fabricate edge strips or minimum 1.25 mm (0.050 inch) thick aluminum.
3. Use material compatible with sheet metal to be secured by the edge strip.
4. Fabricate in 3000 mm (10 feet) maximum lengths with not less than 19 mm (3/4 inch) loose lock into metal secured by edge strip.
5. Fabricate Strips for fascia anchorage to extend below the supporting wood construction to form a drip and to allow the flashing to be hooked over the lower edge at least 19 mm (3/4-inch).
6. Fabricate anchor edge maximum width of 75 mm (3 inches) or of sufficient width to provide adequate bearing area to insure a rigid installation using 1 Kg (32 oz) copper or 1.6 mm (0.0625 inch) thick aluminum.

E. Drips:
1. Form drips at lower edge of sheet metal counter-flashings (cap flashings), fascias, gravel stops, wall copings, by folding edge back 13 mm (1/2 inch) and bending out 45 degrees from vertical to carry water away from the wall.
2. Form drip to provide hook to engage cleat or edge strip for fastening for not less than 19 mm (3/4 inch) loose lock where shown.

F. Edges:
1. Edges of flashings concealed in masonry joints opposite drain side shall be turned up 6 mm (1/4 inch) to form dam, unless otherwise specified or shown otherwise.
2. Finish exposed edges of flashing with a 6 mm (1/4 inch) hem formed by folding edge of flashing back on itself when not hooked to edge strip or cleat. Use 6 mm (1/4 inch) minimum penetration beyond wall face with drip for through-wall flashing exposed edge.
3. All metal roof edges shall meet requirements of IBC, current edition.

G. Metal Options:

1. Where options are permitted for different metals use only one metal throughout.
2. Where copper gravel stops, copings and flashings will carry water onto cast stone, stone, or architectural concrete.

2.5 FINISHES

A. Use same finish on adjacent metal or components and exposed metal surfaces unless specified or shown otherwise.
B. In accordance with NAAMM Metal Finishes Manual AMP 500, unless otherwise specified.
C. Finish exposed metal surfaces as follows, unless specified otherwise:
   1. Copper: Mill finish.
   2. Aluminum:
      a. Clear Finish: AA-C22A41 medium matte, clear anodic coating, Class 1 Architectural, 18 mm (0.7 mils) thick.
      b. Colored Finish: AA-C22A42 (anodized) or AA-C22A44 (electrolytically deposited metallic compound) medium matte, integrally colored coating, Class 1 Architectural, 18 mm (0.7 mils) thick. Dyes will not be accepted.
      c. Fluorocarbon Finish: AAMA 620, high performance organic coating.
      d. Mill finish.
   3. Steel and Galvanized Steel:
      a. Finish painted under Section 09 91 00, PAINTING unless specified as prefinished item.
      b. Manufacturer's finish:
         1) Baked on prime coat over a phosphate coating.
         2) Baked-on prime and finish coat over a phosphate coating.
         3) Fluorocarbon Finish: AAMA 621, high performance organic coating.

2.6 THROUGH-WALL FLASHINGS

A. Form through-wall flashing to provide a mechanical bond or key against lateral movement in all directions. Install a sheet having 2 mm (1/16 inch) deep transverse channels spaced four to every 25 mm (one inch), or ribbed diagonal pattern, or having other deformation unless specified otherwise.
   1. Fabricate in not less than 2400 mm (8 feet) lengths; 3000 mm (10 feet) maximum lengths.

2. Fabricate so keying nests at overlaps.

B. For Masonry Work When Concealed Except for Drip:

1. Copper.
2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
3. Form exposed portions of flashing with drip, approximately 6 mm (1/4 inch) projection beyond wall face.

C. For Masonry Work When Exposed Edge Forms a Receiver for Counter Flashing:

1. Use same metal and thickness as counter flashing.
2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
3. Form exposed portion as snap lock receiver for counter flashing upper edge.

D. For Flashing at Architectural Precast Concrete Panels or Stone Panels.

1. Form exposed portions with drip as specified or receiver.

E. Window Sill Flashing and Lintel Flashing:

1. Use either copper, or nonreinforced elastomeric sheeting, bituminous coated copper, copper covered paper, or polyethylene coated copper.
2. Fabricate flashing at ends with folded corners to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening.
3. Turn up back edge as shown.
4. Form exposed portion with drip as specified or receiver.

F. Door Sill Flashing:

1. Where concealed, use 0.5 Kg (20 ounce) copper.
2. Where shown on drawings as combined counter flashing under threshold, sill plate, door sill, or where subject to foot traffic, use 0.6 Kg (24 ounce) copper.
3. Fabricate flashing at ends to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening with folded corners.

2.7 BASE FLASHING

A. Use metal base flashing at vertical surfaces intersecting built-up roofing without cant strips or where shown.

1. Use copper.
2. When flashing is over 250 mm (10 inches) in vertical height or horizontal width use 0.5 Kg (20 oz) copper.
3. Use stainless steel at aluminum roof curbs where flashing contacts the aluminum.
4. Use copper at pipe flashings.

B. Fabricate metal base flashing up vertical surfaces not less than 200 mm (8 inch) nor more than 400 mm (16 inch).

C. Fabricate roof flange not less than 100 mm (4 inches) wide unless shown otherwise. When base flashing length exceeds 2400 mm (8 feet) form flange edge with 13 mm (1/2 inch) hem to receive cleats.

D. Form base flashing bent from strip except pipe flashing. Fabricate ends for riveted soldered lap seam joints. Fabricate expansion joint ends as specified.

E. Pipe Flashing: (Other than engine exhaust or flue stack)

1. Fabricate roof flange not less than 100 mm (4 inches) beyond sleeve on all sides.
2. Extend sleeve up and around pipe and flange out at bottom not less than 13 mm (1/2 inch) and solder to flange and sleeve seam to make watertight.
3. At low pipes 200 mm (8 inch) to 450 mm (18 inch) above roof:
   a. Form top of sleeve to turn down into the pipe at least 25 mm (one inch).
   b. Allow for loose fit around and into the pipe.
4. At high pipes and pipes with goosenecks or other obstructions which would prevent turning the flashing down into the pipe:
   a. Extend sleeve up not less than 300 mm (12 inch) above roofing.
   b. Allow for loose fit around pipe.

2.8 COUNTERFLASHING (CAP FLASHING OR HOODS)

A. Copper, unless specified otherwise.

B. Fabricate to lap base flashing a minimum of 100 mm (4 inches) with drip:

1. Form lock seams for outside corners. Allow for lap joints at ends and inside corners.
2. In general, form flashing in lengths not less than 2400 mm (8 feet) and not more than 3000 mm (10 feet).
3. Two-piece, lock in type flashing may be used in-lieu-of one piece counter-flashing.
4. Manufactured assemblies may be used.
5. Where counterflashing is installed at new work use an integral flange at the top designed to be extended into the masonry joint or reglet in concrete.

6. Where counterflashing is installed at existing work use surface applied type, formed to provide a space for the application of sealant at the top edge.

C. One-piece Counterflashing:
1. Back edge turned up and fabricate to lock into reglet in concrete.
2. Upper edge formed to extend full depth of masonry unit in mortar joint with back edge turned up 6 mm (1/4 inch).

D. Two-Piece Counterflashing:
1. Receiver to extend into masonry wall depth of masonry unit with back edge turned up 6 mm (1/4 inch) and exposed edge designed to receive and lock counterflashing upper edge when inserted.
2. Counterflashing upper edge designed to snap lock into receiver.

E. Surface Mounted Counterflashing; one or two piece:
1. Use at existing or new surfaces where flashing cannot be inserted in vertical surface.
2. One piece fabricate upper edge folded double for 65 mm (2 1/2 inches) with top 19 mm (3/4 inch) bent out to form "V" joint sealant pocket with vertical surface. Perforate flat double area against vertical surface with horizontally slotted fastener holes at 400 mm (16 inch) centers between end holes. Option: One piece surface mounted counter-flashing (cap flashing) may be used. Fabricate as detailed on Plate 51 of SMACNA Architectural Sheet Metal Manual.
3. Two pieces: Fabricate upper edge to lock into surface mounted receiver. Fabricate receiver joint sealant pocket on upper edge and lower edge to receive counterflashing, with slotted fastener holes at 400 mm (16 inch) centers between upper and lower edge.

F. Pipe Counterflashing:
1. Form flashing for water-tight umbrella with upper portion against pipe to receive a draw band and upper edge to form a "V" joint sealant receiver approximately 19 mm (3/4 inch) deep.
2. Fabricate 100 mm (4 inch) over lap at end.
3. Fabricate draw band of same metal as counter flashing. Use 0.6 Kg (24 oz) copper.
4. Use stainless steel bolts on draw band tightening assembly.
5. Vent pipe counter flashing may be fabricated to omit draw band and turn down 25 mm (one inch) inside vent pipe.

G. Where vented edge decks intersect vertical surfaces, form in one piece, shape to slope down to a point level with and in front of edge-set notched plank; then, down vertically, overlapping base flashing.

2.9 GRAVEL STOPS

A. General:

1. Fabricate in lengths not less than 2400 mm (8 feet) long and maximum of 3000 mm (10 feet).
2. Fabricate internal and external corners as one-piece with legs not less than 600 mm (2 feet) or more than 1200 mm (4 feet) long.
3. Fabricate roof flange not less than 100 mm (4 inches) wide.
4. Fabricate top edge to extend above roof not less than 25 mm (one inch) for embedded gravel aggregate and not less than 100 mm (4 inches) for loose laid ballast.
5. Fabricate lower edge outward at an angle of 45 degrees to form drip and as fascia or as counter flashing as shown:
   a. Fabricate of one-piece material of suitable width for fascia height of 250 mm (10 inch) maximum or counterflashing lap of not less than 100 mm (4 inch) over base flashing.
   b. Fabricate bottom edge of formed fascia to receive edge strip.
   c. When fascia bottom edge forms counter flashing over roofing lap roofing not less than 150 mm (6 inches).

B. Formed Flat Sheet Metal Gravel Stops and Fascia:

1. Fabricate as shown of 0.5 Kg (20 ounce) copper or 1.25 mm (0.050 inch) thick aluminum.
2. When fascia exceeds 150 mm (6 inches) in depth, form one or more horizontal stops not less than 13 mm (1/2 inch) high in the fascia.
3. Fabricate as two-piece fascia when fascia depth exceeds 250 mm (10 inches).
4. At joint between ends of sheets, provide a concealed clip soldered or welded near one end of each sheet to hold the adjoining sheet in lapped position. The clip shall be approximately 100 mm (4 inches) wide and shall be the full depth of the fascia less 25 mm (one inch) at top and bottom. Clip shall be of the same thickness as the fascia.
5. Provide edge strip as specified with lower hooked edge bent outward at an angle of 45 degrees.

C. Formed (Corrugated Sheet) Sheet Metal Gravel Stops and Fascia:

1. Fabricate as shown of 0.5 Kg (16 ounce) copper or0.8 mm (0.032 inch) thick aluminum.
2. Sheets shall have 2 mm (1/16 inch) deep corrugations either transversely or diagonally rolled into the sheet. Crimped sheets are not acceptable.
3. Factory fabricate prepackaged system, complete with fastenings.
4. Provide concealed flashing splice plate at joints not less than 150 mm (6 inches) long and continuous edge strip at lower edge of fascia made from same metal.
5. Fabricate as two-piece fascia when fascia depth exceeds 175 mm (7 inches).

2.10 BITUMEN STOPS

A. Fabricate bitumen stops for bituminous roofing edges for use with formed sheet metal gravel stops, pipe penetrations, and other penetrations through roof deck without a curb.

B. Fabricate with 19 mm (3/4 inch) vertical legs and 75 mm (3 inch) horizontal legs.

C. When used with gravel stop or metal base flashing use same metal for bitumen stop in thickness specified for concealed locations.

2.11 HANGING GUTTERS – NOT USED

2.12 CONDUCTORS (DOWNSPOUTS)- NOT USED

2.13 SPLASHPANS – NOT USED

2.14 REGLETS

A. Fabricate reglets of one of the following materials:
   1. 0.4 Kg (16 ounce) copper.
   2. Plastic coated extruded aluminum, not less than 1.4 mm (0.055 inch) thick prefilled with butyl rubber sealer and complete with plastic wedges inserted at 1000 mm (40 inches) on centers.
   3. Plastic, ASTM D1784, Type II, not less than 2 mm (0.075 inch) thick.

B. Fill open-type reglets with fiberboard or other suitable separator, to prevent crushing of the slot during installation.

C. Bend edges of reglets for setting into concrete to an angle of not less than 45 degrees, and make wide enough to provide firm anchorage in the concrete.

D. Fabricate reglets for building into horizontal masonry mortar joints not less than 19 mm (3/4 inch) deep, nor more than 25 mm (one inch) deep.

E. Fabricate mitered corners, fittings, and special shapes as may be required by details.

F. Reglets for concrete may be formed to receive flashing and have a 10 mm (3/8 inch), 45 degree snap lock.

2.15 INSULATED EXPANSION JOINT COVERS

A. Either type optional, use only one type throughout.

B. Types:

1. Construct of two preformed, stainless steel strips, not less than 0.4 mm (0.015 inch) thick, mechanically and adhesively bonded to both sides of a 2 mm (1/16 inch) thick neoprene or butyl sheet, or to a 0.4 mm (32 mil) thick reinforced chlorinated polyethylene sheet. Adhesively attach a 10 mm (3/8 inch) thick sheet of closed cell, neoprene foam insulation, to the underside of the neoprene, butyl, or chlorinated polyethylene sheet.
2. Constructed of a 2 mm (1/16 inch) thick vinyl sheet, flanged at both sides with stainless steel strips not less than 0.4 mm (0.015 inch) thick. Vinyl sheet locked and encased by the stainless steel strip and prepunched for nailing. A 10 mm (3/8 inch) thick closed cell polyvinyl chloride foam insulating strip shall be heat laminated to the underside of the vinyl sheet between the stainless steel strips.

C. Expansion joint covers shall have factory fabricated mitered corners, crossing tees, and other necessary accessories. Furnish in the longest available lengths.

D. Metal flange of sufficient width to extend over the top of the curb and down curb sides 50 mm (2 inches) with hemmed edge for lock to edge strip.

2.16 ENGINE EXHAUST PIPE OR FLUE OR STACK FLASHING

A. Flashing at penetrations through roofing shall consist of a metal collar, sheet metal flashing sleeve and hood.

B. Fabricate collar with roof flange of 1.2 mm (0.047 inch) minimum thick black iron or galvanized steel sheet.

1. Fabricate inside diameter of collar 100 mm (4 inches) larger than the outside diameter of the item penetration the roofing.
2. Extend collar height from structural roof deck to not less than 350 mm (14 inches) above roof surface.
3. Fabricate collar roof flange not less than 100 mm (4 inches) wide.

4. Option: Collar may be of steel tubing 3 mm (0.125 inch) minimum wall thickness, with not less than four, 50 mm x 100 mm x 3 mm (2 inch by 4 inch by 0.125 inch) thick tabs bottom edge evenly spaced around tube in lieu of continuous roof flange. Full butt weld joints of collar.

C. Fabricate sleeve base flashing with roof flange of copper.
   1. Fabricate sleeve roof flange not less than 100 mm (4 inches) wide.
   2. Extend sleeve around collar up to top of collar.
   3. Flange bottom of sleeve out not less than 13 mm (1/24 inch) and soldered to 100 mm (4 inch) wide flange to make watertight.
   4. Fabricate interior diameter 50 mm (2 inch) greater than collar.

D. Fabricate hood counter flashing from same material and thickness as sleeve.
   1. Fabricate the same as pipe counter flashing except allow not less than 100 mm (4 inch) lap below top of sleeve and to form vent space minimum of 100 mm (4 inch) wide.
   2. Hem bottom edge of hood 13 mm (1/2 inch).
   3. Provide a 50 mm (2 inch) deep drawband.

E. Fabricate insect screen closure between sleeve and hood. Secure screen to sleeve with sheet metal screws.

2.17 SCUPPERS – NOT USED

2.18 GOOSENECK ROOF VENTILATORS – NOT USED

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Install flashing and sheet metal items as shown in Sheet Metal and Air Conditioning Contractors National Association, Inc., publication, ARCHITECTURAL SHEET METAL MANUAL, except as otherwise shown or specified.
   2. Apply Sealant as specified in Section 07 92 00, JOINT SEALANTS.
   3. Apply sheet metal and other flashing material to surfaces which are smooth, sound, clean, dry and free from defects that might affect the application.
   4. Remove projections which would puncture the materials and fill holes and depressions with material compatible with the substrate. Cover holes or cracks in wood wider than 6 mm (1/4 inch) with sheet metal compatible with the roofing and flashing material used.

5. Coordinate with masonry work for the application of a skim coat of mortar to surfaces of unit masonry to receive flashing material before the application of flashing.
6. Apply a layer of 7 Kg (15 pound) saturated felt followed by a layer of rosin paper to wood surfaces to be covered with copper. Lap each ply 50 mm (2 inch) with the slope and nail with large headed copper nails.
7. Confine direct nailing of sheet metal to strips 300 mm (12 inch) or less wide. Nail flashing along one edge only. Space nail not over 100 mm (4 inches) on center unless specified otherwise.
8. Install bolts, rivets, and screws where indicated, specified, or required in accordance with the SMACNA Sheet Metal Manual. Space rivets at 75 mm (3 inch) on centers in two rows in a staggered position. Use neoprene washers under fastener heads when fastener head is exposed.
9. Coordinate with roofing work for the installation of metal base flashings and other metal items having roof flanges for anchorage and watertight installation.
10. Nail continuous cleats on 75 mm (3 inch) on centers in two rows in a staggered position.
11. Nail individual cleats with two nails and bend end tab over nail heads. Lock other end of cleat into hemmed edge.
12. Install flashings in conjunction with other trades so that flashings are inserted in other materials and joined together to provide a water tight installation.
13. Where required to prevent galvanic action between dissimilar metal isolate the contact areas of dissimilar metal with sheet lead, waterproof building paper, or a coat of bituminous paint.
14. Isolate aluminum in contact with dissimilar metals others than stainless steel, white bronze or other metal compatible with aluminum by:
    a. Paint dissimilar metal with a prime coat of zinc-chromate or other suitable primer, followed by two coats of aluminum paint.
    b. Paint dissimilar metal with a coat of bituminous paint.
    c. Apply an approved caulking material between aluminum and dissimilar metal.

15. Paint aluminum in contact with or built into mortar, concrete, plaster, or other masonry materials with a coat of bituminous paint.
16. Paint aluminum in contact with absorptive materials that may become repeatedly wet with two coats of bituminous paint or two coats of aluminum paint.
17. Bitumen Stops:
    a. Install bitumen stops for built-up roof opening penetrations through deck and at formed sheet metal gravel stops.
    b. Nail leg of bitumen stop at 300 mm (12 inch) intervals to nailing strip at roof edge before roofing material is installed.

3.2 THROUGH-WALL FLASHING

A. General:

1. Install continuous through-wall flashing between top of concrete foundation walls and bottom of masonry building walls; at top of concrete floors; under masonry, concrete, or stone copings and elsewhere as shown.
2. Where exposed portions are used as a counterflashings, lap base flashings at least 100 mm (4 inches) and use thickness of metal as specified for exposed locations.
3. Exposed edge of flashing may be formed as a receiver for two piece counter flashing as specified.
4. Terminate exterior edge beyond face of wall approximately 6 mm (1/4 inch) with drip edge where not part of counter flashing.
5. Turn back edge up 6 mm (1/4 inch) unless noted otherwise where flashing terminates in mortar joint or hollow masonry unit joint.
6. Terminate interior raised edge in masonry backup unit approximately 38 mm (1 1/2 inch) into unit unless shown otherwise.
7. Under copings terminate both edges beyond face of wall approximately 6 mm (1/4 inch) with drip edge.
8. Lap end joints at least two corrugations, but not less than 100 mm (4 inches). Seal laps with sealant.
9. Where dowels, reinforcing bars and fastening devices penetrate flashing, seal penetration with sealing compound. Sealing compound is specified in Section 07 92 00, JOINT SEALANTS.
10. Coordinate with other work to set in a bed of mortar above and below flashing so that total thickness of the two layers of mortar and flashing are same as regular mortar joint.

11. Where ends of flashing terminate turn ends up 25 mm (1 inch) and fold corners to form dam extending to wall face in vertical mortar or veneer joint.
12. Turn flashing up not less than 200 mm (8 inch) between masonry or behind exterior veneer.
13. When flashing terminates in reglet extend flashing full depth into reglet and secure with lead or plastic wedges spaced 150 mm (6 inch) on center.
14. Continue flashing around columns:
    a. Where flashing cannot be inserted in column reglet hold flashing vertical leg against column.
    b. Counterflash top edge with 75 mm (3 inch) wide strip of saturated cotton unless shown otherwise. Secure cotton strip with roof cement to column. Lap base flashing with cotton strip 38 mm (1 1/2 inch).

B. Flashing at Top of Concrete Foundation Walls Where concrete is exposed. Turn up not less than 200 mm (8 inch) high and into masonry backup mortar joint or reglet in concrete backup as specified.

C. Flashing at Top of Concrete Floors (except where shelf angles occur): Place flashing in horizontal masonry joint not less than 200 mm (8 inch) below floor slab and extend into backup masonry joint at floor slab 38 mm (1 1/2 inch).

D. Flashing at Cavity Wall Construction: Where flashing occurs in cavity walls turn vertical portion up against backup under waterproofing, if any, into mortar joint. Turn up over insulation, if any, and horizontally through insulation into mortar joint.

E. Flashing at Veneer Walls:
    1. Install near line of finish floors over shelf angles or where shown.
    2. Turn up against sheathing.
    3. At stud framing, hem top edge 19 mm (3/4 inch) and secure to each stud with stainless steel fasteners through sheathing.
    4. At concrete backing, extend flashing into reglet as specified.
    5. Coordinate with installation of waterproofing or asphalt felt for lap over top of flashing.

F. Lintel Flashing when not part of shelf angle flashing:
    1. Install flashing full length of lintel to nearest vertical joint in masonry over veneer.

2. Turn ends up 25 mm (one inch) and fold corners to form dam and extend end to face of wall.
3. Turn back edge up to top of lintel; terminate back edge as specified for back-up wall.

G. Window Sill Flashing:
1. Install flashing to extend not less than 100 mm (4 inch) beyond ends of sill into vertical joint of masonry or veneer.
2. Turn back edge up to terminate under window frame.
3. Turn ends up 25 mm (one inch) and fold corners to form dam and extend to face of wall.

H. Door Sill Flashing:
1. Install flashing under bottom of plate sills of doors over curbs opening onto roofs. Extend flashing out to form counter flashing or receiver for counter flashing over base flashing. Set in sealant.
2. Extend sill flashing 200 mm (8 inch) beyond jamb opening. Turn ends up one inch in vertical masonry joint, extend end to face of wall. Join to counter flashing for water tight joint.
3. Where doors thresholds cover over waterproof membranes install sill flashing over water proof membrane under thresholds. Extend beyond opening to cover exposed portion of waterproof membrane and not less than 150 mm (6 inch) beyond door jamb opening at ends. Turn up approximately 6 mm (1/4 inch) under threshold.

I. Flashing at Masonry, Stone, or Precast Concrete Copings:
1. Install flashing with drips on both wall faces unless shown otherwise.
2. Form penetration openings to fit tight against dowel or other item with edge turned up. Seal penetrations with sealant.

3.3 BASE FLASHING

A. Install where roof membrane type base flashing is not used and where shown.
1. Install flashing at intersections of roofs with vertical surfaces or at penetrations through roofs, to provide watertight construction.
2. Install metal flashings and accessories having flanges extending out on top of the built-up roofing before final bituminous coat and roof aggregate is applied.
3. Set flanges in heavy trowel coat of roof cement and nail through flanges into wood nailers over bituminous roofing.

4. Secure flange by nailing through roofing into wood blocking with nails spaced 75 mm (3 inch) on centers or, when flange over 100 mm (4 inch) wide terminate in a 13 mm (1/2 inch) folded edge anchored with cleats spaced 200 mm (8 inch) on center. Secure one end of cleat over nail heads. Lock other end into the seam.

B. For long runs of base flashings install in lengths of not less than 2400 mm (8 feet) nor more than 3000 mm (ten feet). Install a 75 mm (3 inch) wide slip type, loose lock expansion joint filled with sealant in joints of base flashing sections over 2400 mm (8 feet) in length. Lock and solder corner joints at corners.

C. Extend base flashing up under counter flashing of roof specialties and accessories or equipment not less than 75 mm (3 inch).

3.4 COUNTERFLASHING (CAP FLASHING OR HOODS)

A. General:

1. Install counterflashing over and in conjunction with installation of base flashings, except as otherwise specified or shown.
2. Install counterflashing to lap base flashings not less than 100 mm (4 inch).
3. Install upper edge or top of counterflashing not less than 225 mm (9 inch) above top of the roofing.
4. Lap joints not less than 100 mm (4 inch). Stagger joints with relation to metal base flashing joints.
5. Use surface applied counterflashing on existing surfaces and new work where not possible to integrate into item.
6. When fastening to concrete or masonry, use screws driven in expansion shields set in concrete or masonry. Use screws to wood and sheet metal. Set fasteners in mortar joints of masonry work.

B. One Piece Counterflashing:

1. Where flashing is installed at new masonry, coordinate to insure proper height, embed in mortar, and end lap.
2. Where flashing is installed in reglet in concrete insert upper edge into reglet. Hold flashing in place with lead wedges spaced not more than 200 mm (8 inch) apart. Fill joint with sealant.
3. Where flashing is surface mounted on flat surfaces.
   a. When top edge is double folded anchor flat portion below sealant "V" joint with fasteners spaced not over 400 mm (16 inch) on center:

1) Locate fasteners in masonry mortar joints.
2) Use screws to sheet metal or wood.

b. Fill joint at top with sealant.

4. Where flashing or hood is mounted on pipe.
   a. Secure with draw band tight against pipe.
   b. Set hood and secure to pipe with a one by 25 mm x 3 mm (1 x 1/8 inch) bolt on stainless steel draw band type clamp, or a stainless worm gear type clamp.
   c. Completely fill joint at top with sealant.

C. Two-Piece Counterflashing:
   1. Where receiver is installed at new masonry coordinate to insure proper height, embed in mortar, and lap.
   2. Surface applied type receiver:
      a. Secure to face construction in accordance, with manufacturers' instructions.
      b. Completely fill space at the top edge of receiver with sealant.
   3. Insert counter flashing in receiver in accordance with fabricator or manufacturer's instructions and to fit tight against base flashing.

D. Where vented edge occur install so lower edge of counterflashing is against base flashing.

E. When counter flashing is a component of other flashing install as shown.

3.5 REGLETS

A. Install reglets in a manner to provide a watertight installation.

B. Locate reglets not less than 225 mm (9 inch) nor more than 400 mm (16 inch) above roofing, and not less than 125 mm (5 inch) nor more than 325 mm (13 inch) above cant strip.

C. Butt and align end joints or each section of reglet and securely hold in position until concrete or mortar are hardened:
   1. Coordinate reglets for anchorage into concrete with formwork construction.
   2. Coordinate reglets for masonry to locate horizontally into mortar joints.

3.6 GRAVEL STOPS

A. General:
   1. Install gravel stops and fascias with allowance for expansion at each joint; minimum of 6 mm (1/4 inch).

2. Extend roof flange of gravel stop and splice plates not less than four inches out over roofing and nail or screw to wood nailers. Space fasteners on 75 mm (3 inch) centers in staggered pattern.
3. Install continuous cleat for fascia drip edge. Secure with fasteners as close to lower edge as possible on 75 mm (3 inch) centers.
4. Where ends of gravel stops and fascias abut a vertical wall, provide a watertight, flashed and sealant filled joint.
5. Set flange in roof cement when installed over built-up roofing.
6. Edge securement for low-slope roofs: Low-slope membrane roof systems metal edge securement, except gutters, shall be designed in accordance with ANSI/SPRI/FM ES-1, except the basic wind speed shall be determined from Figure 1609, of IBC 2003.

B. Sheet metal gravel stops and fascia:
1. Install with end joints of splice plates sheets lapped three inches.
2. Hook the lower edge of fascia into a continuous edge strip.
3. Lock top section to bottom section for two-piece fascia.

C. Corrugated sheet gravel stops and fascia:
1. Install 300 mm (12 inch) wide sheet flashing centered under joint. A combination bottom and cover plate, extending above and beneath the joint, may be used.
2. Hook lower edge of fascia into a continuous edge strip.

D. Scuppers:
1. Install scupper with flange behind gravel stops; leave 6 mm (1/4 inch) joint to gravel stop.
2. Set scupper at roof water line and fasten to wood blocking.
3. Use sealant to seal joint with fascia gravel stops at ends.
4. Coordinate to lap over conductor head and to discharge water into conductor head.

3.7 COPINGS

A. General:
1. On walls topped with a wood plank, install a continuous edge strip on the front edge of the plank. Lock the coping to the edge strip with a 19 mm (3/4 inch) loose lock seam.
2. Where shown turn down roof side of coping and extend down over base flashing as specified for counter-flashing. Secure counter-flashing to lock strip in coping at continuous cleat.

3. Install ends adjoining existing construction so as to form space for installation of sealants. Sealant is specified in Section 07 92 00, JOINT SEALANTS.

B. Aluminum Coping:
1. Install with 6 mm (1/4 inch) joint between ends of coping sections.
2. Install joint covers, centered at each joint, and securely lock in place.

C. Copper Copings:
1. Join ends of sheets by a 19 mm (3/4 inch) locked and soldered seam, except at intervals of 9600 mm (32 feet), provide a 38 mm (1 1/2 inch) loose locked expansion joint filled with sealant or mastic.
2. At straight runs between 7200 mm (24 feet) and 19200 mm (64 feet) locate expansion joint at center.
3. At straight runs that exceed 9600 mm (32 feet) and form the leg of a corner locate the expansion joint not more than 4800 mm (16 feet) from the corner.

3.8 EXPANSION JOINT COVERS, INSULATED

A. Install insulated expansion joint covers at locations shown on curbs not less than 200 mm (8 inch) high above roof surface.

B. Install continuous edge strips of same metal as expansion joint flange, nailed at not less than 75 mm (3 inch) centers.

C. Install insulated expansion joint covers in accordance with manufacturer's directions locking edges to edge strips.

3.9 ENGINE EXHAUST PIPE OR STACK FLASHING

A. Set collar where shown and secure roof tabs or flange of collar to structural deck with 13 mm (1/2 inch) diameter bolts.

B. Set flange of sleeve base flashing not less than 100 mm (4 inch) beyond collar on all sides as specified for base flashing.

C. Install hood to above the top of the sleeve 50 mm (2 inch) and to extend from sleeve same distance as space between collar and sleeve beyond edge not sleeve:
1. Install insect screen to fit between bottom edge of hood and side of sleeve.
2. Set collar of hood in high temperature sealant and secure with one by 3 mm (1/8 inch) bolt on stainless steel draw band type, or stainless steel worm gear type clamp. Install sealant at top of head.

3.10 HANGING GUTTERS – NOT USED

3.11 CONDUCTORS (DOWNSPOUTS)- NOT USED

3.12 SPLASH PANS – NOT USED

3.13 GOOSENECK ROOF VENTILATORS – NOT USED

- - - E N D - - -

SECTION 07 71 00
ROOF SPECIALTIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies copings, gravel stops, fascias, and expansion joints.

1.2 RELATED WORK

A. Section 01 PRODUCT REQUIREMENTS: Sustainable Design Requirements.

B. Section 07 21 13, THERMAL INSULATION: General Insulation.

C. Section 07 22 00, ROOF AND DECK INSULATION: Rigid Insulations for Roofing.

D. Section 07 92 00, JOINT SEALANTS: Sealant Material and Installation.

1.3 QUALITY CONTROL

A. Provide roof accessories that products of manufacturers regularly engaged in producing the kinds of products specified.

B. For each accessory type provide products made by the same manufacturer.

C. Assemble each accessory to the greatest extent possible before delivery to the site.

D. Provide each accessory with FM approval listing for class specified.

1.4 PERFORMANCE REQUIREMENTS

A. Provide roof accessories that withstand exposure to weather and resist thermal movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, or installation.

B. Manufacture and install roof accessories to allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects.

1. Provide clips that resist rotation and avoid shear stress as a result of thermal movements.
2. For design purposes, base provisions for thermal movement on assumed ambient temperature (range) from minus 18 degrees C (0 degrees F), ambient to 82 degrees C (180 degrees F).

1.5 SUBMITTALS

A. Submit in accordance with Section 01 30 00 ADMINISTRATIVE REQUIREMENTS.

B. Sustainable Design Submittals, as described below:

1. Postconsumer and preconsumer recycled content as specified in PART 2 - PRODUCTS.

C. Samples: Representative sample panel of color-anodized aluminum not less than 101 x 101 mm (4 x 4 inches), except extrusions are to be of a width not less than section to be used. Submit sample that shows coating with integral color and texture. Include manufacturer's identifying label.

D. Shop Drawings: Each item specified showing design, details of construction, installation and fastenings.

E. Manufacturer's Literature and Data: Each item specified.

F. Certificates: Stating that aluminum has been given specified thickness of anodizing.

1.6 APPLICABLE PUBLICATIONS:

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. ASTM International (ASTM):

A240/A240M-20.....Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

A653/A653M-20.....Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process

A666-15.....Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

B209-14.....Aluminum and Aluminum Alloy-Sheet and Plate

B209M-14.....Aluminum and Aluminum Alloy-Sheet and Plate (Metric)

B221-14.....Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

B221M-13.....Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes (Metric)

B32-08(2014).....Solder Metal

B370-12(2019).....Copper Sheet and Strip for Building Construction

B882-10(2018).....Pre-Patinated Copper for Architectural Applications

C612-14(2019).....Mineral Fiber Block and Board Thermal Insulation

D1187/D1187M-97(2018)...Asphalt-Base Emulsions for Use as Protective Coatings for Metal

D1970/D1970M-20.....Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection

D226/D226M-17.....Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

D4869/D4969M-16a.....Asphalt-Saturated Organic Felt Underlayment Used In Steep Slope Roofing

C. National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500-06.....Metal Finishes Manual

D. American Architectural Manufacturers Association (AAMA):

2605-11.....High Performance Organic Coatings on Architectural Extrusions and Panels.

611-14.....Anodized Architectural Aluminum

E. FM Global (FM):

RoofNav.....Approved Roofing Assemblies and Products

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum, Extruded: ASTM B221M (B221).

B. Aluminum Sheet: ASTM B209M (B209).

C. Galvanized Sheet Steel: ASTM A653/A653M; G-90 coating.

D. Stainless-Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.

E. Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 or H01 temper.

F. Recycled Content of Metal Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 30 percent.

G. Insulation: ASTM C612, Class 1 or 2.

H. Asphalt Coating: ASTM D1187, Type I, quick setting.

2.2 UNDERLAYMENT

A. Self-Adhering Modified Bitumen Underlayment:

1. Provide self-adhering modified bitumen membrane underlayment material in compliance with ASTM D1970/D1970M, suitable for use as underlayment for metal copings and fascias.

2. Provide membrane resistant to cyclical elevated temperatures for extended period of time in high heat service conditions (stable after testing at 116 degrees C (240 degrees F)).
3. Provide membrane with integral non-tacking top surface of polyethylene film or other surface material to serve as separator between bituminous material and metal products to be applied above.
4. Provide primer.

B. Felt Underlayment: Provide No. 30 asphalt saturated organic, non-perforated felt underlayment in compliance with ASTM D226/D226M, Type II, or ASTM D4869/D4869M.

C. Slip Sheet: Provide 0.24 kg per square meter (5 pounds per 100 sf) rosin sized unsaturated building paper for slip sheet.

2.3 SOLDER

A. Copper Solder conforming to ASTM B32, lead-free solder.

2.4 COPINGS

A. Fabricate of aluminum sheet not less than 0.125 inch thick; 16 oz. copper.

B. Turn outer edges down each face of wall as shown on construction documents.

C. Maximum lengths of 3.05 M (10 feet).

D. Shop fabricate external and internal corners as one-piece assemblies with not less than 305 mm (12 inch) leg lengths.

E. Provide 101 mm (4 inch) wide 0.81 mm (0.032 inch) thick watertight joint covers.

F. Provide anchor gutter bar of 0.81 mm (0.032 inch) thick with anchor holes formed for underside of joint.

G. Provide concealed guttered splice plate of 0.81 mm (0.032 inch) thick with butyl or other resilient seal strips anchored to splice plate for underside of joint. Use galvanized steel anchor plate providing compression spring anchoring of coping cover.

H. Finish: Clear anodic.

2.5 EXTRUDED ALUMINUM GRAVEL STOPS AND FASCIAS

A. Fabricate of aluminum not less than 2 mm (0.078 inch) thick.

B. Turn fascia down face of wall and up above roof as shown in construction documents.

C. Maximum lengths of 3.05 M (10-feet).

D. Shop fabricate external and internal corners as one (1)-piece assemblies with not less than 305 mm (12 inch) leg lengths.
E. Provide 101 mm (4 inch) wide 2 mm (0.078 inch) thick watertight joint covers with 152 mm (6 inch) wide 0.8 mm (0.030 inch) thick underside joint flashing.
F. Finish: Clear anodic.

2.6 EXTRUDED ALUMINUM FASCIA-CANT SYSTEM

A. The fascia-cant system consists of three (3) pieces, an extruded aluminum fascia, a galvanized steel cant, and an aluminum compression clamp.
B. Furnish in stock lengths of not more than 3.05 M (10 feet) long.
C. Form fascia from not less than 2 mm (0.070 inch) thick aluminum. Provide 101 mm (4 inch) wide 0.81 mm (0.032-inch) thick concealed sheet aluminum joint cover plates in back of fascia.
D. Form cant strip from galvanized steel not less than 0.75 mm (0.0299 inch) thick, to profile shown and design to hold lower edge of the fascia.
E. Form compression clamp of not less than 0.81 mm (0.032 inch) thick aluminum designed to hold the top edge of the fascia and the built-up flashing.
F. Internal and external corners:
   1. Factory fabricate and fully weld mitered joints.
   2. Furnish corner sections in manufacturers standard sizes with not less than 305 mm (12 inch) leg lengths.
G. Finish on aluminum: Clear anodic.

2.7 EXTRUDED ALUMINUM ROOF EXPANSION JOINT COVERS – NOT REQUIRED

2.8 FINISH:

A. In accordance with NAAMM AMP 500-505.
B. Aluminum, Clear Anodic Finish AAMA 611, Class I, 0.017 mm (0.7 mil) thick (min.).
C. Copper Sheet Finishes: Non-Patinated Finish: Mill finish.
D. Stainless-Steel Finish: No. 4 (bright, polished directional satin).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine substrates, areas, and conditions, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.

C. Underlayment Installation:

1. Self-Adhering Sheet Underlayment:
   a. Apply primer as required by manufacturer.
   b. Comply with temperature restrictions of underlayment manufacturer for installation.
   c. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than 152 mm (6 inches) staggered 610 mm (24 inches) between courses.
   d. Overlap side edges not less than 89 mm (3-1/2 inches). Roll laps with roller.
   e. Cover underlayment within 14 days.
   f. Apply continuously under copings and roof-edge fascias and gravel stops.
   g. Coordinate application of self-adhering sheet underlayment under roof specialties with requirements for continuity with adjacent air barrier materials.
2. Felt Underlayment:
   a. Install with adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties.
   b. Apply in shingle fashion to shed water, with lapped joints of not less than 50 mm (2 inches).
3. Slip Sheet:
   a. Install with tape or adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties.
   b. Apply in shingle fashion to shed water, with lapped joints of not less than 50 mm (2 inches).

D. Install roof accessories where indicated in construction documents.

E. Secure with fasteners in accordance with manufacture's printed installation instructions and approved shop drawings unless shown otherwise. Provide fasteners suitable for application, for metal types being secured and designed to meet performance requirements.

F. Where soldered joints are required, clean surfaces to be soldered, removing oils and foreign matter.
   1. Pre-tin edges of sheets to be soldered to a width of 38 mm (1-1/2 inches).
   2. Reduce pre-tinning where pre-tinned surface would show in completed work.
   3. Tin edges of uncoated copper sheets using solder for copper.
   4. Do not use torches for soldering.
   5. Heat surfaces to receive solder and flow solder into joint.
   6. Fill joint completely.
   7. Completely remove flux and spatter from exposed surfaces.
G. Coordinate to install insulation where shown; see Section 07 21 13, THERMAL INSULATION and Section 07 22 00, ROOF AND DECK INSULATION.
H. Comply with section 07 92 00, JOINT SEALANTS to install sealants where required by manufactures installation instructions.
I. Coordinate with roofing work for installation of items in sequence to prevent water infiltration.
J. Gravel Stops and Fascias:
   1. Install gravel stops and fascia with butt joints with approximately 6 mm (1/4 inch) space for expansion.
   2. Over each joint provide cover plates of sheet aluminum, complete with concealed sheet aluminum flashing, centered under each joint.
   3. Provide lap cover plates and concealed flashing over the gravel stop and fascia not less than 101 mm (4 inches).
   4. Extend concealed flashing over built-up roofing, embed in roof cement and turn down over face of blocking at roof edge.
K. Aluminum Coping:
   1. Install sections of coping with approximately 6 mm (1/4-inch) space between ends of sections.
   2. Center joint gutter bar and covers at joints and lock in place.
   3. When snap-on system is installed ensure front and back edges are locked in place.
L. Fascia-Cant System:
   1. Install galvanized steel cant; coordinate with roofing work and after completion of roofing work install extruded aluminum fascia, concealed joint cover plate, and aluminum compression clamp, where shown in construction documents.

2. Install system to allow for expansion and contraction with 6 mm (1/4 inch) space between extruded aluminum members and galvanized steel cant as required by manufacturer of system.
3. Offset joints in extruded aluminum members from galvanized steel cant joints.

M. Expansion Joint Covers:
1. Install to terminate base flashing 203 mm (8 inches) above roof.
2. Install moisture seals to drain water to outlets that do not permit water to enter building.
3. Provide stainless steel screws when exposed.
4. Three piece assembly:
   a. Install curb section with screws to wood blocking, allowing 6 mm (1/4 inch) at butt joints between sections with splice plate at joint.
   b. Install cant to wood blocking by nailing along horizontal flange every 152 mm (6 inches), with galvanized roofing nails 25 mm (1 inch) long.
   c. After completion of base flashing install cap flashing and compression clamp and fasten to the curb or metal cant with stainless steel self-tapping screws with neoprene washers under head spaced approximately 457 mm (18 inches) on center.
   d. Install expansion joint cover with a 6 mm (1/4 inch) wide end joints.
   e. Install over end joint a cover plate complete with concealed aluminum flashing, centered under each joint. Fabricate flashing to lap cover not less than 101 mm (4 inches.
5. Two piece assembly:
   a. Install curb section with screws allowing 6 mm (1/4 inch) space at end joints with splice plate at joint.
   b. After completion of base flashing bend down cap flashing flange and secure to blocking with screws.
   c. Install expansion joint cover with 6 mm (1/4 inch) wide space at end joints and tension bars at 610 mm (24 inches) on center.
   d. Install cover plates with formed aluminum flashing concealed and centered on joint. Flashing to lap cover not less than 101 mm (4 inches).

3.2 PROTECTION OF ALUMINUM

A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with two (2) coats of asphalt coating (complete coverage), or by separating the contact surfaces with a preformed neoprene tape having pressure sensitive adhesive coating on one (1) side.

B. Paint aluminum in contact with wood, concrete and masonry, or other absorptive materials, that may become repeatedly wet, with two (2) coats of asphalt coating.

3.3 ADJUSTING

A. Adjust expansion joints to close tightly and be watertight; insuring maximum allowance for building movement.

3.4 PROTECTION

A. Protect roof accessories from damage during installation and after completion of the work from subsequent construction.

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SECTION 07 72 00
ROOF ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies roof hatches; equipment supports; gravity ventilators; and metal grating roof walkway system.

1.2 RELATED WORK

A. Section 07 21 13, THERMAL INSULATION: General insulation.

B. Section 07 22 00, ROOF AND DECK INSULATION: Rigid insulations for roofing.

C. Section 07 92 00, JOINT SEALANTS: Sealant material and installation.

1.3 QUALITY ASSURANCE

A. Provide roof accessories that are the products of manufacturers regularly engaged in producing the kinds of products specified.

B. For each accessory type provide the same product made by the same manufacturer.

C. Assemble each accessory to the greatest extent possible before delivery to the site.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 30 00 ADMINISTRATIVE REQUIREMENTS.

B. Samples: Submit representative sample panel of color anodized aluminum not less than 101 x 101 mm (4 x 4 inches). For extrusions, submit width not less than section to be installed. Show coating with integral color and texture and include manufacturer's identifying label.

C. Shop Drawings: Each item specified showing design, details of construction, installation and fastenings.

D. Manufacturer's Literature and Data: Each item specified.

E. Certificates: Stating that aluminum has been given specified thickness of anodizing.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extend referenced. The publications are referenced in the text by the basic designation only.

B. ASTM International (ASTM):

A653/A653M-20.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) By the Hot-Dip Process

B209-14.....Aluminum and Aluminum-Alloy Sheet and Plate

B209M-14.....Aluminum and Aluminum-Alloy Sheet and Plate (Metric)

B221-14.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

B221M-13.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes (Metric)

C726-17.....Mineral Wool Roof Insulation Board

C1289-19.....Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board

D1187/D1187M-97(2018)...Asphalt-Base Emulsions for Use as Protective Coatings for Metal

C. National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500-06 Series.....Metal Finishes Manual

D. American Architectural Manufacturers Association (AAMA):

2603-20.....Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

2605-20.....Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Architectural Extrusions and Panels (with Coil Coating Appendix).

611-14.....Anodized Architectural Aluminum

621-02.....High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates

E. American Society of Civil Engineers (ASCE):

ASCE/SEI 7-16.....Minimum Design Loads and Associated Criteria for Buildings and Other Structures

F. U.S. Occupational Safety and Health Standards (OSHA):

29 CFR 1910 Subpart D... Walking-Working Surfaces (1910.21-1910.30)

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum, Extruded: ASTM B221M (B221).

B. Aluminum Sheet: ASTM B209M (B209).

C. Galvanized Sheet Steel: ASTM A653/A653M; G-90 coating.

2.2 ROOF HATCH (SCUTTLE)- NOT USED

2.3 EQUIPMENT SUPPORTS

A. Supported Load Capacity:300 lbs..

B. Fabricate equipment supports from 1.3 mm (0.0516 inch) thick galvanized ASTM A653/A653M steel fabricate with welded corners and with seams joined by continuous water and air tight welds.

C. Equipment supports to be internally reinforced with angles 1.22 m (48 inches) on center.

D. Form exterior curb with integral base.

E. Use galvanized steel liners for curbs having inside dimension over 305 mm (12 inches).

F. Internally insulate with 38 mm (1-1/2 inch) glass-fiber board insulation (ASTM C726).

G. Fabricate curb with a minimum height of 203 mm (8 inches) above roof surface.

H. Attach preservative treated wood nailers to top of curb. Provide 50 mm (2 inch) by 50 mm (2 inch) minimum nominal size on curb with openings and 50 mm (2 inch) thick, width of curb up to 305 mm (12 inches) on equipment support curbs.

I. Make size of supports suit size of equipment furnished, with height as shown on construction documents, but not less than 203 mm (8 inches) above roof surface.

J. Top of Equipment Supports: Level with pitch built into curb when deck slopes. Equip supports with water diverter or cricket on side that obstructs water flow.

2.4 LOW SILHOUETTE GRAVITY VENTILATORS

A. Fabricate base of 1 mm (0.04 inch) thick aluminum, and vent of 0.8 mm (0.032 inch) thick aluminum.

1. Height not to exceed 305 mm (12 inches) above top of roof curb.

2. Design ventilators to withstand 137 Km (85 miles) per hour wind velocity.
3. Provide ventilators with a removable 18 by 18 mesh by 0.28 mm (0.11 inch) diameter aluminum wire cloth insect screen.
4. Provide security grille where indicated on construction documents.

B. Construct damper of the same material as the ventilator and design to completely close opening or remain wide open. Hold damper in closed position by a brass chain and catch. Extend chains 305 mm (12 inches) below and engage catch when damper is closed.

2.5 METAL GRATING ROOF WALKWAY SYSTEM – NOT USED

2.6 FINISH:

A. In accordance with NAAMM AMP 500 Series.

B. Aluminum, Clear Finish AAMA 611: AA-M12C22A41 medium matte, clear anodic coating, Class I, Architectural, 0.018 mm (0.7 mils) thick (min.).

C. Aluminum Colored Finish AAMA 611: AA-C22A42 (anodized or AA-M12C22A44 (electrolytically deposited metallic compound) medium matte, integrally colored coating, Class 1, Architectural, 0.018 mm (0.7 mils) thick (min.).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof specialties where indicated on construction documents.

B. Secure with fasteners in accordance with manufacture's printed installation instructions and approved shop drawings unless shown otherwise.

C. Coordinate to install insulation where shown; see Section 07 21 13, THERMAL INSULATION and Section 07 22 00, ROOF AND DECK INSULATION.

D. Comply with section 07 92 00, JOINT SEALANTS to install sealants where required by manufactures installation instructions require sealant.

E. Coordinate with roofing work for installation of items in sequence to prevent water infiltration.

1. After completion of base flashing bend down cap flashing flange and secure to blocking with screws.
2. Install expansion joint cover with 6 mm (1/4 inch) wide space at end joints and tension bars at 610 mm (24 inches) on center.

3. Install cover plates with formed aluminum flashing concealed and centered on joint. Flashing to lap cover not less than 101 mm (4 inches).

F. Equipment Supports: Do not anchor to insulating concrete or metal deck. Anchor only to building structure as per manufacturers recommendations.

3.2 PROTECTION OF ALUMINUM

A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with two (2) coats of asphalt coating (complete coverage), or by separating the contact surfaces with a preformed neoprene tape having pressure sensitive adhesive coating on side.

B. Paint aluminum in contact with wood, concrete and masonry, or other absorptive materials, that may become repeatedly wet, with two coats of asphalt coating.

3.3 ADJUSTING

A. Adjust roof hatch hardware to operate freely and so that cover will operate without binding, close tightly at perimeter, and latch securely.

3.4 PROTECTION

A. Protect roof accessories from damage during installation and after completion of the work from subsequent construction.

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SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section covers interior and exterior sealant and their application, wherever required for complete installation of building materials or systems.

1.2 RELATED WORK (INCLUDING BUT NOT LIMITED TO THE FOLLOWING):

A. Sealing of Site Work Concrete Paving: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.

B. Masonry Control and Expansion Joint: Section 04 20 00, UNIT MASONRY.

C. NOT USED

D. Glazing: Section 08 80 00, GLAZING.

E. Mechanical Work: Section 22

1.3 QUALITY ASSURANCE:

A. Installer Qualifications: An experienced installer with a minimum of three (3) years' experience and who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance. Submit qualification.

B. Source Limitations: Obtain each type of joint sealant through one (1) source from a single manufacturer.

C. Product Testing: Obtain test results from a qualified testing agency based on testing current sealant formulations within a 12-month period.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021.
2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.
3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in peel, and indentation hardness.
4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

D. Lab Tests: Submit samples of materials that will be in contact or affect joint sealants to joint sealant manufacturers for tests as follows:
   1. Adhesion Testing: Before installing elastomeric sealants, test their adhesion to protect joint substrates according to the method in ASTM C794 to determine if primer or other specific joint preparation techniques are required.
   2. Compatibility Testing: Before installing elastomeric sealants, determine compatibility when in contact with glazing and gasket materials.
   3. Stain Testing: Perform testing per ASTM C1248 on interior and exterior sealants to determine if sealants or primers will stain adjacent surfaces. No sealant work is to start until results of these tests have been submitted to the Contracting Officer Representative (COR) and the COR has given written approval to proceed with the work.

E. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to joint substrates according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
   1. Locate test joints where indicated in construction documents or, if not indicated, as directed by COR.
   2. Conduct field tests for each application indicated below:
      a. Each type of elastomeric sealant and joint substrate indicated.
      b. Each type of non-elastomeric sealant and joint substrate indicated.
   3. Notify COR seven (7) days in advance of dates and times when test joints will be erected.
   4. Arrange for tests to take place with joint sealant manufacturer’s technical representative present.

F. Mockups: Before installing joint sealants, apply elastomeric sealants as follows to verify selections and to demonstrate aesthetic effects and qualities of materials and execution:
   1. Joints in mockups of assemblies that are indicated to receive elastomeric joint sealants.

1.4 CERTIFICATION:

A. Contractor is to submit to the COR written certification that joints are of the proper size and design, that the materials supplied are compatible with adjacent materials and backing, that the materials will properly perform to provide permanent watertight, airtight or vapor tight seals (as applicable), and that materials supplied meet specified performance requirements.

1.5 SUBMITTALS:

A. Submit in accordance with Section 01 30 00 ADMINISTRATIVE REQUIREMENTS.

B. Sustainable Design Submittals, as described below:

1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.

C. Installer qualifications.

D. Contractor certification.

E. Manufacturer's installation instructions for each product used.

F. Cured samples of exposed sealants for each color.

G. Manufacturer's Literature and Data:

1. Primers
2. Sealing compound, each type, including compatibility when different sealants are in contact with each other.

H. Manufacturer warranty.

1.6 PROJECT CONDITIONS:

A. Environmental Limitations:

1. Do not proceed with installation of joint sealants under following conditions:
   a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C (40 degrees F).
   b. When joint substrates are wet.

B. Joint-Width Conditions:

1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint-Substrate Conditions:

1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.7 DELIVERY, HANDLING, AND STORAGE:

A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.

B. Carefully handle and store to prevent inclusion of foreign materials.

C. Do not subject to sustained temperatures exceeding 32 degrees C (90 degrees F) or less than 5 degrees C (40 degrees F).

1.8 DEFINITIONS:

A. Definitions of terms in accordance with ASTM C717 and as specified.

B. Backing Rod: A type of sealant backing.

C. Bond Breakers: A type of sealant backing.

D. Filler: A sealant backing used behind a back-up rod.

1.9 WARRANTY:

A. Construction Warranty: Comply with FAR clause 52.246-21 "Warranty of Construction".

B. Manufacturer Warranty: Manufacturer shall warranty their sealant for a minimum of five (5) years from the date of installation and final acceptance by the Government. Submit manufacturer warranty.

1.10 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. ASTM International (ASTM):

C509-06.....Elastomeric Cellular Preformed Gasket and Sealing Material

C612-14.....Mineral Fiber Block and Board Thermal Insulation

C717-14a.....Standard Terminology of Building Seals and Sealants

C734-06(R2012).....Test Method for Low-Temperature Flexibility of Latex Sealants after Artificial Weathering

C794-10.....Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants

C919-12.....Use of Sealants in Acoustical Applications.

C920-14a.....Elastomeric Joint Sealants.

C1021-08(R2014).....Laboratories Engaged in Testing of Building Sealants

C1193-13.....Standard Guide for Use of Joint Sealants.
C1248-08(R2012).....Test Method for Staining of Porous Substrate by Joint Sealants
C1330-02(R2013).....Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants
C1521-13.....Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints
D217-10.....Test Methods for Cone Penetration of Lubricating Grease
D1056-14.....Specification for Flexible Cellular Materials—Sponge or Expanded Rubber
E84-09.....Surface Burning Characteristics of Building Materials

C. Sealant, Waterproofing and Restoration Institute (SWRI).
The Professionals' Guide

D. Environmental Protection Agency (EPA):
40 CFR 59(2014).....National Volatile Organic Compound Emission Standards for Consumer and Commercial Products

PART 2 - PRODUCTS

2.1 SEALANTS:

A. Exterior Sealants:
1. Vertical surfaces, provide non-staining ASTM C920, Type S or M, Grade NS, Class 25, Use NT.
2. Horizontal surfaces, provide ASTM C920, Type S or M, Grade P, Class 25, Use T.
3. Provide location(s) of exterior sealant as follows:
a. Joints formed where frames and subsills of windows, doors, louvers, and vents adjoin masonry, concrete, or metal frames. Provide sealant at exterior surfaces of exterior wall penetrations.
b. Metal to metal.
c. Masonry to masonry or stone.
d. Stone to stone.
e. Cast stone to cast stone.
f. Masonry expansion and control joints.
g. Wood to masonry.
h. Masonry joints where shelf angles occur.

i. Voids where items penetrate exterior walls.

j. Metal reglets, where flashing is inserted into masonry joints, and where flashing is penetrated by coping dowels.

B. Floor Joint Sealant:

1. ASTM C920, Type S or M, Grade P, Class 25, Use T.

2. Provide location(s) of floor joint sealant as follows.

a. Seats of metal thresholds exterior doors.

b. Control and expansion joints in floors, slabs, ceramic tile, and walkways.

C. Interior Sealants:

1. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system are to comply with the following limits for VOC content when calculated according to 40 CFR 59, (EPA Method 24):

a. Architectural Sealants: 250 g/L.

b. Sealant Primers for Nonporous Substrates: 250 g/L.

c. Sealant Primers for Porous Substrates: 775 g/L.

2. Vertical and Horizontal Surfaces: ASTM C920, Type S or M, Grade NS, Class 25, Use NT.

3. Provide location(s) of interior sealant as follows:

a. Typical narrow joint 6 mm, (1/4 inch) or less at walls and adjacent components.

b. Perimeter of doors, windows, access panels which adjoin concrete or masonry surfaces.

c. Interior surfaces of exterior wall penetrations.

d. Joints at masonry walls and columns, piers, concrete walls or exterior walls.

e. Perimeter of lead faced control windows and plaster or gypsum wallboard walls.

f. Exposed isolation joints at top of full height walls.

g. Joints between bathtubs and ceramic tile; joints between shower receptors and ceramic tile; joints formed where nonplanar tile surfaces meet.

h. Joints formed between tile floors and tile base cove; joints between tile and dissimilar materials; joints occurring where substrates change.

i. Behind escutcheon plates at valve pipe penetrations and showerheads in showers.

D. Acoustical Sealant:

1. Conforming to ASTM C919; flame spread of 25 or less; and a smoke developed rating of 50 or less when tested in accordance with ASTM E84. Acoustical sealant have a consistency of 250 to 310 when tested in accordance with ASTM D217; remain flexible and adhesive after 500 hours of accelerated weathering as specified in ASTM C734; and be non-staining.
2. Provide location(s) of acoustical sealant as follows:
   a. Exposed acoustical joint at sound rated partitions.
   b. Concealed acoustic joints at sound rated partitions.
   c. Joints where item pass-through sound rated partitions.

2.2 COLOR:

A. Sealants used with exposed masonry are to match color of mortar joints.

B. Sealants used with unpainted concrete are to match color of adjacent concrete.

C. Color of sealants for other locations to be light gray or aluminum, unless otherwise indicated in construction documents.

2.3 JOINT SEALANT BACKING:

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Type C: Closed-cell material with a surface skin.

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056 or synthetic rubber (ASTM C509), nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 32 degrees C (minus 26 degrees F). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

D. 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 where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.4 WEEPS:

A. Weep/Vent Products: Provide the following unless otherwise indicated or approved.

1. Round Plastic Tubing: Medium-density polyethylene, 10 mm (3/8-inch) OD by thickness of stone or masonry veneer.

2.5 FILLER:

A. Mineral fiberboard: ASTM C612, Class 1.

B. Thickness same as joint width.

C. Depth to fill void completely behind back-up rod.

2.6 PRIMER:

A. As recommended by manufacturer of caulking or sealant material.

B. Stain free type.

2.7 CLEANERS-NON POROUS SURFACES:

A. Chemical cleaners compatible with sealant and acceptable to manufacturer of sealants and sealant backing material. Cleaners to be free of oily residues and other substances capable of staining or harming joint substrates and adjacent non-porous surfaces and formulated to promote adhesion of sealant and substrates.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Inspect substrate surface for bond breaker contamination and unsound materials at adherent faces of sealant.

B. Coordinate for repair and resolution of unsound substrate materials.

C. Inspect for uniform joint widths and that dimensions are within tolerance established by sealant manufacturer.

3.2 PREPARATIONS:

A. Prepare joints in accordance with manufacturer's instructions and SWRI (The Professionals’ Guide).

B. Clean surfaces of joint to receive caulking or sealants leaving joint dry to the touch, free from frost, moisture, grease, oil, wax, lacquer paint, or other foreign matter that would tend to destroy or impair adhesion.

1. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to

produce a clean, sound substrate capable of developing optimum bond with joint sealants.

2. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include but are not limited to the following:
   a. Concrete.
   b. Masonry.
   c. Unglazed surfaces of ceramic tile.
3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous surfaces include but are not limited to the following:
   a. Metal.
   b. Glass.
   c. Porcelain enamel.
   d. Glazed surfaces of ceramic tile.

C. Do not cut or damage joint edges.

D. Apply non-staining masking tape to face of surfaces adjacent to joints before applying primers, caulking, or sealing compounds.
   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.

E. Apply primer to sides of joints wherever required by compound manufacturer's printed instructions or as indicated by pre-construction joint sealant substrate test.
   1. Apply primer prior to installation of back-up rod or bond breaker tape.
   2. Use brush or other approved means that will reach all parts of joints. Avoid application to or spillage onto adjacent substrate surfaces.

3.3 BACKING INSTALLATION:

A. Install backing material, to form joints enclosed on three sides as required for specified depth of sealant.

B. Where deep joints occur, install filler to fill space behind the backing rod and position the rod at proper depth.

C. Cut fillers installed by others to proper depth for installation of backing rod and sealants.

D. Install backing rod, without puncturing the material, to a uniform depth, within plus or minus 3 mm (1/8 inch) for sealant depths specified.

E. Where space for backing rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.

3.4 SEALANT DEPTHS AND GEOMETRY:

A. At widths up to 6 mm (1/4 inch), sealant depth equal to width.

B. At widths over 6 mm (1/4 inch), sealant depth 1/2 of width up to 13 mm (1/2 inch) maximum depth at center of joint with sealant thickness at center of joint approximately 1/2 of depth at adhesion surface.

3.5 INSTALLATION:

A. General:

1. Apply sealants and caulking only when ambient temperature is between 5 degrees C and 38 degrees C (40 degrees and 100 degrees F).
2. Do not install polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementitious materials may be present.
3. Do not install sealant type listed by manufacture as not suitable for use in locations specified.
4. Apply caulking and sealing compound in accordance with manufacturer's printed instructions.
5. Avoid dropping or smearing compound on adjacent surfaces.
6. Fill joints solidly with compound and finish compound smooth.
7. Tool exposed joints to form smooth and uniform beds, with slightly concave surface conforming to joint configuration per Figure 5A in ASTM C1193 unless shown or specified otherwise in construction documents. Remove masking tape immediately after tooling of sealant and before sealant face starts to “skin” over. Remove any excess sealant from adjacent surfaces of joint, leaving the working in a clean finished condition.
8. Finish paving or floor joints flush unless joint is otherwise detailed.
9. Apply compounds with nozzle size to fit joint width.

10. Test sealants for compatibility with each other and substrate. Use only compatible sealant. Submit test reports.
11. Replace sealant which is damaged during construction process.

B. Weeps: Place weep holes and vents in joints where moisture may accumulate, including at base of cavity walls, above shelf angles, at all flashing, and as indicated on construction documents.
1. Use round plastic tubing to form weep holes.
2. Space weep holes formed from plastic tubing not more than 406 mm (16 inches) o.c.
3. Trim tubing material used in weep holes flush with exterior wall face after sealant has set.

C. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise. Take all necessary steps to prevent three-sided adhesion of sealants.

D. Interior Sealants: Where gypsum board partitions are of sound rated, fire rated, or smoke barrier construction, follow requirements of ASTM C919 only to seal all cut-outs and intersections with the adjoining construction unless specified otherwise.
1. Apply a 6 mm (1/4 inch) minimum bead of sealant each side of runners (tracks), including those used at partition intersections with dissimilar wall construction.
2. Coordinate with application of gypsum board to install sealant immediately prior to application of gypsum board.
3. Partition intersections: Seal edges of face layer of gypsum board abutting intersecting partitions, before taping and finishing or application of veneer plaster-joint reinforcing.
4. Openings: Apply a 6 mm (1/4 inch) bead of sealant around all cutouts to seal openings of electrical boxes, ducts, pipes and similar penetrations. To seal electrical boxes, seal sides and backs.
5. Control Joints: Before control joints are installed, apply sealant in back of control joint to reduce flanking path for sound through control joint.

3.6 FIELD QUALITY CONTROL:

A. Field-Adhesion Testing: Field-test joint-sealant adhesion to joint substrates according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.

1. Extent of Testing: Test completed elastomeric sealant joints as follows:
   a. Perform 10 tests for first 305 m (1000 feet) of joint length for each type of elastomeric sealant and joint substrate.
   b. Perform one test for each 305 m (1000 feet) of joint length thereafter or one test per each floor per elevation.

B. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.

C. Inspect tested joints and report on following:
   1. 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 type of product and joint substrate.
   2. Compare these results to determine if adhesion passes sealant manufacturer’s field-adhesion hand-pull test criteria.
   3. Whether sealants filled joint cavities and are free from voids.
   4. Whether sealant dimensions and configurations comply with specified requirements.

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 fill, sealant configuration, and sealant dimensions.

E. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.

F. Evaluation of Field-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.

3.7 CLEANING:

A. Fresh compound accidentally smeared on adjoining surfaces: Scrape off immediately and rub clean with a solvent as recommended by manufacturer

of the adjacent material or if not otherwise indicated by the caulking or sealant manufacturer.

B. Leave adjacent surfaces in a clean and unstained condition.

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SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hollow metal doors hung in hollow metal frames at exterior locations.

1.2 RELATED WORK

A. Section 05 50 00, METAL FABRICATIONS: Frames fabricated of structural steel.

B. Section 08 71 00, DOOR HARDWARE: Door Hardware:

C. Section 08 80 00, GLAZING: Glazing.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American National Standard Institute (ANSI):

A250.8-2014.....Standard Steel Doors and Frames

C. ASTM International (ASTM):

A653/A653M-15.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip

A1008/A1008M-15.....Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy and High Strength Low Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

B209-14.....Aluminum and Aluminum-Alloy Sheet and Plate

B209M-14.....Aluminum and Aluminum-Alloy Sheet and Plate (Metric)

B221-14.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

B221M-13.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)

D3656/D3656M-13.....Insect Screening and Louver Cloth Woven from Vinyl Coated Glass Yarns

D. Federal Specifications (Fed. Spec.):

L-S-125B.....Screening, Insect, Nonmetallic

E. Master Painters Institute (MPI):

No. 18.....Primer, Zinc Rich, Organic

F. National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500-06.....Metal Finishes Manual

G. National Fire Protection Association (NFPA):

80-16.....Fire Doors and Other Opening Protectives

H. UL LLC (UL):

10C-09.....Positive Pressure Fire Tests of Door Assemblies

1784-15.....Air Leakage Tests of Door Assemblies and Other Opening Protectives

I. USDA Forest Service Design and Construction Standards for Southern Region Facilities - 2021

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 30 00 ADMINISTRATIVE REQUIREMENTS.

B. Submittal Drawings:

1. Show size, configuration, and fabrication and installation details.

C. Manufacturer's Literature and Data:

1. Description of each product.
2. Include schedule showing each door and frame requirements for openings.
3. Installation instructions.

D. Test reports: Certify each product complies with specifications.

E. Qualifications: Substantiate qualifications comply with specifications.

1. Manufacturer with project experience list.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Regularly manufactures specified products.
2. Manufactured specified products with satisfactory service on five similar installations for minimum five years.
   a. Project Experience List: Provide contact names and addresses for completed projects.

1.6 DELIVERY

A. Fasten temporary steel spreaders across the bottom of each door frame before shipment.

B. Deliver products in manufacturer's original sealed packaging.

C. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.

D. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight facility.

B. Protect products from damage during handling and construction operations.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Design hollow metal doors and frames complying with specified performance:
   1. Fire Doors and Frames: UL 10C; NFPA 80 labeled.
      a. Fire Ratings: See drawings.
   2. Smoke Control Doors and Frames: UL 1784; NFPA 80 labeled, maximum 0.15424 cubic meter/second/square meter (3.0 cubic feet/minute/square foot) at 24.9 Pa (0.10 inches water gauge) pressure differential.

2.2 MATERIALS

A. Stainless Steel: ASTM A240/A240M; Type 304.
B. Sheet Steel: ASTM A1008/A1008M, cold-rolled.
C. Galvanized Sheet Steel: ASTM A653.
D. Insect Screening: ASTM D3656/D3656M, 18 by 18 aluminum wire mesh.
E. Aluminum Sheet: ASTM B209M (ASTM B209).
F. Aluminum Extrusions: ASTM B221M (ASTM B221).

2.3 PRODUCTS - GENERAL

A. Basis of Design: See FINISH SCHEDULE in drawings.
B. Provide hollow metal doors and frames from one manufacturer.

2.4 HOLLOW METAL DOORS

A. Hollow Metal Doors: ANSI A250.8; 44 mm (1-3/4 inches) thick. See drawings for sizes and designs.
B. Door Faces:
   1. Interior Doors: Galvanized sheet steel minimum Z275 (G90) coating.
   2. Exterior Doors: Galvanized sheet steel minimum Z275 (G90) coating.
C. Door Cores:
   1. Exterior Doors: Polystyrene.

2.5 HOLLOW METAL FRAMES

A. Hollow Metal Frames: ANSI A250.8; face welded. See drawings for sizes and designs.
   a. Exterior Frames:
      1) Level 3Hollow Metal Doors: 1.3 mm (0.053 inch) thick.

2) Level 4 Hollow Metal Doors: 1.7 mm (0.067 inch) thick.

B. Frame Materials:

1. Exterior Frames: Galvanized sheet steel minimum Z275 (G90) coating.

2.6 LOUVERS

A. Louver Style: Sight-proof permitting free ventilation.

1. Provide insect screen and wire guards at exterior doors.

B. Louver Construction: Sheet metal matching door faces.

1. Interior Door Louvers: 0.8 mm (0.032 inch) thick.
2. Exterior Door Louvers: 1.3 mm (0.053 inch) inch thick.

C. Screen Frames: Extruded or tubular aluminum.

2.7 FABRICATION

A. Hardware Preparation: ANSI A250.8; for hardware specified in Section 08 71 00, DOOR HARDWARE.

B. Hollow Metal Door Fabrication:

1. Close top edge of exterior doors flush and seal to prevent water intrusion.
2. Fill spaces between vertical steel stiffeners with insulation.

C. Custom Metal Hollow Doors:

1. Provide custom hollow metal doors where nonstandard steel doors are shown on drawings.
   a. Provide door sizes, design, materials, construction, gauges, and finish as specified for standard steel doors.

D. Hollow Metal Frame Fabrication:

1. Fasten mortar guards to back of hardware reinforcements, except on lead-lined frames.
2. Frame Anchors:
   a. Floor anchors:
      1) Provide extension type floor anchors to compensate for depth of floor fills.
      2) Provide 1.3 mm (0.053 inch) thick steel clip angles welded to jamb and drilled to receive floor fasteners.
      3) Provide 50 mm by 50 mm by 9 mm (2 inch by 2 inch by 3/8 inch) clip angle for lead lined frames, drilled for floor fasteners.
      4) Provide mullion 2.3 mm (0.093 inch) thick steel channel anchors, drilled for two floor fasteners and frame anchor screws.

5) Provide continuous 1 mm (0.042 inch) thick steel rough bucks drilled for floor fasteners and frame anchor screws for sill sections.
   a) Space floor bolts50 mm (24 inches) on center.

b. Jamb anchors:
   1) Place anchors on jambs:
      a) Near top and bottom of each frame.
      b) At intermediate points at maximum 600 mm (24 inches) spacing.
   2) Form jamb anchors from steel minimum 1 mm (0.042 inch) thick.
   3) Anchors set in masonry: Provide adjustable anchors designed for friction fit against frame and extended into masonry minimum 250 mm (10 inches). Provide one of following types:
      a) Wire Loop Type: 5 mm (3/16 inch) diameter wire.
      b) T-Shape type.
      c) Strap and stirrup type: Corrugated or perforated sheet steel.
   4) Anchors for stud partitions: Provide tabs for securing anchor to sides of studs. Provide one of the following:
      a) Welded type.
      b) Lock-in snap-in type.
   5) Anchors for frames set in prepared openings:
      a) Steel pipe spacers 6 mm (1/4 inch) inside diameter, welded to plate reinforcing at jamb stops, or hat shaped formed strap spacers 50 mm (2 inches) wide, welded to jamb near stop.
      b) Drill jamb stop and strap spacers for 6 mm (1/4 inch) flat head bolts to pass through frame and spacers.

E. Louver Fabrication:
   1. Fabricate louvers as complete units.
   2. Weld stationary blades to frames.
   3. Factory install louvers in door cutouts, welded to door.

F. Louver Screen Fabrication:
   1. Fabricate frame to hold wire fabric in channel with retaining bar anchor and to mount on surface of door with screws.
   2. Do not lap frame over louver opening.
   3. Miter frame corners and join by concealed mechanical fastenings extending about 57 mm (2-1/4 inches) into ends of each member.

4. Drill frame and doors for screw attachment:
5. Space screws 50 mm (2 inches) from end of each leg of frame and maximum 300 mm (12 inches) on center.
6. Insect Screens: Fasten insect screens to interior side of doors with retaining bar against door and not exposed to view.
7. Wire Guards: Fasten wire guard to exterior side of door with retaining bar against door and not exposed to view.

2.8 FINISHES

A. Galvanized Steel: ANSI A250.8; shop primed.
B. Finish exposed surfaces after fabrication.
C. Aluminum Anodized Finish: NAAMM AMP 500.
   1. Clear Anodized Finish: AA-C22A41; Class I Architectural, 0.018 mm (0.7 mil) thick.
   2. Color Anodized Finish: AA-C22A42 or AA-C22A44; Class I Architectural, 0.018 mm (0.7 mil) thick.
   3. Clear Anodized Finish: AA-C22A31; Class II Architectural, 0.01 mm (0.4 mil) thick.
   4. Color Anodized Finish: AA-C22A32 or AA-C22A34; Class II Architectural, 0.01 mm (0.4 mil) thick.

2.9 ACCESSORIES

A. Primers: ANSI A250.8.
B. Barrier Coating: ASTM D1187/D1187M.
C. Welding Materials: AWS D1.1/D1.1M, type to suit application.
D. Clips Connecting Members and Sleeves: Match door faces.
E. Fasteners: stainless steel.
   1. Metal Framing: Steel drill screws.
   2. Masonry and Concrete: Expansion bolts and power actuated drive pins.
F. Anchors: stainless steel.
G. Galvanizing Repair Paint: MPI No. 18.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.
B. Protect existing construction and completed work from damage.
C. Apply barrier coating to metal surfaces in contact with cementitious materials to minimum 0.7 mm (30 mils) dry film thickness.

3.2 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions and approved submittal drawings.

1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

3.3 FRAME INSTALLATION

A. Apply barrier coating to concealed surfaces of frames built into masonry.

B. Plumb, align, and brace frames until permanent anchors are set.
   1. Use triangular bracing near each corner on both sides of frames with temporary wood spreaders at midpoint.
   2. Use wood spreaders at bottom of frame when shipping spreader is removed.
   3. Where construction permits concealment, leave shipping spreaders in place after installation, otherwise remove spreaders when frames are set and anchored.
   4. Remove wood spreaders and braces when walls are built and jamb anchors are secured.

C. Floor Anchors:
   1. Anchor frame jambs to floor with two expansion bolts.
      a. Lead Lined Frames: Use 9 mm (3/8 inch) diameter bolts.
      b. Other Frames: Use 6 mm (1/4 inch) diameter bolts.
   2. Power actuated drive pins are acceptable to secure frame anchors to concrete floors.

D. Jamb Anchors:
   1. Masonry Walls:
      a. Embed anchors in mortar.
      b. Fill space between frame and masonry with grout or mortar as walls are built.
   2. Prepared Masonry and Concrete Openings:
      a. Direct Securement: 6 mm (1/4 inch) diameter expansion bolts through spacers.
      b. Subframe or Rough Buck Securement:
         1) 6 mm (1/4 inch) diameter expansion bolts on 600 mm (24 inch) centers.
         2) Power activated drive pins on 600 mm (24 inches) centers.
      c. Secure two-piece frames to subframe or rough buck with machine screws on both faces.

E. Touch up damaged factory finishes.
   1. Repair galvanized surfaces with galvanized repair paint.

2. Repair painted surfaces with touch up primer.

3.4 DOOR INSTALLATION

A. Install doors plumb and level.

B. Adjust doors for smooth operation.

C. Touch up damaged factory finishes.

1. Repair galvanized surfaces with galvanized repair paint.

2. Repair painted surfaces with touch up primer.

3.5 CLEANING

A. Clean exposed door and frame surfaces. Remove contaminants and stains.

3.6 PROTECTION

A. Protect doors and frames from traffic and construction operations.

B. Remove protective materials immediately before acceptance.

C. Repair damage.

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DIVISION 08 16 13
FIBERGLASS ENTRY DOORS

BASIS OF DESIGN: THERMA-TRU

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Impact Resistant Fiberglass Entry Doors

1.2 RELATED SECTIONS

A. 06 40 23 – Interior Architectural Woodwork

B. 07 92 00 – Joint Sealants: Sealants and caulking

C. 08 71 00 – Door Hardware

D. 09 91 00 - Painting and Coating

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM E 90 – Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
2. ASTM E 283 – Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Difference Across the Specimen.
3. ASTM E 330 – Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
4. ASTM E 331 – Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
5. ASTM E 413 – Classification for Rating Sound Insulation (STC).
6. ASTM E 547 – Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference.
7. ASTM E 1332 – Standard Classification for Determination of Outdoor-Indoor Transmission Class.
8. ASTM E 1886 – Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missiles and Exposed to Cyclic Pressure Differentials.
9. ASTM E 1996 – Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.
10. ASTM E 2235 – Standard Test Method for Determination of Decay Rates

for Use in Sound Insulation Test Methods.

B. Environmental Protection Agency and Department of Energy:

1. Energy Star Program Requirements Product Specification for Residential Windows, Doors, and Skylights.

C. Code of Federal Regulations:

1. CFR 1201 Part 2 – Safety Standard for Architectural Glazing Materials.

D. National Accreditation & Management Institute (NAMI)

E. National Fenestration Rating Council

1. NFRC 100 – Procedure for Determining Fenestration Product U-Factors.
2. NFRC 200 – Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance (VT) at Normal Incidence.
3. NFRC 400 – Procedure for Determining Fenestration Product Air Leakage.

I. National Fire Protection Association

1. NFPA 252 – Standard Methods of Fire Tests of Door Assemblies

J. Underwriters Laboratory

1. UL 10B – Standard for Fire Testing Door Assemblies.
2. UL 10C – Standard for Positive Pressure Fire Tests of Door Assemblies.

1.4 PERFORMANCE REQUIREMENTS

A. Doors shall have a structural and impact design pressure rating as determined by manufacturer.

B. Door Unit Air Leakage, NFRC 400, 1.57 psf (25 mph): 0.50 cfm per square foot of frame or less.

C. Door Unit Water Penetration: No water penetration through door unit when tested in accordance with ASTM E 331or ASTM E 547 with water applied at rate of 5 gallons per hour per square foot at 0 psf.

D. Doors shall qualify for Energy Star Rating.

1.5 SUBMITTALS

A. Refer to Division 01 00 00 GENERAL REQUIREMENTS; 01 22 23 SHOP DRAWINGS, PRODUCT DATA and SAMPLES.

B. Product Data: Submit door manufacturer current product literature, including installation instructions.

C. Shop Drawings: Submit manufacturer's shop drawings, indicating dimensions, construction, component connections, anchorage methods and locations, accessories, hardware locations, and installation details.

D. Samples: Submit full-size or partial full-size verification sample of door illustrating quality of construction, texture, and color of finish.

1.6 QUALITY ASSURANCE

A. Mockup:
   1. Provide sample unit of representative product size and using manufacturer approved installation methods to determine acceptability of door installation methods.
   2. Approved mockup shall represent minimum quality required for the Work.
   3. Approved mockup shall [not] remain in place within the Work.

C. Quality Assurance Submittals:
   1. Provide documentation for specified performance as required.
   2. Manufacturers' installation instructions.

D. Manufacturer Qualifications: Manufacturer shall have successful experience in producing the type of product required for project applications equivalent to the requirements for this project.

E. Installer Qualifications:
   1. Installer holds current credential as a NAMI Certified Installer of Therma- Tru Side Hinged Door Installations and as a Therma-Tru® Certified Installer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Refer to Division 01 33 23 Product Requirements.

B. Delivery: Deliver materials to site undamaged with labels clearly identifying manufacturer, product name, and installation instructions

C. Storage: Store materials in an upright position, off ground, under cover, and protected from weather, direct sunlight, and construction activities.

D. Handling: Protect materials and finish during handling and installation to prevent damage.

1.8 WARRANTY

A. Manufacturer's standard limited warranty for fiberglass door product and genuine manufacturer's components, including rot-resistant frames, mullions, and brickmould sourced from manufacturer used in commercial projects will be free from material and workmanship defects for a period of three years subject to certain limitations and restrictions. For complete details and current warranty information go to Basis of Design manufacturer's website:www.thermatru.com.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Basis of Design: Therma-Tru Corp.; 1750 Indian Wood Circle; Maumee, OH 43537; (419) 891-7400

B. Substitutions: Requires Forest Service and Designer approval

C. Requests for substitutions will be considered in accordance with

provisions of Division 01 60 00 – Product Requirements.

2.2 FIBERGLASS ENTRY DOORS

A. Fiberglass Entry Doors: All fiberglass doors manufactured by same manufacturer; Basis of Design: Therma-Tru®. Specification is for complete entry systems with components manufactured by Therma-Tru® and assembled by independent fabricators.

1. Classic -Craft®
2. Construction:
   a. Classic-Craft® 3/32” minimum thickness proprietary fiberglass reinforced thermoset composite, “AccuGrain” textured to duplicate hand-crafted hardwood master or smooth surface. Door edges are machinable kiln-dried hardwood, flush and square with door faces, lock edge reinforced with full-length integrated 3-1/2-inch wide engineered lumber core. Door bottom edge is moisture- and decay-resistant composite. Core is foamed- in-place polyurethane, with a minimum density of 1.9 pcf. Door Style
   b. Classic-Craft®
      1. Mahogany Collection: Style Number CCR100.
3. Frames: Provided and assembled by third party fabricators to exacting specifications from Therma- Tru to help maximize system performance. Therma-Tru® strongly recommends the use of rot- resistant frames, mullions, and brickmould sourced from Therma-Tru, however, the use of a non Therma-Tru® frame system (or a Therma-Tru Primed Pine Frame or Therma-Tru Oak Frame) will not automatically void the entire limited warranty. Refer to 1.8.B for clarification.
   a. Milled from 5/4 kiln-dried material with profiled ½” stop and 6 degree sill gain prep.
   b. Jamb Width [Standard 4 9/16”] Optional: [5 ¼”] [6 9/16”]
   c. Rot Resistant – frames, mullions, and brickmould sourced through Therma-Tru.
   d. Split Steel Redi -Flex frames.

B. Sills

1. Inswing: [Composite Adjustable] [Hardwood Adjustable] [Basic Fixed] [Basic Composite Adjustable] [Moderate Climate]
2. Outswing: [Composite Outswing] [Aluminum with Thermal Break] [Aluminum No Thermal Break][Coastal]
3. Other:[Public Access Sill]
4. Finish: [Mill] [Bronze] [Brass] [Satin nickel]

2.3 HARDWARE

A. Hinges: Steel, 4 x 4 x 0.098 inches finished to match hardware, plated screws to match

1. Finish: US32D stainless steel

B. Locking Hardware:

1. Finish: [US15, brushed nickel]

2.4 GLAZING (NA)

2.5 INSTALLATION ACCESSORIES

A. Sill pan

B. Corner seal pad

C. Rain deflector

D. Rain Guard

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas to receive doors. Notify Architect in writing any unacceptable conditions that would adversely affect installation or subsequent performance of the product. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install fiberglass doors in full compliance with Therma-Tru® written instructions and approved shop drawings.

B. Install 20 minute doors with permanent fire door certification label in compliance with the requirements of the labeling agency and NFPA.

C. Maintain alignment and compatibility with adjacent work.

3.3 FINISHING

A. Finish in compliance with Therma-Tru® written recommendations. Guidance for proper finishing is available at www.thermatru.com – "Recommendations for Proper Finishing and Painting or Staining."

3.3 Protection

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products prior to Substantial Completion in accordance with Therma-Tru written recommendations. Guidance for proper finishing is available at www.thermatru.com – "Recommendations for Proper Finishing and Painting or Staining."

END OF SECTION

SECTION 08 52 13
METAL CLAD WOOD WINDOWS
BASIS OF DESIGN: ANDERSON LOW E SERIES

Purpose and Applications: This guide specification covers Andersen® E-Series windows. These windows are suitable for new construction, remodeling or replacement applications.

Product Features: E-Series window products are extruded aluminum clad wood and each product is made to exact specifications. There are 50 standard exterior colors, 7 anodized finishes and custom colors available in various shapes and sizes to create dramatic window combinations. Wood interiors in 10 species, 12 finish options, between-the-glass blinds, shades and grilles are available.

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Contact Information: Contact manufacturer for more information on this or other products made by Andersen Corporation: Andersen Windows, Inc., Andersen Service Center, 100 Fourth Ave North, Bayport, MN 55003-1096. Telephone: (800) 299-9029.
Website: http://www.andersenwindows.com/for-professionals

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PART 1 GENERAL
1.1 SUMMARY

A. Section Includes: Wood-framed, aluminum-clad windows of the following types: Casement AND Awning.

B. Related Sections: Section(s) related to this section include:
07 92 00 Joint Sealants
08 80 00 Glazing

1.2 REFERENCES

A. General: Standards listed by reference form a part of this specification section. Standards listed are identified by issuing authority, abbreviation, designation number, title or other designation. Standards subsequently referenced in this Section are referred to by issuing authority abbreviation and standard designation.

B. American Architectural Manufacturers Association (AAMA):

1. AAMA 450 - Voluntary Performance Rating Method for Mulled Fenestration Assemblies.
2. AAMA 502 - Voluntary Specification for Field Testing of Newly Installed Fenestration Products.
3. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
4. AAMA 902 - Voluntary Specification for Sash Balances.
5. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
6. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
7. NAFS - North American Fenestration Standard/Specification for windows, doors and skylights.

C. Andersen E-Series Product Installation Guides.

D. ASTM International (ASTM):

1. ASTM C1036 - Standard Specification for Flat Glass.
2. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
3. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
4. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.
5. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.
6. ASTM F2090 - Standard Specification for Window Fall Prevention Devices with Emergency Escape (Egress) Release Mechanisms.

E. Forest Stewardship Council (FSC): FSC Chain-of-Custody Certification.

F. Insulating Glass Certification Council (IGCC): Insulating Glass Unit Certification.

G. International Standards Organization (ISO): ISO 14021 - Environmental Labels and Declarations -- Self-Declared Environmental Claims (Type II Environmental Labeling).

H. National Fenestration Rating Council (NFRC):

1. NFRC 100 - Procedure for Determining Fenestration Product U-Factors.
2. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

I. U.S. Environmental Protection Agency (EPA): ENERGY STAR.

J. Window and Door Manufacturers Association (WDMA):

1. WDMA Hallmark Certification Program for Manufacturers.
2. WDMA I.S. 4 - Industry Specification for Preservative Treatment for Millwork.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation Meetings: Conduct pre-installation meeting to clarify Project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance Requirements:
1. Comply with requirements of NAFS.

1.5 SUBMITTALS

A. Product Data: For each type of product required.

B. Shop Drawings: Showing methods of installation, plans, sections, elevations and details of walls, specified loads, flashings, vents, sealants, and interfaces with all materials not supplied by the window manufacturer, and identification of proposed component parts and finishes.

C. Samples: Selection and verification samples for finishes, colors and textures. Submit two complete sample sets of each type of material required.

D. Certificates: Signed by manufacturer certifying materials comply with specified performance characteristics, criteria and physical requirements.

E. Test and Evaluation Reports: Showing compliance with specified performance characteristics and physical properties.

F. Manufacturer Instructions: Manufacturer installation, storage, and other instructions.

G. Qualification Statements: For manufacturer and installer.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Member in good standing of the Insulating Glass Certification Council (IGCC).
2. Hallmark Certified Manufacturer and member in good standing of the Window and Door Manufacturers Association (WDMA).

3. Member in good standing of the U.S. Green Building Council.
4. U.S. EPA ENERGY STAR Partner.
5. Capable of demonstrating an extended history of window and door design, production and innovation.

B. Installer Qualifications:

1. Minimum five years' experience in the commercial installation of products required for the Project.
2. Experience on at least five projects of similar size, type and complexity as the Project.
3. An entity utilizing workers competent in techniques required by manufacturer for product types and applications indicated.

1.7 DELIVERY, STORAGE AND HANDLING

A. Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

B. Deliver materials to Project in manufacturer's original unopened, undamaged containers with identification labels intact.

C. Storage and Protection: Store materials and accessories protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by manufacturer off ground, under cover and not exposed to weather and construction activities.

1.8 WARRANTY

A. Special Warranty: Manufacturer's transferrable, non-prorated limited warranty.

1. Warranty Period, Glass: 20 years.
2. Warranty Period, Non-Glass Parts: 10 years.

PART 2 PRODUCT
2.1 METAL-CLAD WOOD WINDOWS

A. General: Provide windows complying with the performance requirements indicated and tested according to NAFS.

B. Basis-of-Design Product: Subject to compliance with requirements provide Andersen Corporation: Andersen E-Series windows.

2.2 MATERIALS

A. Construction:

1. Cladding: Extruded aluminum, minimum thickness 0.050 inch (1.27 mm).
2. Frame: Preservative treated laminated veneer lumber.

3. Interior Exposed Frame: Preservative treated solid lumber, kiln dried and suitable for stain or painted finish.
4. Sash: Preservative treated solid lumber, kiln dried and suitable for stain or painted finish.

B. Wood Species: Match existing. Field Verify.

C. Interior Finish:

1. Primed: Factory-applied before assembly.

D. Exterior Finish:

1. Painted Frame: Factory-applied baked-on silicone polyester enamel, in compliance with AAMA 2604.
2. Painted Sash: Factory-applied baked-on silicone polyester enamel, in compliance with AAMA 2604.

2.3 WINDOW

A. Window Type and Performance Requirements:

1. Casement and Awning Performance Class CW and Grade, Non-Impact-Resistant: PG50 MIN.

B. Air Infiltration Requirements:

1. Air Infiltration Rate: < 0.2 cfm/sf².

B. Environmental Certifications:

1. ENERGY STAR performance requirements.
2. Indoor air quality performance.

C. Weatherstrip:

1. Type and Material for Casement or Awning: Flexible tubular, vinyl.

D. Installation Flange Type: Extruded vinyl.

E. Hardware:

1. Operator Gear Type and Material: Rotary, die-cast zinc and stainless steel components.
2. Hinge Type and Material: [Concealed hinge and track] [Piano hinge], 300 Series stainless steel.
3. Crank Handle Type, Material and Finish: Folding, die-cast zinc, painted.
4. Operator Cover Material and Finish: [Polycarbonate, integral color] [Die-cast zinc, plated].
5. Sash Lock Type and Material: Single-actuation, die-cast zinc and engineered polymer components.
6. Crank and Sash Lock Color: White.

7. Operator Gear Type and Material: Rotary, die-cast zinc and stainless steel components.
8. Hinge Type and Material: Piano hinge, 300 Series stainless steel.
9. Crank Handle Type, Material and Finish: Folding, die-cast zinc, painted.
10. Operator Cover Material and Finish: Polycarbonate, integral color.
11. Sash Lock Type and Material: Multi-point, die-cast zinc components.
12. Crank and Lock Lever Finish: White.
13. Hinge Type and Material: Friction hinge/stay, 300 Series stainless steel.
14. Sash Lock Type and Material: Lever, die-cast zinc.
15. Sash Lock Color: White.
16. Window Opening Control Device and Color: Provide device to restrict operable sash to less than four inches maximum clear opening, releasable in compliance with ASTM F2090, White.
17. Vent Limitation Hardware: Provide fixed vent limiters to limit sash travel.
18. Sash Lock/Tilt Mechanism Type and Material: Self-latching, die-cast zinc.
19. Sash Lift Type and Material: Surface mounted, die-cast zinc; White.
20. Sash Lock and Sash Lift Finish: White.
21. Balancer Type and Material: Spring-loaded block and tackle, galvanized steel.
22. Jamb Liner:
    a. Type and Material: Concealed, rigid vinyl.
    b. Color: White.
    c. Interior Inserts: Wood-veneered vinyl, species to match window.
    d. Exterior Inserts: Vinyl, color to match window].
23. Window Opening Control Device: Provide device to restrict operable sash to less than four inches maximum clear opening and releasable, in compliance with ASTM F2090, White.
24. Sash Lock Mechanism Type and Material: Flush mounted die-cast zinc.
25. Sash Lift Type and Material: Surface mounted die-cast zinc; White.
26. Sash Lock and Lift Color: White.
27. Roller Type and Material: Dual adjustable, brass.
28. Head and Sill Track Material and Color: Rigid vinyl, White.

F. Blinds-Between-the-Glass: NOT USED

G. Divided Lights:
1. Full Divided Light: Permanent exterior and interior attachment, spacer between glass panes.

    a. Exterior Style: Chamfer.
    b. Interior Style: Ovolo
    c. Width: 5/8 inch (16mm).
    d. Pattern: As shown in Drawings.
    e. Spacer Color: Match insulated glass spacer color.
    f. Exterior Color: Match window.

g. Interior Finish: Match window.

H. Insect Screens:
1. Type: Conventional.
a. Painted Finish and Color: Match window frame.

I. Blinds and Shades: NOT USED

J. Exterior Trim and Accessories: Match existing windows.

2.4 NON-IMPACT-RESISTANT GLAZING

A: Thermal Transmission (U-Factor), NFRC 100:
1. Casement: 0.35 with grilles.
2. Awning: 0.31 with grilles.

B. Solar Heat Gain Coefficient (SHGC), NFRC 200:
1. Casement: 0.26 with grilles.
3. Awning: 0.26 with grilles.

C. Visible Light Transmittance (VLT), NFRC 200:
1. Casement: 0.43 with grilles.
2. Awning: 0.43 with grilles.

D. Sound Transmission Class (STC)/Outdoor Indoor Transmission Classification (OITC), ASTM E90:

1. Casement: 33/28 with unbalanced glass.
2. Awning: 33/28 with unbalanced glass.

E. Glass Units: Provide insulating glass units certified through [Insulating Glass Certification Council as conforming to the requirements of IGCC and ASTM E2190] [Insulating Glass Manufacturers Alliance of Canada (IGMAC) conforming to the requirements of Canadian General Standards Board CAN/CGSB 12.8].

1. Manufacturer Designation: Andersen Low-E4 Glass.
2. Glazing Configuration: [Dual-pane] [Triple-pane].
3. Tint: [Bronze] [Gray] [Green] [None].
4. Seal and Spacer Type: Dual sealed insulating glass units with polyisobutylene primary seal, silicone secondary seal and stainless steel spacers.
5. Glass Spacer Color: [Black] [Stainless Steel] [White]
6. Glass Type: [Annealed glass, ASTM C1036] [Fully tempered glass, ASTM C1048].
7. Opacity: [Obscure] [Cascade Vertical] [Fern] [Reed Vertical] [Reed Horizontal] [Satin Etch] [None].
8. Laminate Interlayer Thickness: [0.030] [0.060] inch.

PART 3 EXECUTION

8.1 EXAMINATION

A. Verify that all substrate conditions are suitable for installation in compliance with manufacturer’s recommendations.

B. Do not begin installation until substrates have been properly prepared and any conditions not in compliance with manufacturer's recommendations have been corrected.

8.2 INSTALLATION

A. General: Comply with manufacturer's product recommendations, including but not limited to the Andersen Unit Installation Guide, installation information in product literature and on product packaging. Comply with Drawings and Shop Drawings for installing windows, hardware, accessories, and other components.

B. Install windows plumb, level and square. Anchor windows securely to structure in correct orientation to flashing and adjacent construction as indicated. Comply with product installation instructions for proper flashing integration into wall system. Install windows so as to drain water penetration to the exterior.

C. Adjust sashes, insect screens, ventilators, hardware and accessories as applicable for correct fit. Adjust weatherstrip for smooth operation and weather-tight closure.

8.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: If requested by Owner, provide manufacturer's field service consisting of product use recommendations and periodic site visits for observation of product installation in accordance with manufacturer's recommendations.

B. Field Testing: Provide field testing of installed units.

1. Test units in compliance with AAMA 502.
2. Use test equipment calibrated according to ASTM E1105.

8.4 CLEANING

A. Refer to manufacturer for guidance on timing for when best to remove protective films and non-permanent labels after installation.

B. Remove excess sealant, soiling, dirt and other substances. Clean window frame and glass surfaces. Avoid damaging coatings and finishes.

C. Touch-up, repair or replace glass or other window components broken, scratched or damaged during construction prior to Substantial Completion.

D. Remove and lawfully dispose of construction debris from Project site.

8.5 PROTECTION

A. Protect installed windows and finish surfaces from damage during construction until completion of Project and acceptance by Owner.

- - - END OF SECTION - - -

SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Door hardware and related items necessary for complete installation and operation of doors.

1.2 RELATED WORK

A. Caulking: Section 07 92 00 JOINT SEALANTS.

B. Application of Hardware: Section 08 11 13

C. Finishes: See Finish Schedule in Drawings.

D. Painting: Section 09 91 00, PAINTING.

E. Electrical: Division 26, ELECTRICAL.

1.3 GENERAL

A. All hardware shall comply with ABAAS, (Architectural Barriers Act Accessibility Standard) unless specified otherwise.

B. Provide rated door hardware assemblies where required by most current version of the International Building Code (IBC).

C. Hardware for Labeled Fire Doors and Exit Doors: Conform to requirements of NFPA 80 for labeled fire doors and to NFPA 101 for exit doors, as well as to other requirements specified. Provide hardware listed by UL, except where heavier materials, large size, or better grades are specified herein under paragraph HARDWARE SETS. In lieu of UL labeling and listing, test reports from a nationally recognized testing agency may be submitted showing that hardware has been tested in accordance with UL test methods and that it conforms to NFPA requirements.

D. Hardware for application on metal and wood doors and frames shall be made to standard templates. Furnish templates to the fabricator of these items in sufficient time so as not to delay the construction.

E. The following items shall be of the same manufacturer, except as otherwise specified:

1. Mortise locksets.
2. Hinges for hollow metal and wood doors.
3. Surface applied overhead door closers.
4. Exit devices.
5. Floor closers.

1.4 WARRANTY

A. The Warranty period shall be two years in lieu of one year for all items except as noted below:

1. Locks, latchsets, and panic hardware: 5 years.
2. Door closers and continuous hinges: 10 years.

1.5 MAINTENANCE MANUALS

A. In accordance with Section 01 00 00, GENERAL REQUIREMENTS Article titled "INSTRUCTIONS", furnish maintenance manuals and instructions on all door hardware. Provide installation instructions with the submittal documentation.

1.6 SUBMITTALS

A. Submittals shall be in accordance with Section 01 30 00 ADMINISTRATIVE REQUIREMENTS. Submit 6 copies of the schedule per Section 01 30 00. Submit 2 final copies of the final approved schedules to USFS Locksmith as record copies (COR if the USFS does not have a locksmith).

B. Hardware Schedule: AHC certified hardware consultant to prepare and submit hardware schedule in the following form:

Hardware Item	Quantity	Size	Reference Publication Type No.	Finish	Mfr. Name and Catalog No.	Key Control Symbols	UL Mark (if fire rated and listed)	ANSI/BHMA Finish Designation

C. Samples and Manufacturers' Literature:

1. Samples: All hardware items (proposed for the project) that have not been previously approved by Builders Hardware Manufacturers Association shall be submitted for approval. Tag and mark all items with manufacturer's name, catalog number and project number.
2. Samples are not required for hardware listed in the specifications by manufacturer's catalog number, if the contractor proposes to use the manufacturer's product specified.

D. Certificate of Compliance and Test Reports: Submit certificates that hardware conforms to the requirements specified herein. Certificates shall be accompanied by copies of reports as referenced. The testing shall have been conducted either in the manufacturer's plant and certified by an independent

testing laboratory or conducted in an independent laboratory, within four years of submittal of reports for approval.

1.7 DELIVERY AND MARKING

A. Deliver items of hardware to job site in their original containers, complete with necessary appurtenances including screws, keys, and instructions. Tag one of each different item of hardware and deliver to COR for reference purposes. Tag shall identify items by Project Specification number and manufacturer's catalog number. These items shall remain on file in COR's office until all other similar items have been installed in project, at which time the COR will deliver items on file to Contractor for installation in predetermined locations on the project.

1.8 PREINSTALLATION MEETING

A. Convene a preinstallation meeting not less than 30 days before start of installation of door hardware. Require attendance of parties directly affecting work of this section, including Contractor and Installer, Architect, COR and USFS Locksmith, Hardware Consultant, and Hardware Manufacturer’s Representative. Review the following:

1. Inspection of door hardware.
2. Job and surface readiness.
3. Coordination with other work.
4. Protection of hardware surfaces.
5. Substrate surface protection.
6. Installation.
7. Adjusting.
8. Repair.
9. Field quality control.
10. Cleaning.

1.9 INSTRUCTIONS

A. Hardware Set Symbols on Drawings: Except for protective plates, door stops, mutes, thresholds and the like specified herein, hardware requirements for each door are indicated on drawings by symbols. Symbols for hardware sets consist of letters (e.g., "HW") followed by a number. Each number designates a set of hardware items applicable to a door type.

B. Keying: All cylinders shall be keyed into existing Grand Master Key System. Provide removable core cylinders that are removable only with a special key or tool without disassembly of knob or lockset

C. Keying: The key blanks shall be protected by a utility patent with a minimum seven years remaining on the patent from the start of construction, and protected by contract-controlled distribution. The manufacturer shall furnish code pattern listings in both paper and electronic formats so keys may be reproduced by code.; provide electronic format in file type required by project's key control software. The manufacturer shall design the new key system with the capacity to rekey the existing system and also provide for 25 percent expansion capability beyond this requirement. Submit a keying chart for approval showing proposed keying layout and listing expansion capacity.

1. Keying information will be furnished to the Contractor by the COR.
2. Supply information regarding key control of cylinder locks to manufacturers of equipment having cylinder type locks. Notify COR immediately when and to whom keys or keying information is supplied. Return all such keys to the COR.

1.10 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. In text, hardware items are referred to by series, types, etc., listed in such specifications and standards, except as otherwise specified.

B. ASTM International(ASTM):

F883-13.....Padlocks

E2180-18.....Standard Test Method for Determining the Activity of Incorporated Antimicrobial Agent(s) In Polymeric or Hydrophobic Materials

C. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA):

A156.1-06.....Butts and Hinges

A156.2-03.....Bored and Pre-assembled Locks and Latches

A156.3-08.....Exit Devices, Coordinators, and Auto Flush Bolts

A156.4-08.....Door Controls (Closers)

A156.5-14.....Cylinders and Input Devices for Locks.

A156.6-05.....Architectural Door Trim

A156.8-05.....Door Controls-Overhead Stops and Holders

A156.11-14.....Cabinet Locks

A156.12-05 .....Interconnected Locks and Latches

A156.13-05.....Mortise Locks and Latches Series 1000

A156.14-07 .....Sliding and Folding Door Hardware
A156.15-06.....Release Devices-Closer Holder, Electromagnetic and Electromechanical
A156.16-08.....Auxiliary Hardware
A156.17-04 .....Self-Closing Hinges and Pivots
A156.18-06.....Materials and Finishes
A156.20-06 .....Strap and Tee Hinges, and Hasps
A156.21-09.....Thresholds
A156.22-05.....Door Gasketing and Edge Seal Systems
A156.23-04.....Electromagnetic Locks
A156.24-03.....Delayed Egress Locking Systems
A156.25-07 .....Electrified Locking Devices
A156.26-06.....Continuous Hinges
A156.28-07 .....Master Keying Systems
A156.29-07 .....Exit Locks and Alarms
A156.30-03 .....High Security Cylinders
A156.31-07 .....Electric Strikes and Frame Mounted Actuators
A156.36-10.....Auxiliary Locks
A250.8-03.....Standard Steel Doors and Frames

D. National Fire Protection Association (NFPA):
80-10.....Fire Doors and Other Opening Protectives
101-09.....Life Safety Code

E. Underwriters Laboratories, Inc. (UL):
Building Materials Directory (2008)

F. Architectural Barriers Act Accessibility Standards (ABAAS)

PART 2 - PRODUCTS

2.1 BUTT HINGES

A. ANSI A156.1. Provide only three-knuckle hinges, except five-knuckle where the required hinge type is not available in a three-knuckle version (e.g., some types of swing-clear hinges). The following types of butt hinges shall be used for the types of doors listed, except where otherwise specified:

1. Exterior Doors: Type A2112/A5112 for doors 900 mm (3 feet) wide or less and Type A2111/A5111 for doors over 900 mm (3 feet) wide. Hinges for exterior outswing doors shall have non-removable pins. Hinges for exterior fire-rated doors shall be of stainless steel material.
2. Interior Doors: Type A8112/A5112 for doors 900 mm (3 feet) wide or less and Type A8111/A5111 for doors over 900 mm (3 feet) wide.

Hinges for doors exposed to high humidity areas (shower rooms, toilet rooms, kitchens, janitor rooms, etc. shall be of stainless steel material.

B. Provide quantity and size of hinges per door leaf as follows:

A. Doors up to 1210 mm (4 feet) high: 2 hinges.

A. Doors 1210 mm (4 feet) to 2260 mm (7 feet 5 inches) high: 3 hinges minimum.

A. Doors greater than 2260 mm (7 feet 5 inches) high: 4 hinges.

A. Doors up to 900 mm (3 feet) wide, standard weight: 114 mm x 114 mm (4-1/2 inches x 4-1/2 inches) hinges.

A. Doors over 900 mm (3 feet) to 1065 mm (3 feet 6 inches) wide, standard weight: 127 mm x 114 mm (5 inches x 4-1/2 inches).

A. Doors over 1065 mm (3 feet 6 inches) to 1210 mm (4 feet), heavy weight: 127 mm x 114 mm (5 inches x 4-1/2 inches).

A. Provide heavy-weight hinges where specified.

A. At doors weighing 330 kg (150 pounds) or more, furnish 127 mm (5 inch) high hinges.

C. See Articles "MISCELLANEOUS HARDWARE" and "HARDWARE SETS" for pivots and hinges other than butts specified above and continuous hinges specified below.

2.2 CONTINUOUS HINGES (NOT USED)

2.3 DOOR CLOSING DEVICES

A. Closing devices shall be products of one manufacturer.

2.4 OVERHEAD CLOSERS

A. Conform to ANSI A156.4, Grade 1.

B. Closers shall conform to the following:

A. The closer shall have minimum 50 percent adjustable closing force over minimum value for that closer and have adjustable hydraulic back check effective between 60 degrees and 85 degrees of door opening.

A. Where specified, closer shall have hold-open feature.

A. Size Requirements: Provide multi-size closers, sizes 1 through 6, except where multi-size closer is not available for the required application.

A. Material of closer body shall be forged or cast.

A. Arm and brackets for closers shall be steel, malleable iron or high strength ductile cast iron.

A. Where closers are exposed to the exterior or are mounted in rooms that experience high humidity, provide closer body and arm assembly of stainless steel material.

A. Closers shall have full size metal cover; plastic covers will not be accepted.

A. Closers shall have adjustable hydraulic back-check, separate valves for closing and latching speed, adjustable back-check positioning valve, and adjustable delayed action valve.

A. Provide closers with any accessories required for the mounting application, including (but not limited to) drop plates, special soffit plates, spacers for heavy-duty parallel arm fifth screws, bull-nose or other regular arm brackets, longer or shorter arm assemblies, and special factory templating. Provide special arms, drop plates, and templating as needed to allow mounting at doors with overhead stops and/or holders.

A. Closer arms or backcheck valve shall not be used to stop the door from overswing, except in applications where a separate wall, floor, or overhead stop cannot be used.

A. Provide parallel arm closers with heavy duty rigid arm.

A. Where closers are to be installed on the push side of the door, provide parallel arm type except where conditions require use of top jamb arm.

A. Provide all surface closers with the same body attachment screw pattern for ease of replacement and maintenance.

A. All closers shall have a 1 ½" (38mm) minimum piston diameter.

2.5 FLOOR CLOSERS AND FLOOR PIVOT SETS (NOT USED)

2.6 DOOR STOPS

A. Conform to ANSI A156.16.

B. Provide door stops wherever an opened door or any item of hardware thereon would strike a wall, column, equipment or other parts of building construction. For concrete, masonry or quarry tile construction, use expansion shields for mounting door stops.

C. Where cylindrical locks with turn pieces or pushbuttons occur, equip wall bumpers Type L02251 (rubber pads having convex face) to receive turn piece or button.

D. Wall bumpers, where used, must be installed to impact the trim or the door within the leading half of its width.

E. Provide stop Type L02011, as applicable for exterior doors. At outswing doors where stop can be installed in concrete, provide stop mated to concrete anchor set in 76mm (3-inch) core-drilled hole and filled with quick-setting cement.

2.7 OVERHEAD DOOR STOPS AND HOLDERS (NOT USED)

2.8 FLOOR DOOR HOLDERS

A. Conform to ANSI Standard A156.16. Provide extension strikes for Types L01301 and L01311 holders where necessary.

2.9 LOCKS AND LATCHES

A. Conform to ANSI A156.2. Locks and latches for doors 45 mm (1-3/4 inch) thick or over shall have beveled fronts. Lock cylinders shall have not less than six pins. Cylinders for all locksets shall be removable core type. Cylinders shall be furnished with construction removable cores and construction master keys. Cylinder shall be removable by special key or tool. Construct all cores so that they will be interchangeable into the core housings of all mortise locks, rim locks, cylindrical locks, and any other type lock included in the Great Grand Master Key System. Disassembly of lever or lockset shall not be required to remove core from lockset. All locksets or latches on double doors with fire label shall have latch bolt with 19 mm (3/4 inch) throw, unless shorter throw allowed by the door manufacturer’s fire label. Provide temporary keying device or construction core to allow opening and closing during construction and prior to the installation of final cores.

B. In addition to above requirements, locks and latches shall comply with following requirements:

A. Mortise Lock and Latch Sets: Conform to ANSI/BHMA A156.13. Mortise locksets shall be series 1000, minimum Grade 2.

A. Cylindrical Lock and Latch Sets: levers shall meet ADA (Americans with Disabilities Act) requirements. Cylindrical locksets shall be series 4000 Grade I. All locks and latchsets shall be furnished with 122.55 mm (4-7/8-inch) curved lip strike and wrought box. At outswing pairs with overlapping astragals, provide flat lip strip with 21mm (7/8-inch) lip-to-center dimension. Provide lever design to match design selected by Architect or to match existing lever design. Where two turn pieces are specified for lock F76, turn piece on inside knob shall lock and unlock inside knob, and turn piece on outside knob shall unlock outside knob when inside knob is in the

locked position. (This function is intended to allow emergency entry into these rooms without an emergency key or any special tool.)

A. Auxiliary locks shall be as specified under hardware sets and conform to ANSI A156.36.

2.10 KEYS

A. Stamp all keys with change number and key set symbol. Furnish keys in quantities as follows:

Locks/Keys	**Quantity**
Cylinder locks	2 keys each
Cylinder lock change key blanks	100 each different key way
Master-keyed sets	6 keys each
Grand Master sets	6 keys each
Great Grand Master set	5 keys
Control key	2 keys

2.11 KEY CABINET (NOT REQUIRED)

2.12 ARMOR PLATES, KICK PLATES, MOP PLATES AND DOOR EDGING

A. Conform to ANSI Standard A156.6.

B. Provide protective plates as specified below:

A. Kick plates, mop plates and armor plates of metal, Type J100 series.

A. Provide kick plates and mop plates where specified. Kick plates shall be 254 mm (10 inches) or 305 mm (12 inches) high. Mop plates shall be 152 mm (6 inches) high. Both kick and mop plates shall be minimum 1.27 mm (0.050 inches) thick. Provide kick and mop plates beveled on all 4 edges (B4E). On push side of doors where jamb stop extends to floor, make kick plates 38 mm (1-1/2 inches) less than width of door, except pairs of metal doors which shall have plates 25 mm (1 inch) less than width of each door. Extend all other kick and mop plates to within 6 mm (1/4 inch) of each edge of doors. Kick and mop plates shall butt astragals. For jamb stop requirements, see specification sections pertaining to door frames.

A. Kick plates and/or mop plates are not required on following door sides:

a. Armor plate side of doors;

b. Exterior side of exterior doors;

c. Closet side of closet doors;

d. Both sides of aluminum entrance doors.

A. Armor plates for doors are listed under Article "Hardware Sets". Armor plates shall be thickness as noted in the hardware set, 875 mm (35 inches) high and 38 mm (1-1/2 inches) less than width of doors, except on pairs of metal doors. Provide armor plates beveled on all 4 edges (B4E). Plates on pairs of metal doors shall be 25 mm (1 inch) less than width of each door. Where top of intermediate rail of door is less than 875 mm (35 inches) from door bottom, extend armor plates to within 13 mm (1/2 inch) of top of intermediate rail. On doors equipped with panic devices, extend armor plates to within 13 mm (1/2 inch) of panic bolt push bar.

A. Provide stainless steel edge guards where so specified at wood doors. Provide mortised type instead of surface type except where door construction and/or ratings will not allow. Provide edge guards of bevel and thickness to match wood door. Provide edge guards with factory cut-outs for door hardware that must be installed through or extend through the edge guard. Provide full-height edge guards except where door rating does not allow; in such cases, provide edge guards to height of bottom of typical lockset armor front. Forward edge guards to wood door manufacturer for factory installation on doors.

2.13 EXIT DEVICES (NOT USED)

2.14 FLUSH BOLTS (LEVER EXTENSION)(NOT USED)

2.15 FLUSH BOLTS (AUTOMATIC)(NOT USED)

2.16 LIGATURE RESISTANT DOOR ALARM: (NOT USED)

2.17 DOOR PULLS WITH PLATES

A. Conform to ANSI A156.6. Pull Type J401, 152 mm CTC (6 inches CTC) length by 19 mm (3/4 inches) diameter minimum with plate Type J302, 102 mm by 406 mm (4 inches by 16 inches), unless otherwise specified. Provide pull with projection of 57.2 mm (2 1/4 inches) minimum and a clearance of 38.1 mm (1 1/2 inches) minimum. Cut plates of door pull plate for cylinders, or turn pieces where required.

2.18 PUSH PLATES (NOT USED)

2.19 COMBINATION PUSH AND PULL PLATES (NOT USED)

2.20 COORDINATORS (NOT USED)

2.21 THRESHOLDS

A. Conform to ANSI A156.21, mill finish extruded aluminum, except as otherwise specified. In existing construction, thresholds shall be installed in a bed of sealant with ¼-20 stainless steel machine screws and expansion shields. In new construction, embed aluminum anchors coated with epoxy in concrete to secure thresholds. Furnish thresholds for the full width of the openings.

B. At exterior doors and any interior doors exposed to moisture, provide threshold with non-slip abrasive finish.

C. Provide with miter returns where threshold extends more than 12 mm (0.5 inch) beyond face of frame.

2.22 AUTOMATIC DOOR BOTTOM SEAL AND RUBBER GASKET FOR LIGHT PROOF OR SOUND CONTROL DOORS (NOT USED)

2.23 WEATHERSTRIPS (FOR EXTERIOR DOORS)

A. Conform to ANSI A156.22. Air leakage shall not to exceed 0.50 CFM per foot of crack length (0.000774m^3/s/m).

2.24 MISCELLANEOUS HARDWARE (NOT USED)

2.25 PADLOCKS FOR VARIOUS DOORS, GATES AND HATCHES (NOT USED)

2.26 THERMOSTATIC TEMPERATURE CONTROL VALVE CABINETS (NOT USED)

2.27 HINGED WIRE GUARDS (FOR WINDOWS, DOORS AND TRANSOMS) AND WIRE PARTITION DOORS (NOT USED)

2.28 FINISHES

A. Exposed surfaces of hardware shall have ANSI A156.18, finishes as specified below. Finishes on all hinges, pivots, closers, thresholds, etc., shall be as specified below under "Miscellaneous Finishes." For field painting (final coat) of ferrous hardware, see Section 09 91 00, PAINTING.

B. 626 or 630: All surfaces on exterior and interior of buildings, except where other finishes are specified.

C. Miscellaneous Finishes:

A. Hinges --exterior doors: 626 or 630.

A. Hinges --interior doors: 652 or 630.

A. Pivots: Match door trim.

A. Door Closers: Factory applied paint finish. Dull or Satin Aluminum color.

A. Thresholds: Mill finish aluminum.

A. Cover plates for floor hinges and pivots: 630.

A. Other primed steel hardware: 600.

D. Hardware Finishes for Existing Buildings: U.S. Standard finishes shall match finishes of hardware in (similar) existing spaces except where otherwise specified.

E. Special Finish: Exposed surfaces of hardware for dark bronze anodized aluminum doors shall have oxidized oil rubbed bronze finish (dark bronze) finish on door closers shall closely match doors.

2.29 BASE METALS

A. Apply specified U.S. Standard finishes on different base metals as following:

Finish	**Base Metal**
652	Steel
626	Brass or bronze
630	Stainless steel

PART 3 - EXECUTION

3.1 HARDWARE HEIGHTS

A. For existing buildings locate hardware on doors at heights to match existing hardware. The Contractor shall visit the site, verify location of existing hardware and submit locations to COR for approval.

B. For new buildings locate hardware on doors at heights specified below, with all hand-operated hardware centered within 864 mm (34 inches) to 1200 mm (48 inches), unless otherwise noted:

C. Hardware Heights from Finished Floor:

1. Exit devices centerline of strike (where applicable) 1024 mm (40-5/16 inches).
2. Locksets and latch sets centerline of strike 1024 mm (40-5/16 inches).
3. Deadlocks centerline of strike 1219 mm (48 inches).
4. Centerline of door pulls to be 1016 mm (40 inches).
5. Push plates and push-pull shall be 1270 mm (50 inches) to top of plate.
6. Push-pull latch to be 1024 mm (40-5/16 inches) to centerline of strike.

7. Locate other hardware at standard commercial heights. Locate push and pull plates to prevent conflict with other hardware.

3.2 INSTALLATION

A. Closer devices, including those with hold-open features, shall be equipped and mounted to provide maximum door opening permitted by building construction or equipment. Closers shall be mounted on side of door inside rooms, inside stairs, and away from corridors. At exterior doors, closers shall be mounted on interior side. Where closers are mounted on doors they shall be mounted with hex nuts and bolts; foot shall be fastened to frame with machine screws. Door opening force shall not exceed 22.2 N (5 pounds) maximum in accordance with ABAAS.

B. Hinge Size Requirements:

Door Thickness	**Door Width**	**Hinge Height**
45 mm (1-3/4 inch)	900 mm (3 feet) and less	113 mm (4-1/2 inches)
45 mm (1-3/4 inch)	Over 900 mm (3 feet) but not more than 1200 mm (4 feet)	125 mm (5 inches)
35 mm (1-3/8 inch) (hollow core wood doors)	Not over 1200 mm (4 feet)	113 mm (4-1/2 inches)

C. Hinge leaves shall be sufficiently wide to allow doors to swing clear of door frame trim and surrounding conditions.

D. Where new hinges are specified for new doors in existing frames or existing doors in new frames, sizes of new hinges shall match sizes of existing hinges; or, contractor may reuse existing hinges provided hinges are restored to satisfactory operating condition as approved by COR. Existing hinges shall not be reused on door openings having new doors and new frames. Coordinate preparation for hinge cut-outs and screw-hole locations on doors and frames.

E. Hinges Required Per Door:

Door Description	**Number butts**
Doors 1500 mm (5 ft) or less in height	2 butts
Doors over 1500 mm (5 ft) high and not over 2280 mm (7 ft 6 in) high	3 butts
Doors over 2280 mm (7 feet 6 inches) high	4 butts

F. Fastenings: Suitable size and type and shall harmonize with hardware as to material and finish. Provide machine screws and lead expansion shields to secure hardware to concrete, ceramic or quarry floor tile, or solid masonry. Fiber or rawl plugs and adhesives are not permitted. All fastenings exposed to weather shall be of nonferrous metal.

G. After locks have been installed; show in presence of COR that keys operate their respective locks in accordance with keying requirements. (All keys, Master Key level and above shall be delivered to the COR along with the bitting list. Also a copy of the invoice shall be sent to the COR for his records.) Installation of locks which do not meet specified keying requirements shall be considered sufficient justification for rejection and replacement of all locks installed on project.

3.3 FINAL INSPECTION

A. Installer to provide letter to COR that upon completion, installer has visited the Project and has accomplished the following:

1. Re-adjust hardware.
2. Evaluate maintenance procedures and recommend changes or additions, and instruct USFS personnel.
3. Identify items that have deteriorated or failed.
4. Submit written report identifying problems.

3.4 DEMONSTRATION

A. Demonstrate efficacy of mechanical hardware and electrical, and electronic hardware systems, including adjustment and maintenance procedures, to satisfaction of COR and USFS Locksmith.

3.5 HARDWARE SETS

A. Following sets of hardware correspond to hardware symbols shown on drawings. Only those hardware sets that are shown on drawings will be required. Disregard hardware sets listed in specifications but not shown on drawings.

B. Non-Electrified Hardware

1. Hardware Grade: Grade 1 as defined and certified by the Builders Hardware Manufacturers Association.
2. Keying: Grand Master. (Keying to match existing system used by the Forestry Service @ Sherando Recreation Area)
3. Locks: Mortise or cylinder locks

Lock cylinders: Interchangeable core

C. INTERIOR SINGLE DOORS (NOT USED)

D. INTERIOR PAIRS OF DOORS (NOT USED)

E. **EXTERIOR SINGLE DOORS**

HW-E1 (Basis of Design)

Each Door to Have:	NON-RATED
1 Hinges	STAINLESS STEEL – PROVIDED BY DOOR MANUFACTURER
1 Door Pull w/ plate	ROCKWOOD No. 106 x 70C; US 32D OR EQUAL (INSIDE AND OUT).
1 Cylindrical Lock	CORBIN NO. DL3212; DOUBLE CYLINDRICAL DEAD BOLT; US26D (ALL KEYED THE SAME).
1 Closer	SARGENT 1331-JO; EN; SIZE 3 OR EQUAL (BOLT THRU DOOR ATTACHMENT).
1 Kick Plate	N/A
1 Wall Stop	ROCKWOOD 402; CONVEX WALL STOP; US26D
1 Door Hold (Stop)	ROCKWOOD 461; KICK DOWN DOOR STOP; US26D
1 Door Sweep	N/A
1 Set Frame Seals	R0Y 164; RUBBER
1 Aluminum Threshold	N/A

HW-E2 (Basis of Design)

Each Door to Have:	NON-RATED
1 Hinges	STAINLESS STEEL – PROVIDED BY DOOR MANUFACTURER
1 Door Pull w/ plate	ROCKWOOD No. 106 x 70C; US 32D OR EQUAL (INSIDE AND OUT).
1 Cylindrical Lock	CORBIN NO. DL3213; SINGLE CYLINDRICAL DEAD BOLT; US26D (ALL KEYED THE SAME).
1 Closer	SARGENT 1331-JPS; EN; SIZE 3 OR EQUAL (BOLT THRU DOOR ATTACHMENT).
1 Kick Plate	N/A
1 Door Hold (Stop)	ROCKWOOD 461; KICK DOWN DOOR STOP; US26D
1 Door Sweep	N/A
1 Set Frame Seals	R0Y 164; RUBBER
1 Aluminum Threshold	N/A

F. **EXTERIOR PAIRS OF DOORS (NOT USED)**

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SECTION 08 80 00
GLAZING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the following:
   1. Glass.
   2. Glazing materials and accessories for both factory and field glazed assemblies.

1.2 RELATED WORK

A. Section 08 11 13, HOLLOW METAL DOORS AND FRAMES, and Section 08 14 00, WOOD DOORS: Sound resistant doors.
B. Section 10 28 00, TOILET, BATH, AND LAUNDRY ACCESSORIES: Mirrors.
C. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER AND CONDUCTORS AND CABLES: Wiring (120 V AC, 15A or 20A).
D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Junction and Switch Boxes.

1.3 LABELS

A. Temporary labels:
   1. Provide temporary label on each light of glass identifying manufacturer or brand and glass type, quality and nominal thickness.
   2. Label in accordance with NFRC label requirements.
   3. Temporary labels are to remain intact until glass is approved by Contracting Officer Representative (COR).
B. Permanent labels:
   1. Locate in corner for each pane.
   2. Label in accordance with ANSI Z97.1 and SGCC label requirements.
      a. Tempered glass.
      b. Laminated glass or have certificate for panes without permanent label.
      c. Organic coated glass.
   3. Bullet resistance glass or plastic assemblies:
      a. Bullet resistance glass or plastic assemblies in accordance with UL 752 requirements for power rating specified.
      b. Identify each security glazing permanently with glazing manufacturer's name, date of manufacture, product number, and DOS Code number inconspicuously located in lower corner on protective side and visible after glazing is framed.

c. The "attack (threat) side" is to be identified in bold lettering on each side of glazing with removable label.

4. Fire rated glazing assemblies: Mark in accordance with IBC.

1.4 PERFORMANCE REQUIREMENTS

A. General: Design glazing system consistent with guidance and practices presented in the GANA Glazing Manual, GANA Laminated Glazing Manual, and GANA Sealant Manual, as applicable to project. Installed glazing is to withstand applied loads, thermal stresses, thermal movements, building movements, permitted tolerances, and combinations of these conditions without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; unsafe engagement of the framing system; deflections beyond specified limits; or other defects in construction.

B. Glazing Unit Design: Design glass, including engineering analysis meeting requirements of authorities having jurisdiction. Thicknesses listed are minimum. Coordinate thicknesses with framing system manufacturers.

1. Design glass in accordance with ASTM E1300, and for conditions beyond the scope of ASTM E1300, by a properly substantiated structural analysis.
2. Design Wind Pressures: In accordance with applicable code.
3. Wind Design Data: In accordance with applicable code.
4. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than the structural capacity of the glazing unit, the threshold at which frame engagement is no longer safely assured, whichever is less.

C. Windborne-Debris-Impact Resistance: Comply with enhanced-protection testing requirements in ASTM E1996 for project wind zone when tested according to ASTM E1886, based upon testing of specimens not less than the size required for project and utilizing installation method identical to that specified for project.

1. Project Wind Zone: Wind Zone 3.
2. Large-Missile Test: For glazing located within 9.1 m (30 feet) of grade.

3. Small-Missile Test: For glazing located more than 9.1 m (30 feet) above grade.

D. Building Enclosure Vapor Retarder and Air Barrier:

1. Utilize the inner pane of multiple pane sealed units for the continuity of the air barrier and vapor retarder seal.
2. Maintain a continuous air barrier and vapor retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.

1.5 SUBMITTALS

A. In accordance with Section 01 30 00 ADMINISTRATIVE REQUIREMENTS.

B. Manufacturer's Certificates:

1. Certificate stating that fire-protection and fire-resistive glazing units meet code requirements for fire-resistance-rated assembly and applicable safety glazing requirements.
2. Certificate on solar heat gain coefficient when value is specified.
3. Certificate on "R" value when value is specified.
4. Certificate test reports confirming compliance with specified bullet resistive rating.
5. Certificate that blast resistant glass meets the specified requirements.

C. Manufacturer Warranty.

D. Manufacturer's Literature and Data:

1. Glass, each kind required.
2. Insulating glass units.
3. Putty, for wood sash glazing.
4. Glazing cushion.
5. Sealing compound.

E. Samples:

1. Size: 305 mm by 305 mm (12 inches by 12 inches).
2. Tinted glass.
3. Reflective glass.

F. Preconstruction Adhesion and Compatibility Test Report: Submit glazing sealant manufacturer’s test report indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery: Schedule delivery to coincide with glazing schedules so minimum handling of crates is required. Do not open crates except as required for inspection for shipping damage.

B. Storage: Store cases according to printed instructions on case, in areas least subject to traffic or falling objects. Keep storage area clean and dry.

C. Handling: Unpack cases following printed instructions on case. Stack individual windows on edge leaned slightly against upright supports with separators between each.

D. Protect laminated security glazing units against face and edge damage during entire sequence of fabrication, handling, and delivery to installation location. Provide protective covering on exposed faces of glazing plastics, and mark inside as "INTERIOR FACE" or "PROTECTED FACE":

1. Treat security glazing as fragile merchandise, and packaged and shipped in export wood cases with width end in upright position and blocked together in a mass. Storage and handling to comply with manufacturer's directions and as required to prevent edge damage or other damage to glazing resulting from effects of moisture, condensation, temperature changes, direct exposure to sun, other environmental conditions, and contact with chemical solvents.
2. Protect sealed-air-space insulating glazing units from exposure to abnormal pressure changes, as could result from substantial changes in altitude during delivery by air freight. Provide temporary breather tubes which do not nullify applicable warranties on hermetic seals.
3. Temporary protections: The glass front and polycarbonate back of glazing are to be temporarily protected with compatible, peelable, heat-resistant film which will be peeled for inspections and re-applied and finally removed after doors and windows are installed at destination. Since many adhesives will attack polycarbonate, the film used on exposed polycarbonate surfaces is to be approved and applied by manufacturer.
4. Edge protection: To cushion and protect glass clad, and polycarbonate edges from contamination or foreign matter, the four (4) edges are to be sealed the depth of glazing with continuous

standard-thickness thermoplastic rubber tape. Alternatively, continuous channel shaped extrusion of thermoplastic rubber are to be used, with flanges extending into face sides of glazing.

5. Protect "Constant Temperature" units including every unit where glass sheet is directly laminated to or directly sealed with metal-tube type spacer bar to polycarbonate sheet, from exposures to ambient temperatures outside the range of 16 to 24 degrees C (60 to 75 degrees F), during the fabricating, handling, shipping, storing, installation, and subsequent protection of glazing.

1.7 PROJECT CONDITIONS:

A. Field Measurements: Field measure openings before ordering tempered glass products to assure for proper fit of field measured products.

1.8 WARRANTY

A. Construction Warranty: Comply with the FAR clause 52.246-21 “Warranty of Construction”.

B. Manufacturer Warranty: Manufacturer shall warranty their glazing from the date of installation and final acceptance by the Government as follows. Submit manufacturer warranty.

1.9 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. American Architectural Manufacturers Association (AAMA):
800.....Test Methods for Sealants
810.1-77.....Expanded Cellular Glazing Tape

C. American National Standards Institute (ANSI):
Z97.1-14.....Safety Glazing Material Used in Building - Safety Performance Specifications and Methods of Test

D. American Society of Civil Engineers (ASCE):
7-10.....Wind Load Provisions

E. ASTM International (ASTM):
C542-05(2017).....Lock-Strip Gaskets
C716-06(2020).....Installing Lock-Strip Gaskets and Infill Glazing Materials
C794-18.....Adhesion-in-Peel of Elastomeric Joint Sealants

C864-05(2019).....Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers

C920-18.....Elastomeric Joint Sealants

C964-20.....Standard Guide for Lock-Strip Gasket Glazing

C1036-16.....Flat Glass

C1048-18.....Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.

C1172-19.....Laminated Architectural Flat Glass

C1349-17.....Standard Specification for Architectural Flat Glass Clad Polycarbonate

C1376-15.....Pyrolytic and Vacuum Deposition Coatings on Flat Glass

D635-18.....Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastic in a Horizontal Position

D4802-16.....Poly (Methyl Methacrylate) Acrylic Plastic Sheet

E84-20.....Surface Burning Characteristics of Building Materials

E119-20.....Standard Test Methods for Fire Test of Building Construction and Material

E1300-16.....Load Resistance of Glass in Buildings

E1886-19.....Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials

E1996-17.....Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes

E2141-14.....Test Methods for Assessing the Durability of Absorptive Electrochromic Coatings on Sealed Insulating Glass Units

E2190-19.....Insulating Glass Unit

E2240-06.....Test Method for Assessing the Current-Voltage Cycling Stability at 90 Degree C (194 Degree F)

of Absorptive Electrochromic Coatings on Sealed Insulating Glass Units

E2241-06.....Test Method for Assessing the Current-Voltage Cycling Stability at Room Temperature of Absorptive Electrochromic Coatings on Sealed Insulating Glass Units

E2354-10.....Assessing the Durability of Absorptive Electrochromic Coatings within Sealed Insulating Glass Units

E2355-10.....Test Method for Measuring the Visible Light Transmission Uniformity of an Absorptive Electrochromic Coating on a Glazing Surface

F1233-08(2019).....Standard Test Method for Security Glazing Materials and Systems

F1642/F1642M-17.....Test Method for Glazing and Glazing Systems Subject to Airblast Loadings

F. Code of Federal Regulations (CFR):

16 CFR 1201-10.....Safety Standard for Architectural Glazing Materials

G. Glass Association of North America (GANA):

2010 Edition.....GANA Glazing Manual

2008 Edition.....GANA Sealant Manual

2009 Edition.....GANA Laminated Glazing Reference Manual

2010 Edition.....GANA Protective Glazing Reference Manual

H. International Code Council (ICC):

IBC.....International Building Code

I. Insulating Glass Certification Council (IGCC)

J. Insulating Glass Manufacturer Alliance (IGMA):

TB-3001-13.....Guidelines for Sloped Glazing

TM-3000.....North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use

K. Intertek Testing Services – Warnock Hersey (ITS-WHI)

L. National Fire Protection Association (NFPA):

80-16.....Fire Doors and Windows

252-12.....Fire Tests of Door Assemblies

257-12.....Standard on Fire Test for Window and Glass Block Assemblies

M. National Fenestration Rating Council (NFRC)

N. Safety Glazing Certification Council (SGCC) 2012:
Certified Products Directory (Issued Semi-Annually).

O. Underwriters Laboratories, Inc. (UL):
9-08(R2009).....Fire Tests of Window Assemblies
263-14.....Fire Tests of Building Construction and Materials
752-11.....Bullet-Resisting Equipment.

S. Environmental Protection Agency (EPA):
40 CFR 59(2014).....National Volatile Organic Compound Emission Standards for Consumer and Commercial Products

PART 2 - PRODUCT

2.1 GLASS

A. Provide minimum thickness stated and as additionally required to meet performance requirements.
   1. Provide minimum 6 mm (1/4 inch) thick glass units unless otherwise indicated.

B. Obtain glass units from single source from single manufacturer for each glass type.

C. Clear Glass:
   1. ASTM C1036, Type I, Class 1, Quality q4.

2.2 GLAZING ACCESSORIES

A. As required to supplement the accessories provided with the items to be glazed and to provide a complete installation. Ferrous metal accessories exposed in the finished work are to have a finish that will not corrode or stain while in service. Fire rated glazing to be installed with glazing accessories in accordance with the manufacturer’s installation instructions.

B. Setting Blocks: ASTM C864:
   1. Silicone type.
   2. Channel shape; having 6 mm (1/4 inch) internal depth.
   3. Shore A hardness of 80 to 90 Durometer.
   4. Block lengths: 50 mm (2 inches) except 100 to 150 mm (4 to 6 inches) for insulating glass.

5. Block width: Approximately 1.6 mm (1/16 inch) less than the full width of the rabbet.
6. Block thickness: Minimum 4.8 mm (3/16 inch). Thickness sized for rabbet depth as required.

C. Spacers: ASTM C864:
1. Channel shape having a 6 mm (1/4 inch) internal depth.
2. Flanges not less 2.4 mm (3/32 inch) thick and web 3 mm (1/8 inch) thick.
3. Lengths: 25 to 76 mm (1 to 3 inches).
4. Shore A hardness of 40 to 50 Durometer.

D. Glazing Tapes:
1. Semi-solid polymeric based closed cell material exhibiting pressure-sensitive adhesion and withstanding exposure to sunlight, moisture, heat, cold, and aging.
2. Shape, size and degree of softness and strength suitable for use in glazing application to prevent water infiltration.
3. Complying with AAMA 800 for the following types:
   a. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
   b. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

E. Spring Steel Spacer: Galvanized steel wire or strip designed to position glazing in channel or rabbeted sash with stops.

F. Glazing Clips: Galvanized steel spring wire designed to hold glass in position in rabbeted sash without stops.

G. Glazing Points (Sprigs): Pure zinc stock, thin, flat, triangular or diamond shaped pieces, 6 mm (1/4 inch) minimum size.

H. Glazing Gaskets: ASTM C864:
1. Firm dense wedge shape for locking in sash.
2. Soft, closed cell with locking key for sash key.
3. Flanges may terminate above the glazing-beads or terminate flush with top of beads.

I. Lock-Strip Glazing Gaskets: ASTM C542, shape, size, and mounting as indicated.

J. Glazing Sealants: ASTM C920, silicone neutral cure:
1. Type S.
2. Class 25 or 50 as recommended by manufacturer for application.

3. Grade NS.
4. Shore A hardness of 25 to 30 Durometer.
5. VOC Content: For sealants used inside the weatherproofing system, not more than 250 g/L or less when calculating according to 40 CFR 59, (EPA Method 24).

K. Structural Sealant: ASTM C920, silicone acetoxy cure:
1. Type S.
2. Class 25.
3. Grade NS.
4. Shore a hardness of 25 to 30 Durometer.

L. Neoprene, EPDM, or Vinyl Glazing Gasket: ASTM C864.
1. Channel shape; flanges may terminate above the glazing channel or flush with the top of the channel.
2. Designed for dry glazing.

M. Color:
1. Color of glazing compounds, gaskets, and sealants used for aluminum color frames to match color of the finished aluminum and be nonstaining.
2. Color of other glazing compounds, gaskets, and sealants which will be exposed in the finished work and unpainted are to be black, gray, or neutral color.

N. Smoke Removal Unit Targets: Adhesive targets affixed to glass to identify glass units intended for removal for smoke control. Comply with requirements of local Fire Department.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
1. Examine openings for glass and glazing units; determine they are proper size; plumb; square; and level before installation is started.
2. Verify that glazing openings conform with details, dimensions and tolerances indicated on manufacturer is approved shop drawings.

B. Review for conditions which may adversely affect glass and glazing unit installation, prior to commencement of installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

C. Verify that wash down of adjacent masonry is completed prior to erection of glass and glazing units.

3.2 PREPARATION

A. For sealant glazing, prepare glazing surfaces in accordance with GANA Sealant Manual.

B. Determine glazing unit size and edge clearances by measuring the actual unit to receive the glazing.

C. Shop fabricate and cut glass with smooth, straight edges of full size required by openings to provide GANA recommended edge clearances.

D. Verify that components used are compatible.

E. Clean and dry glazing surfaces.

F. Prime surfaces scheduled to receive sealants, as determined by preconstruction sealant-substrate testing.

3.3 INSTALLATION – GENERAL

A. Install in accordance with GANA Glazing Manual, GANA Sealant Manual, IGMA TB-3001, and IGMA TM-3000 unless specified otherwise.

B. Glaze in accordance with recommendations of glazing and framing manufacturers, and as required to meet the Performance Test Requirements specified in other applicable sections of specifications.

C. Set glazing without bending, twisting, or forcing of units.

D. Do not allow glass to rest on or contact any framing member.

E. Glaze doors and operable sash, in a securely fixed or closed and locked position, until sealant, glazing compound, or putty has thoroughly set.

3.4 INSTALLATION - REGLAZING HISTORIC FRAMING

A. Wood Sash: For glazing with glazing beads: Tape or ASTM C920, gunnable sealant.

B. Lock-strip Gaskets: Follow ASTM C716 for installation.

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SECTION 08 90 00
LOUVERS AND VENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies fixed and operable wall louvers, door louvers and wall vents.

1.2 RELATED WORK

A. Section 08 11 13, HOLLOW METAL DOORS AND FRAMES: Louvers in Steel Doors.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 30 00 ADMINISTRATIVE REQUIREMENTS.

B. Shop Drawings:

1. Each type, showing material, finish, size of members, method of assembly, and installation and anchorage details.

C. Manufacturer's Literature and Data:

1. Each type of louver and vent.

D. Color samples.

1.4 APPLICABLE PUBLICATIONS:

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. The Master Painters Institute (MPI):
Approved Product List - Updated Monthly

C. ASTM International (ASTM):

A653/A653M-20.....Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process

A1008/A1008M-20.....Steel, Sheet, Carbon, Cold Rolled, Structural, and High Strength Low-Alloy with Improved Formability

B209-14.....Aluminum and Aluminum Alloy, Sheet and Plate

B209M-14.....Aluminum and Aluminum Alloy, Sheet and Plate (Metric)

B221-14.....Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

B221M-13.....Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes (Metric)

D1187/D1187M-97(2018)...Asphalt-Base Emulsions for Use as Protective Coatings for Metal

D. National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500-06.....Metal Finishes Manual

E. American Architectural Manufacturers Association (AAMA):
2605-13.....High Performance Organic Coatings on Architectural Extrusions and Panels

F. Air Movement and Control Association, Inc. (AMCA):
500-L-07 Testing Louvers

G. USDA Forest Service Design and Construction Standards for Southern Region Facilities - 2021

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Aluminum, Extruded: ASTM B221M (B221).

B. Galvanized Steel Sheet: ASTM A653/A653M; G90 min.

C. Carbon Steel and Sheet: ASTM A1008/A1008M (interior use louvers only).

D. Aluminum, Plate and Sheet: ASTM B209M (B209); alloy 3003 or 5005 with temper as required for forming.

E. Fasteners: Fasteners for securing louvers and wall vents to adjoining construction, except as otherwise specified or indicated in construction documents, to be toggle or expansion bolts of size and type as required for each specific type of installation and service condition.

1. Where type, size, or spacing of fasteners is not shown or specified, submit shop drawings showing proposed fasteners, and method of installation.
2. Fasteners for louvers, louver frames, and wire guards to be of stainless steel or aluminum with same finish as louvers.
3. Fasteners for louvers, louver frames and wire guards within mental health areas to be non-removable/tamper-proof type.

F. Inorganic Zinc Primer: MPI No. 19.

2.2 EXTERIOR WALL LOUVERS:

A. General:

1. Provide fixed type louvers of size and design shown.
2. Heads, sills and jamb sections are to have formed caulking slots or be designed to retain caulking. Head sections are to have exterior drip lip, and sill sections an integral water stop.

3. Furnish louvers with sill extension or separate sill as shown.
4. Frame is to be mechanically fastened or welded construction with welds dressed smooth and flush.

B. Performance Characteristics:
1. Weather louvers are to have a minimum of 50 percent free area.
2. Louvers are to bear AMCA certified rating seals for air performance and water penetration ratings.

C. Aluminum Louvers:
1. General: Frames, blades, and mullions (sliding interlocking type); 2 mm (0.078-inch) thick extruded 6063-T5 or –T52 aluminum. Blades to be drainable type and have reinforcing bosses.
2. Louvers, fixed: Make frame sizes 13 mm (1/2-inch) smaller than openings. Single louvers frames are not to exceed 1676 mm (66 inches) wide. When openings exceed 1676 mm (66 inches), provide twin louvers separated by mullion members.
3. Louvers are to withstand the effects or gravity loads and wind loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors.

2.3 CLOSURE ANGLES AND CLOSURE PLATES:

A. Fabricate from 2 mm (0.078-inch) thick aluminum.
B. Provide continuous closure angles and closure plates on inside head, jambs and sill of exterior wall louvers.
C. Secure angles and plates to louver frames with screws, and to masonry or concrete with fasteners as indicated in construction documents.

2.4 WIRE GUARDS:

A. Provide wire guards on outside of all exterior louvers, except on exhaust air louvers.
B. Fabricate frames from 2 mm (0.078-inch) thick extruded or sheet aluminum designed to retain wire mesh.
C. Wire mesh to be woven from not less than 1.6 mm (0.063-inch) diameter aluminum wire in 13 mm (1/2-inch) square mesh.
D. Miter corners and join by concealed corner clips or locks extending not less than 57 mm (2-1/4 inches) into rails and stiles. Equip wire guards over 1219 mm (4 feet) in height with a mid-rail constructed as specified for frame components.

E. Fasten frames to outside of louvers with aluminum or stainless steel devices of same finish as louvers designed to allow removal and replacement without damage to the wire guard or the louver.

2.5 BLANK-OFF PANELS:

A. Uninsulated panels attached with clips or screws as follows: Panel finish is to be same finish applied to louvers.
   1. Aluminum sheet for aluminum louvers, 1.27 mm (0.050 inch) minimum thickness.
   2. Galvanized-steel sheet for galvanized-steel louvers, 1.02 mm (0.040 inch) minimum.

2.6 EXTERIOR DOOR LOUVERS:

A. Fabricate of 1.6 mm (0.063-inch) thick extruded aluminum. Miter frames at corners and join by concealed corner brackets. Louvers are to be weather resistant type.

B. Equip louvers on outside with wire guards.

2.7 WALL VENTS:

A. Fabricate exterior wall vents from 4.7 mm (0.185-inch) thick aluminum plate, perforated in diamond lattice pattern, with not over 19 mm (3/4-inch) openings.

B. Vents are to have aluminum screen frame with aluminum alloy insect screening mounted on back of vent by means of 19 mm x 5 mm (3/4-inch by 3/16-inch) top and bottom bars screwed to grille.

C. Vent Frames in Masonry: Fabricate of 45 mm x 30 mm x 5 mm (1-3/4 inch by 1-1/4 inch by 3/16-inch) steel angles bolted with 6 mm (1/4-inch) diameter expansion bolts at jambs.

2.8 AIR INTAKE VENTS:

A. Fabricate exterior louvered wall ventilators for fresh air intake from extruded aluminum, ASTM B221M (B221). Form with integral horizontal louvers and frame, with drip extending beyond face of wall and integral water stops.

2.9 FINISH:

A. In accordance with NAAMM Metal Finishes Manual: AMP 500-505

B. Aluminum Louvers:
   1. Anodized finish
      a. AA-M1X, Mill finish, as fabricated.
      b. AA-M10C22A41, Chemically etched medium matte, with clear anodic coating, Class I Architectural, 0.17 mm (0.7 mils) thick.

c. AA-M10C22A42, Chemically etched medium matte, with integrally colored anodic coating, Class I Architectural, 0.17 mm (0.7 mils) thick.

d. AA-M10C22A44, Chemically etched medium matte, with electronically deposited metallic compound, Class I Architectural, 0.17 mm (0.7 mils) thick color anodic coating. Dyes will not be accepted.

2. Organic Finish: AAMA 2605 (Fluorocarbon coating) with total dry film thickness of not less than 0.03 mm (1.2 mil).

A. Aluminum Wall Vents: Sand blasted satin finish.

B. Galvanized Sheet Steel: Two-coat baked-enamel or powder-coat finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 0.05 mm (2 mils).

1. Paint interior surfaces of lightproof louvers with two (2) additional finish shop coats of baked-on flat black enamel.

2. Finish painting of exposed surfaces of shop primed louvers is specified in Section 09 91 00, PAINTING.

C. Steel: Surfaces of steel work, for which no other finish is specified, are to be cleaned free from scale, rust, oil and grease, and then given a light colored prime paint after fabrication, except ferrous metals concealed in finished work. Paint all contact surfaces of assembled work (except welded contact surfaces) with an additional shop coat of similar paint.

2.10 PROTECTION:

A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with a heavy coat of bituminous coating (complete coverage), or by separating the contact surfaces with a preformed synthetic rubber tape having pressure sensitive adhesive coating on one side.

B. Isolate the aluminum from plaster, concrete and masonry by coating aluminum with zinc-chromate primer.

C. Protect finished surfaces from damage during fabrication, erection, and after completion of the work. Strippable plastic coating on finish is not approved.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Set work accurately, in alignment and where indicated in construction documents. Install plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.

B. Furnish setting drawings and instructions for installation of anchors and for the positioning of items having anchors to be built into masonry construction. Provide temporary bracing for such items until masonry is set.

C. Provide anchoring devices and fasteners as shown and as necessary for securing louvers and vents to building construction as specified. Power actuated drive pins may be used, except for removal items and where members would be deformed or substrate damaged by their use.

D. Set wall louvers and vents in masonry walls during progress of the work. If wall louvers and vents are not delivered to job in time for installation in prepared openings, make provision for later installation. Set in cast-in-place concrete in prepared openings.

3.2 CLEANING AND ADJUSTING:

A. After installation, all exposed prefinished and plated items and all items fabricated from aluminum are to be cleaned as recommended by the manufacturer and protected from damage until completion of the project.

B. All movable parts, including hardware, are to be cleaned and adjusted to operate as designed without binding or deformation of the members, so as to be centered in the opening of frame, and where applicable, to have all contact surfaces fit tight and even without forcing or warping the components.

C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Contracting Officer Representative (COR) damaged units and replace with new units.

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SECTION 09 05 16
SUBSURFACE PREPARATION FOR FLOOR FINISHES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies subsurface preparation requirements for areas to receive the installation of applied flooring. This section includes removal of existing floor coverings, testing concrete for moisture and pH, remedial floor coating for concrete floor slabs having unsatisfactory moisture or pH conditions, floor leveling and repair as required.

1.2 RELATED WORK

A. Section 07 92 00, JOINT SEALANTS.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 30 00 ADMINISTRATIVE REQUIREMENTS.

B. Written approval confirming product compatibility with subfloor material manufacturer and the flooring manufacturer

C. Product Data:

1. Moisture remediation system
2. Underlayment Primer
3. Cementitious Self-Leveling Underlayment
4. Cementitious Trowel-Applied Underlayment

D. Test Data:

1. Moisture test and pH results performed by a qualified independent testing agency or warranty holding manufacturer’s technical representative.

1.4 DELIVERY AND STORAGE

A. Deliver materials in containers with labels legible and intact and grade-seals unbroken.

B. Store material to prevent damage or contamination.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in text by basic designation only.

B. ASTM International(ASTM):

D4259-18(2019).....Standard Practice for Preparation of Concrete by Abrasion Prior to Coating Application.

C109/C109M-20b(2020)....Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens

7234-19(2020).....Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers

E96/E96M-16(2016).....Standard Test Methods for Water Vapor Transmission of Materials

F1869-16a.....Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

F2170-19a(2020).....Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

C348-20(2020).....Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars

C191-19(2020).....Standard Test Method for Time of Setting of Hydraulic Cement by Vicat Needle

PART 2 - PRODUCTS

2.1 MOISTURE REMEDIATION COATING

A. System Descriptions:
   1. High-solids, epoxy system designed to suppress excess moisture in concrete prior to an overlayment. For use under, tile where issues caused by moisture vapor are a concern.

B. Products: Subject to compliance with applicable fire, health, environmental, and safety requirements for storage, handling, installation, and clean up.

C. System Components: Verify specific requirements as systems vary by manufacturer. Verify build up layers and installation method. Verify compatibility with substrate. Use manufacturer’s standard components, compatible with each other and as follows:
   1. Liquid applied coating:
      a. Resin: epoxy.
      b. Formulation Description: Multiple component high solids.
      c. Application: Per manufacturer’s written installation requirements.
      d. Thickness: minimum 10 mils

D. Material Vapor Permeance: Application shall achieve a permeance rating of less than 0.1 perm in accordance with ASTM E96/E96M.

E. Maximum RH requirement: 100% testing in accordance with ASTM F2170.

Property	Test	Value
Tensile Strength	ASTM D638	4,400 psi
Volatile Organic Compound Limits (V.O.C.)	SCAMD Rule 1113 (Ammended 02/05/2016)	25 grams per liter
Permeance	ASTM E96	0.1 perms
Tensile Modulus	ASTM D638	$1.9X10^5$psi
Percent Elongation	ASTM D638	12%
Cure Rate	Per manufacture's Data	4 hours Tack free with 24hr recoat window
Bond Strength	ASTM D7234	100% bond to concrete failure

2.2 CEMENTITIOUS SELF-LEVELING UNDERLAYMENT

A. System Descriptions:

1. High performance self-leveling underlayment resurfacer. Single component, self-leveling, cementitious material designed for easy application as an underlayment for all types of flooring materials. It is used for substrate repair and leveling.

B. Products: Subject to compliance with applicable fire, health, environmental, and safety requirements for storage, handling, installation, and clean up. Gypsum-based products are unacceptable.

C. System Characteristics:

1. Wearing Surface: smooth
2. Thickness: Per architectural drawings, ranging from feathered edge to 1", per application. Applications greater than 1" require additional 3/8" aggregate to mix or as recommended by manufacturer.

D. Underlayment shall be calcium aluminate cement-based, containing Portland cement. Gypsum-based products are unacceptable.

E. Compressive Strength: Minimum 4100 psi in 28 days in accordance with ASTM C109/C109M.

F. Flexural Strength: Minimum 1000 psi in 28 days in accordance with ASTM C348

G. Dry Time: Underlayment shall receive the application of moisture insensitive tile in 6 hours.

H. Primer: compatible and as recommended by manufacturer for use over intended substrate

I. System Components: Manufacturer's standard components that are compatible with each other and as follows:

1. Primer:
   a. Resin: copolymer
   b. Formulation Description: single component ready to use.
   c. Application Method: Squeegee and medium nap roller.
   d. All puddles shall be removed, and material shall be allowed to dry, 1-2 hours at 70F/21C.
   e. Number of Coats: (1) one.
2. Grout Resurfacing Base:
   a. Formulation Description: Single component, cementitious self-leveling high-early and high-ultimate strength grout.
   b. Application Method: colloidal mix pump, cam rake, spike roll.
      1) Thickness of Coats: Per architectural scope, 1” lifts.
      2) Number of Coats: More than one if needed.
   c. Aggregates: for applications greater than 1 inch, require additional 3/8” aggregate to mix.

J.

Property	Test	Value
Compressive Strength	ASTM C109/C109M	2,200 psi @ 24 hrs 3,000 psi @ 7 days
Initial set time Final Set time	ASTM C191	30-45 min. 1 to 1.5 hours
Bond Strength	ASTM D7234	100% bond to concrete failure

2.3 CEMENTITIOUS TROWEL-APPLIED UNDERLAYMENT

A. Underlayment shall be calcium aluminate cement-based, containing Portland cement. Gypsum-based products are unacceptable.

B. Compressive Strength: Minimum 4000 psi in 28 days

C. Trowel-applied underlayment shall not contain silica quartz (sand).

D. Dry Time: Underlayment shall receive the application of floor covering in 15-20 minutes.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperature of work areas at not less than 16 degree C (60 degrees F), without interruption, for not less than 24 hours before testing and not less than three days after testing.

B. Maintain higher temperatures for a longer period of time where required by manufacturer's recommendation.

C. Do not install materials when the temperatures of the substrate or materials are not within 60-85 degrees F/ 16-30 degrees C.

3.2 SURFACE PREPARATION

A. Existing concrete slabs with existing floor coverings:

1. Conduct visual observation of existing floor covering for adhesion, water damage, alkaline deposits, and other defects.
2. Remove existing floor covering and adhesives. Comply with local, state and federal regulations and the RFCI Recommended Work Practices for Removal of Resilient Floor Coverings, as applicable to the floor covering being removed.

B. Concrete shall meet the requirements of ASTM F710 and be sound, solid, clean, and free of all oil, grease, dirt, curing compounds, and any substance that might act as a bond-breaker before application. As required prepare slab by mechanical methods. No chemicals or solvents shall be used.

C. General: Prepare and clean substrates according to flooring manufacturer's written instructions for substrate indicated.

D. Prepare concrete substrates per ASTM D4259 as follows:

1. Dry abrasive blasting.
2. Wet abrasive blasting.
3. Vacuum-assisted abrasive blasting.
4. Centrifugal-shot abrasive blasting.
5. Comply with manufacturer's written instructions.

E. Repair damaged and deteriorated concrete according to flooring manufacturer's written recommendations.

F. Verify that concrete substrates are dry.

G. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application only after substrates have maximum moisture-vapor-emission

rate of per flooring manufactures formal and project specific written recommendation.

H. Perform in situ probe test, ASTM F2170. Proceed with application only after substrates do not exceed a maximum potential equilibrium relative humidity per flooring manufacture’s formal and project specific written recommendation.

I. Provide a written report showing test placement and results.

J. Prepare joints in accordance with Section 07 92 00, JOINT SEALANTS and material manufacturer’s instructions.

K. Alkalinity: Measure surface pH in accordance with procedures provided in ASTM F710 or as outlined by qualified testing agency or flooring manufacturer’s technical representative.

L. Tolerances: Subsurface shall meet the flatness and levelness tolerance specified on drawings or recommended by the floor finish manufacturer. Tolerance shall also not to exceed 1/4” deviation in 10’. As required, install underlayment to achieve required tolerance.

M. Other Subsurface: For all other subsurface conditions, such as wood or metal, contact the floor finish or underlayment manufacturer, as appropriate, for proper preparation practices.

3.3 MOISTURE REMEDIATION COATING

A. Where results of relative humidity testing (ASTM F2170) exceed the requirements of the specified flooring manufacturer, apply remedial coating as specified to correct excessive moisture condition.

B. Prior to remedial floor coating installation mechanically prepare the concrete surface to provide a concrete surface profile in accordance with ASTM D4259.

C. Mix and apply moisture remediation coating in accordance with manufacturer’s instructions.

3.4 CEMENTITOUS UNDERLAYMENT

A. Install cementitious self-leveling underlayment as required to correct surface defects, floor flatness or levelness corrections to meet the tolerance requirements as or detailed on drawings, address non-moving cracks or joints, provide a smooth surface for the installation of floor covering, or meet elevation requirements detailed on drawings.

B. Mix and apply in accordance with manufacturer's instructions.

3.5 PROTECTION

A. Prior to the installation of the finish flooring, the surface of the underlayment should be protected from abuse by other trades by the use of plywood, tempered hardwood, or other suitable protection course

3.6 FIELD QUALITY CONTROL

A. Where specified, field sampling of products shall be conducted by a qualified, independent testing facility.

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SECTION 09 06 00
SCHEDULE FOR FINISHES

PART I – GENERAL

1.1 DESCRIPTION

A. This section contains a coordinated system in which requirements for materials specified in other sections shown are identified by abbreviated material names and finish codes in the Room Finish Schedule or shown for other locations.

1.2 MANUFACTURERS

A. Manufacturer's trade names and numbers used herein are only to identify colors, finishes, textures and patterns. Products of other manufacturer's equivalent to colors, finishes, textures and patterns of manufacturers listed that meet requirements of technical specifications will be acceptable upon approval in writing by contracting officer for finish requirements.

1.3 SUBMITALS

A. Submit in accordance with SECTION 01 30 00 Administrative Requirements, Article 3.10 Submittals for Review, provide quadruplicate samples for color approval of materials and finishes specified in this section.

B. Color Schedule: Submit full color schedule including manufacturers intending to be provided for project, with equivalent colors to selections provided by this section; format to match this section.

1.4 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

B. MASTER PAINTING INSTITUTE: (MPI)
Architectural Painting Specification Manual

PART 2 - PRODUCTS

2.1 COLOR BOARD

A. Size: As required to display building finishes.

B. Labeled for:

1. Building name and number.
2. All finishes used.

2.2 DIVISION 03 – CONCRETE

A. SECTION 03 30 53, CAST IN PLACE CONCRETE (SHORT FORM)

Surface	Finish Description
Pedestrian Walkways (Upper and Lower Loop A Bathhouses)	Medium broom finish, tooled control joints
Pedestrian Walkways (Day Use Areas)	Exposed Aggregate, tooled control joints
Boat Launch Ramp	Heavy transverse broom finish, tooled grooves for traction

2.3 DIVISON 04 – MASONRY

A. SECTION 04 05 13, MASONRY MORTARING and SECTION 04 05 31, MASONRY TUCK POINTING

NOT USED

2.4 DIVISON 12 – SITE FURNISHING

A. SECTION 32 33 00, SITE FURNISHINGS

Item	Finish Type	Color	Application / Notes.
Picnic Tables	1: Semi-transparent penetrating stains with UV inhibitors and water repellents and MPI approved low-VOC	2: Earth tones - Forest Service Brown, semigloss, darker shades on large surfaces for blending. Avoid bright/reflective colors unless directed by FS	3: Clean, sand to remove mill glaze; Apply 2-3 coats (4-6 mils dry film). Reseal every 5 years; protect end grains.
Benches	1: Semi-transparent penetrating stains with UV inhibitors and water repellents and MPI approved low-VOC	2: Earth tones - Forest Service Brown, semigloss, darker shades on large surfaces for blending. Avoid bright/reflective colors unless directed by FS	3: Clean, sand to remove mill glaze; Apply 2-3 coats (4-6 mils dry film). Reseal every 5 years; protect end grains.
Rail Fences	1: Semi-transparent penetrating stains with UV inhibitors and water repellents and MPI approved low-VOC	2: Earth tones - Forest Service Brown, semigloss, darker shades on large surfaces for blending. Avoid bright/reflective colors unless directed by FS	3: Clean, sand to remove mill glaze; Apply 2-3 coats (4-6 mils dry film). Reseal every 5 years; protect end grains.

Ref: 1. Preservative-Treated Wood and Alternative Products in the Forest Service (MTDC Tech. Rep. 0677-2809P)
2. https://www.fs.usda.gov/sites/default/files/fs_media/fs_document/TheBuiltEnvironmentImageGuide-2001-09.pdf
3. https://www.fpl.fs.usda.gov/documnts/fplgtr/fpl_gtr190.pdf

4. https://www.fs.usda.gov/t-d/pubs/pdfpubs/pdf22232803/2223%E2%80%932803_SRSDG_240408_LoRez_508.pdf

B. SECTION 04 20 00, UNIT MASONRY

NOT USED

C. SECTION 04 43 00, NATURAL STONE VENEER

Name of Stone	Color, Texture, Finish	Stone Source
Manufactured Stone Veneer	Natural earth tones, rough face texture	Owner selected, contractor furnished

D. SECTION 04 72 00, CAST STONE MASONRY

Type	Color	Manufacturer	Mfg. Color & Texture No.
Cap stones, sills	Medium gray-buff	TBD	Submit sample

2.4 DIVISION 05 – METALS

A. SECTION 05 50 00, METAL FABRICATIONS

Item	Finish
Loose Lintels	Hot dipped galvanized
Shelf Angles	Hot dipped galvanized
Handrails	Hot dipped galvanized, prime coat

Item	Finish
	+ 2 finish coats alkyd or epoxy paint

2.6 DIVISION 07 - THERMAL AND MOISTURE PROTECTION

A. SECTION 07 31 34, COMPOSITE SHAKE ROOFING

Size	Shape	Manufacturer	Mfg. Color Name/No.
Random widths	Hand-split and resawn shake profile	TBD	Owner selected

2.8 DIVISION 09 - FINISHES

G. SECTION 09 91 00, PAINT AND COATINGS

1.MPI Gloss and Sheen Standards:	Finish Description	Gloss @60	Sheen @85
Gloss Level 1	a traditional matte finish-flat	max 5 units, and	max 10 units
Gloss Level 2	a high side sheen flat-“a velvet-like” finish	max 10 units, and	10-35 units
Gloss Level 3	a traditional “egg-shell like” finish	10-25 units, and	10-35 units
Gloss Level 4	a “satin-like” finish	20-35 units, and	min. 35 units
Gloss Level 5	a traditional semi-gloss	35-70 units	
Gloss Level 6	a traditional gloss	70-85 units	
Gloss Level 7	a high gloss	more than 85 units	

SECTION 09 23 00
GYPSUM PLASTERING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies metal and gypsum lathing and gypsum plaster.

1.2 RELATED WORK

A. See Finish Schedule in Drawings: Room Finish schedule.

1.3 TERMINOLOGY

A. Definitions and description of terms to be in accordance with ASTM C11, ASTM C841, and ASTM C842 and as specified.

B. Underside of Structure Overhead: In spaces where trusses or joists are shown, the underside of structure overhead is the underside of the floor or roof construction supported by beams, trusses, and joists.

C. Self-furring Lath: Metal plastering bases having dimples or crimps designed to hold the back plane of the lath 6 to 10 mm (1/4 to 3/8 inch) away from the plane of the solid backing.

D. Solid Backing or Solid Bases: Concrete, masonry, sheathing, rigid insulation, and similar materials to which plaster is directly applied.

E. Wet Areas: Areas of a building where cyclic or continuous exposure to very humid or wet conditions, or in which a dew point condition may occur in the plaster.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 30 00 ADMINISTRATIVE REQUIREMENTS.

B. Shop Drawings:

1. Details of floating interior angle unrestrained construction.
2. Details of assembly and anchorage of lath and accessories.

C. Manufacturers' Literature and Data:

1. Accessories for plaster, each type.
2. Metal plaster bases, each type.
3. Fasteners.
4. Bonding compounds, including application instructions.
5. Admixtures, including mixing and application instructions.

D. Manufacturers certificates:

1. Gypsum plaster.

E. Samples: Accessories for plaster, each type, not less than 152 mm (6 inches) long.

F. Panel showing finish coat, 6 by 12 inches minimum.

G. Installer qualifications.

1.5 DELIVERY, STORAGE, AND PROTECTION

A. Deliver manufactured materials in the manufacturers' original unbroken packages or containers which are labeled plainly with the manufacturers' names and brands. Keep cementitious materials dry and stored off the ground, under cover, and away from sweating walls and other damp surfaces until ready for use.

1.6 PROJECT CONDITIONS

A. Comply with ASTM C842 requirements.

B. Maintain work areas at not less than 13 degrees C (55 degrees F) or greater than 27 degrees C (80 degrees F) for not less than one (1) week prior to application of plaster, continuously during application of plaster, and one (1) week after plaster has set or until plaster has dried.

1.7 QUALITY ASSURANCE

A. Installers qualifications: Work to be performed by installer having a minimum of three (3) years' experience for work relating to this Section.

1.8 PERFORMANCE REQUIREMENTS

A. Where indicated on construction documents, provide gypsum plaster assemblies identical to those of assemblies tested for fire resistance according to ASTM E119 by a qualified testing agency.

B. Where indicated on construction documents provide gypsum plaster assemblies identical to those of assemblies tested for STC ratings according to ASTM E90 and classified according to ASTM E413 by a qualified testing agency.

1.9 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.

B. ASTM International (ASTM):

A641/A641M-19.....Zinc-Coated (Galvanized) Carbon Steel Wire

A653/A653M-20.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

C11-18b.....Terminology Relating to Gypsum and Related Building Materials and Systems.

C28/C28M-10(2020).....Gypsum Plasters
C35-01(2019).....Inorganic Aggregates For Use in Gypsum Plaster
C206-14.....Finishing Hydrated Lime
C472-20.....Physical Testing of Gypsum, Gypsum Plaster and Gypsum Concrete
C631-09(2020).....Bonding Compounds for Interior Gypsum Plastering
C841-03(2018).....Installation of Interior Lathing and Furring
C842-05(2015).....Application of Interior Gypsum Plaster
C847-18.....Metal Lath
C1002-18.....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
D3678-19.....Rigid Poly (Vinyl Chloride) (PVC) Interior-Profile Extrusions
E413-16.....Classification for Rating Sound Insulation
E90-09(2016).....Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

C. Commercial Item Description (CID):
A-A-55615-95(R2006).....Shield, Expansion; (Wood Screw and Log Bolt Self-Threading Anchor)

D. USDA Forest Service Design and Construction Standards for Southern Region Facilities - 2021

PART 2 - PRODUCTS

1.1 PLASTERING BASES (LATH)

A. Expanded-Metal Lath: ASTM C847, cold-rolled carbon-steel sheet with ASTM A653/A653M, G60 (Z180), hot-dip galvanized-zinc coating.
   1. Paper Backing: Kraft paper factory bonded to back of lath.
   2. Diamond-Mesh Lath:
      a. Type: Self-furring.
      b. Weight: 1.4 kg/square meter (2.5 pound/square yard).
   3. Flat-Rib Lath: Rib depth of not more than 3 mm (1/8 inch), 1.5 kg/square meter (2.75 pound/square yard).
   4. 10 mm (3/8-inch) Rib Lath: 1.8 kg/square meter (3.4 pound/square yard).

B. Gypsum Lath:

1. Sheet; 610 mm x 2438 mm (2 feet. x 8 feet.).
2. 10 mm (3/8 inch) thick.
3. Type “X” for fire rated assemblies.

1.2 GYPSUM PLASTERS

A. Base Coat: High strength gypsum plaster with a minimum average, dry compressive strength of 19 MPa (2800 psi) according to ASTM C472 for a mix of 45 kg (100 pounds) of plaster and .06 cubic meter (2 cubic feet) of sand.

B. Finish Coat: High strength gypsum gauging plaster with a minimum average dry compressive strength of 34 MPa (5000 pounds square inch) according to ASTM C472.

1.3 LIME

A. ASTM C206, Type S.

1.4 AGGREGATES:

A. Natural sand, except grade aggregates in accordance with ASTM C35, "TABLE 1".

B. Vermiculite and perlite aggregates are not acceptable, except where required for fire rated assemblies.

1.5 BONDING COMPOUND (FOR INTERIOR WORK)

A. ASTM C631, except water re-emulsifiable compound is prohibited.

1.6 ACCESSORIES FOR GYPSUM PLASTER

A. General: Coordinate depth of trim and accessories with thicknesses and number of plaster coats required as per ASTM C841.

B. Cornerite: Fabricated from expanded-metal lath with ASTM A653/A653M, G60 (Z180), hot-dip galvanized-zinc coating.

C. Striplath: Fabricated from expanded-metal lath with ASTM A653/A653M, G60 (Z180), hot-dip galvanized-zinc coating.

D. Cornerbeads: Fabricated from zinc-coated (galvanized) steel.

1. Smallnose cornerbead with expanded flanges; use unless otherwise indicated on construction documents.
2. Smallnose cornerbead with perforated flanges; use on curved corners.
3. Smallnose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing unit masonry corners.
4. Bullnose cornerbead, radius 19 mm (3/4 inch) minimum, with expanded flanges; use at locations indicated on construction documents.

E. Casing Beads: Fabricated from zinc-coated (galvanized) steel; square-edged style; with expanded flanges.

F. 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.

1.7 FASTENERS

A. Tie wire, screws, staples, clips, nails, and other fasteners ASTM C841, except as otherwise specified.

B. Provide fasteners for securing metal plastering bases having heads, or inserted through washers large enough to engage two strands (1 on each side of the washer) of the metal plastering base.

C. For fire rated construction type and size as used in fire rated test.

D. Screws: ASTM C1002.

E. Expansion Shields: CID A-A-55615.

PART 3 - EXECUTION

3.1 APPLYING LATH BASES

A. Apply lath base in accordance with ASTM C841, except as otherwise specified or shown.

B. Provide metal plastering bases where plaster is required on partitions, ceilings and furring, where required for setting ceramic tile in adhesive on gypsum plaster.

1. Where plaster is required on solid bases, metal plastering bases are not required, unless shown on the construction documents.
2. Form true surfaces, straight or in moderate curves where shown on construction documents, without sags or buckles and with long dimension of lath at right angles to direction of supports.
3. Shape lathing to within 19 mm (3/4 inch) of finished profiles of irregular surfaces.
4. Terminate lath for ceiling construction at casing bead (Floating Angle Construction) where butting into or penetrated by walls, columns, beams, and similar elements.

C. Gypsum lath may be used in lieu of expanded metal lath for gypsum plaster only on straight flat surfaces of partitions and walls, and on furring, except for lathing in wet areas and as a base for marble finishes.

D. Installing Metal Plastering Bases:

1. Select type of expanded metal lath to conform to Table 2 of ASTM C841.
2. Select type of fasteners based upon expanded metal lath type to be installed to conform to Table 1 of ASTM C841.
3. Where metal plastering bases are required over solid backing, provide self-furring, diamond-mesh lath type.
4. Attach self-furring diamond-mesh lath directly to masonry and concrete with hardened nails, power actuated drive pins. Locate fasteners at the dimples or crimps only.
5. Where metal plastering bases are required over steel columns and studless solid plaster partitions supports by L-runners, provide rib lath.
6. Provide rib lath above ceramic title wainscots where the finish above the wainscot is required to finish flush with the tile face.
7. Do not install continuous plastering bases through expansion and control joints. Terminate plastering base at each side of joint.

3.2 SURFACE PREPARATION OF SOLID BASES

A. Prepare in accordance with ASTM C842, except as otherwise specified.
B. Terminate concrete form ties and other metal projections not less than 3.2 mm (1/8 inch) below the surface of concrete.
C. Remove projections and fill depressions, holes, cracks and similar voids flush with patching compound compatible with the substrate and plaster, within the tolerance, specified in ASTM C842.
D. Clean existing concrete surfaces specified to receive plaster to ensure bonding as specified in ASTM C842.
E. Condition new or existing concrete surfaces specified to receive plaster by applying bonding compound as specified in ASTM C842.
F. Condition new, surfaces (solid backing) specified to receive plaster by applying metal plastering base as specified in ASTM C842.

3.3 INSTALLING PLASTERING ACCESSORIES

A. Install accessories in accordance with ASTM C841, except as follows:
   1. Set plastering accessories plumb, level and true to line, mitered at corners and intersections, and securely attach to supporting surfaces.
   2. Install in one piece, within the limits of the longest commercially available lengths.
   3. Wood plugs are not acceptable anchorage for fasteners.

B. Corner Beads: Install at external plaster corners.

C. Strip Lath:

1. Install centered over joints between dissimilar materials, such as clay tile, brick, concrete masonry units, concrete, and expanded metal and gypsum lath. Install where surfaces are required to be plastered and are in contact with each other in same plane, except where expansion joints and casing beads are required.
2. Wire tie, staple, screw, or nail strip lath to base along both edges at not over 152 mm (6 inches) on centers.
3. Reinforce gypsum lath at corners of openings, at internal corners, and at chases and similar breaks in continuity in accordance with ASTM C841.

D. Casing Beads:

1. Provide at locations where plaster terminates against other materials.
2. Provide where indicated in construction documents.
3. Provide where plaster terminates against trim of steel frames and trim of other materials and equipment, except where trim overlaps plaster.
4. Provide where plaster for new walls or furring (vertical or horizontal) terminates against existing construction.
5. Provide around perimeter of openings for recessed casework and equipment, except where edge is covered by flanges. Locate to conform to dimensions shown on approved shop drawings.
6. Both sides of expansion and control joints, unless shown otherwise.
7. Where ceilings butt into or are penetrated by walls, columns, beams, and similar elements so as to provide floating angle (unrestrained) construction in accordance with ASTM C841.

E. Cornerites:

1. Provide at interior corners of walls, partitions, and other vertical surfaces to be plastered, except where lath is carried around angle.
2. Fasten only as necessary to retain position during plastering.
3. Omit cornerites at junction of new plastered walls with existing plastered walls.
4. Provide where metal plastering bases are specified not to be carried around internal angles, and at locations where casing beads are specified and shown.

F. Control Joints:
   1. Where control joints are placed parallel to framing members, install joints within 101 mm (4 inches) of framing member.
   2. Install control joints only to the edges of abutting sheets of lath so that the lath is not continuous or tied across joint.
   3. Extend control joints the full width and height of the wall or length of soffit/ceiling plaster membrane.

3.4 GYPSUM PLASTER APPLICATION

A. Proportion, mix, and apply plaster in accordance with ASTM C842.
B. Thickness of Plaster: ASTM C842, except as follows:
   1. Where greater thickness is indicated on construction documents.
   2. Where thickness is required to match existing.
   3. On metal plaster base 19 mm (3/4 inch), except where greater thickness is required for fire rated construction.
   4. Apply finish coats to a uniform thickness of approximately 2 mm (1/16 inch) with not more than 3 mm (1/8 inch) thickness at any point.
C. Cut 2 mm (1/16 inch) deep V-joint in finish coat of plaster adjacent to metal door frames and wherever plaster finishes flush with other materials, except where casing beads are required. Omit 2 mm (1/16 inch) deep V-joint on walls and partitions where plaster is recessed back from face of door frames, or similar conditions.
D. Plaster to have a smooth-trowel finish unless specified or shown otherwise.
E. Apply gypsum plaster in three (3) coats except as follows: Gypsum plaster applied to gypsum lath using the two-coat double back method.
F. Gypsum Plaster Base Coat: Apply base coats with sufficient pressure and ensure plaster is sufficiently plastic to provide a strong bond to bases. Work base coats into screeds at intervals from 1524 to 2438 mm (5 to 8 feet). Plaster must not be continuous across expansion and control joints occurring in walls, partitions, and ceilings. Finish work level, plumb, square, and true, within a tolerance of 3 mm in 2438 mm (1/8 inch in 8 feet) without waves, cracks, blisters, pits, crazing, discoloration, projections, or other imperfections. Form plaster work carefully around angles and contours, and well up to screeds. Take special care to prevent sagging and consequent dropping

of applications. There must be no visible junction marks in finish coat where one day's work adjoins another.

1. Gypsum Two-Coat Base Coat: Apply the first coat to cover the base with sufficient material and pressure to form a good bond on the wall or ceiling base. Before the first coat has set and without scratching or cracking the surface, apply a second coat (double back) of the same material proportion as the base coat to the screeds. Straighten to a true surface without application of water, and cross rake or scratch to receive the finish coat.
2. Gypsum Three-Coat Base Coat: Apply scratch coat 5 to 6 mm (3/16 to 1/4 inch) thick to cover the base with sufficient material and pressure to form a good bond on the wall or ceiling base. Rake or scratch the surface and allow to set firm and hard. Apply the brown coat to bring the base coat out to the screeds, compact, and straighten to a true surface without the application of water, and cross rake or scratch to receive the finish coat.

G. Gypsum Plaster Finish Coats: Moderately moisten or fog spray base coat of plaster that has become dry before finish coat is applied. Accelerate plaster, if necessary, to provide a setting time of not more than four (4) hours from the time the plaster is mixed.

1. Lime-Putty and Gypsum Gauged Finish Coat: Apply lime-putty gypsum finish white coat over the base coat, scratch in thoroughly, lay on well, double back, and fill out to a true, even surface. Allow the finish to dry not more than five (5) minutes, then trowel well with water. Apply maximum pressure in order to compact the finish coat and provide a smooth finish free from blemishes and irregularities. Apply trowel finish coats of gypsum-gauged lime-putty over properly prepared base coats as thin as possible and 2 to 3 mm (1/16 to 1/8 inch) thick for conventional plaster system, except as necessary in spots to level out hollows in base coat.

H. Concealed Plaster:

1. Where plaster is concealed behind built in cabinets, furnishings, or equipment, apply finish coat.
2. Where plaster is concealed above ceilings, omit finish coat.
3. Where plaster is used as a base for adhesive application of tile and similar finishes, omit finish coat.

3.5 PATCHING

A. After all work except painting is finished, point around trim, frames, and similar items.

B. Patch damaged plaster to match previously applied plaster in color and texture.

C. Sanding plaster is prohibited.

D. Patch, alter and replace existing plaster surfaces as required to complete work.

3.6 CLEANING AND PROTECTION

A. Remove temporary protection and enclosure of other work after plastering is complete. Remove droppings or spatterings from other surfaces not indicated to be plastered. Leave clean and in a condition to receive paint or other finish.

- - - E N D - - -

SECTION 09 29 00
GYPSUM BOARD

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies installation and finishing of gypsum board.

1.2 RELATED WORK

A. Acoustical Sealants: Section 07 92 00, JOINT SEALANTS.

1.3 TERMINOLOGY

A. Definitions and description of terms shall be in accordance with ASTM C11, C840, and as specified.

B. Underside of Structure Overhead: In spaces where trusses or joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by the trusses or joists.

C. "Yoked": Gypsum board cut out for opening with no joint at the opening (along door jamb or above the door).

1.4 SUBMITTALS

A. Submit in accordance with Section 01 30 00 ADMINISTRATIVE REQUIREMENTS.

B. Manufacturer's Literature and Data:

1. Cornerbead and edge trim.
2. Finishing materials.
3. Laminating adhesive.
4. Gypsum board, each type.

C. Shop Drawings:

1. Typical gypsum board installation, showing corner details, edge trim details and the like.
2. Typical fire rated assembly, indicating details of construction same as that used in fire rating test.

D. Samples:

1. Cornerbead.
2. Edge trim.
3. Control joints.

E. Test Results:

1. Fire rating test, each fire rating required for each assembly.

F. Certificates: Certify that gypsum board types, gypsum backing board types, cementitious backer units, and joint treating materials do not contain asbestos material.

1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE

In accordance with the requirements of ASTM C840.

1.6 ENVIRONMENTAL CONDITIONS

In accordance with the requirements of ASTM C840.

1.7 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society for Testing And Materials (ASTM):

C11-15.....Terminology Relating to Gypsum and Related Building Materials and Systems

C475-15.....Joint Compound and Joint Tape for Finishing Gypsum Board

C840-13.....Application and Finishing of Gypsum Board

C1002-14.....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs

C1047-14.....Accessories for Gypsum Wallboard and Gypsum Veneer Base

C1177-13.....Glass Mat Gypsum Substrate for Use as Sheathing

C1178/C1178M-18.....Specification for Coated Glass Mat Water Resistant Backing Panel

C1658-13.....Glass Mat Gypsum Panels

C1396-14.....Gypsum Board

C. Underwriters Laboratories Inc. (UL):

Latest Edition.....Fire Resistance Directory

D. Inchcape Testing Services (ITS):

Latest Editions.....Certification Listings

PART 2 - PRODUCTS

2.1 GYPSUM BOARD

A. Gypsum Board: ASTM C1396, Type X, 1/2 inch thick unless shown otherwise.

2.2 GYPSUM SHEATHING BOARD

A. ASTM C1396, Type X, water-resistant core, 1/2 inch thick.

B. ASTM C1177, Type X.

2.3 ACCESSORIES

A. ASTM C1047, except form of 0.39 mm (0.015 inch) thick zinc coated steel sheet or rigid PVC plastic.

B. Flanges not less than 22 mm (7/8 inch) wide with punchouts or deformations as required to provide compound bond.

2.4 FASTENERS

A. ASTM C1002 and ASTM C840, except as otherwise specified.

B. Select screws of size and type recommended by the manufacturer of the material being fastened.

C. For fire rated construction, type and size same as used in fire rating test.

D. Clips: Zinc-coated (galvanized) steel; gypsum board manufacturer's standard items.

2.5 FINISHING MATERIALS AND LAMINATING ADHESIVE

ASTM C475 and ASTM C840. Free of antifreeze, vinyl adhesives, preservatives, biocides and other VOC. Adhesive shall contain a maximum VOC content of 50 g/l.

PART 3 - EXECUTION

3.1 GYPSUM BOARD HEIGHTS

A. Extend all layers of gypsum board from floor to underside of structure overhead where indicated on the drawings.

3.2 INSTALLING GYPSUM BOARD

A. Coordinate installation of gypsum board with other trades and related work.

B. Install gypsum board in accordance with ASTM C840, except as otherwise specified.

C. Moisture and Mold-Resistant Assemblies: Provide and install moisture and mold-resistant glass mat gypsum wallboard products with moisture-resistant surfaces complying with ASTM C1658 where shown and in locations which might be subject to moisture exposure during construction.

D. Use gypsum boards in maximum practical lengths to minimize number of end joints.

E. Bring gypsum board into contact, but do not force into place.

F. Ceilings:

1. For single-ply construction, use perpendicular application.
2. For two-ply assembles:

a. Use perpendicular application.
b. Apply face ply of gypsum board so that joints of face ply do not occur at joints of base ply with joints over framing members.

G. Walls (Except Shaft Walls):
1. When gypsum board is installed parallel to framing members, space fasteners 300 mm (12 inches) on center in field of the board, and 200 mm (8 inches) on center along edges.
2. When gypsum board is installed perpendicular to framing members, space fasteners 300 mm (12 inches) on center in field and along edges.
3. Stagger screws on abutting edges or ends.
4. For single-ply construction, apply gypsum board with long dimension either parallel or perpendicular to framing members as required to minimize number of joints.
5. For two-ply gypsum board assemblies, apply base ply of gypsum board to assure minimum number of joints in face layer. Apply face ply of wallboard to base ply so that joints of face ply do not occur at joints of base ply with joints over framing members.
6. No offset in exposed face of walls and partitions will be permitted because of single-ply and two-ply or three-ply application requirements.
7. Control Joints ASTM C840 and as follows:
a. Locate at both side jambs of openings if gypsum board is not "yoked". Use one system throughout.
b. Not required for wall lengths less than 9000 mm (30 feet).
c. Extend control joints the full height of the wall or length of soffit/ceiling membrane.

H. Acoustical or Sound Rated Partitions, Fire and Smoke Partitions:
1. Cut gypsum board for a space approximately 3 mm to 6 mm (1/8 to 1/4 inch) wide around partition perimeter.
2. Coordinate for application of caulking or sealants to space prior to taping and finishing.

I. Electrical and Telecommunications Boxes:
1. Seal annular spaces between electrical and telecommunications receptacle boxes and gypsum board partitions.

J. Accessories:

1. Set accessories plumb, level and true to line, neatly mitered at corners and intersections, and securely attach to supporting surfaces as specified.
2. Install in one piece, without the limits of the longest commercially available lengths.
3. Corner Beads:
   a. Install at all vertical and horizontal external corners and where shown.
   b. Use screws only. Do not use crimping tool.
4. Edge Trim (casings Beads):
   a. At both sides of expansion and control joints unless shown otherwise.
   b. Where gypsum board terminates against dissimilar materials and at perimeter of openings, except where covered by flanges, casings or permanently built-in equipment.
   c. Where gypsum board surfaces of non-load bearing assemblies abut load bearing members.
   d. Where shown.

3.3 INSTALLING GYPSUM SHEATHING

A. Install in accordance with ASTM C840, except as otherwise specified or shown.
B. Use screws of sufficient length to secure sheathing to framing.
C. Space screws 9 mm (3/8 inch) from ends and edges of sheathing and 200 mm (8 inches) on center. Space screws a maximum of 200 mm (8 inches) on center on intermediate framing members.
D. Apply 600 mm by 2400 mm (2 foot by 8 foot) sheathing boards horizontally with tongue edge up.
E. Apply 1200 mm by 2400 mm or 2700 mm (4 ft. by 8 ft. or 9 foot) gypsum sheathing boards vertically with edges over framing.

3.5 FINISHING OF GYPSUM BOARD

A. Finish joints, edges, corners, and fastener heads in accordance with ASTM C840. Use Level 4 finish for all finished areas open to public view.
B. Before proceeding with installation of finishing materials, assure the following:
   1. Gypsum board is fastened and held close to framing or furring.

2. Fastening heads in gypsum board are slightly below surface in dimple formed by driving tool.

C. Finish joints, fasteners, and all openings, including openings around penetrations. Seal remaining openings and maintain the integrity of the construction. Sanding is not required of non decorated surfaces.

3.6 REPAIRS

A. After taping and finishing has been completed, and before decoration, repair all damaged and defective work, including nondecorated surfaces.

B. Patch holes or openings 13 mm (1/2 inch) or less in diameter, or equivalent size, with a setting type finishing compound or patching plaster.

C. Repair holes or openings over 13 mm (1/2 inch) diameter, or equivalent size, with 1/2 inch thick gypsum board secured in such a manner as to provide solid substrate equivalent to undamaged surface.

D. Tape and refinish scratched, abraded or damaged finish surfaces including cracks and joints in non decorated surfaces.

3.7 UNACCESSIBLE CEILINGS (NOT USED)

- - - E N D - - -

SECTION 09 30 00 TILING

BASIS OF DESIGN – SCHLUTER SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Ceramic tile and dimension stone

B. Edge-protection and transition profiles for floors

C. Finishing and edge-protection profiles for walls

D. Wall access panel system

E. Cove-shaped profiles

F. Modular screed system

G. Uncoupling membrane

H. Waterproofing membrane

I. Floor drain, with integrated bonding flange

J. Shower waterproofing: prefabricated substrates, waterproofing membrane, floor drain with integrated bonding flange, and sealant

K. Drainage membranes

L. Setting materials: adhesives, mortars, grouts, and sealants

1.02 RELATED SECTIONS

A. Section 03 00 00 – Concrete

B. Section 06 10 00 - Rough Carpentry: plywood subfloor and underlayment

C. Section 07 92 00 - Joint Sealants

D. Section 09 29 00- Gypsum Board: gypsum board and tile backer boards

E. Section 22 40 00 - Plumbing Fixtures: floor drains

1.03 REFERENCES

A. CSA B79: Floor, Area, and Shower Drains, and Cleanouts for Residential Construction

B. IAPMO IGC 195: Interim Guide Criteria for Floor Drain with Integrated Bonding Flange

C. Tile Council of North America (TCNA) Handbook for Ceramic Tile Installation

D. Terrazzo, Tile and Marble Association of Canada (TTMAC) Specification Guide 09300 Tile Installation Manual

E. American National Standard Specifications for the installation of ceramic tile A108 / A118 / A136.1

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Schluter Systems, L.P., 194 Pleasant Ridge Road, Plattsburgh, NY 12901- 5841. Tel.: (800) 472-4588. Fax: (800) 477-9783. E-mail: specassist@schluter.com. Internet: www.schluter.com.

B. Crossville Tile and Crossville Studios. See Finish Schedule in Drawing set for contact information.

2.02 TILE

A. Crossville Tile and Crossville Studios. See Finish Schedule in Drawing set for contact information.

2.03 EDGE-PROTECTION AND TRANSITION PROFILES FOR FLOORS (NOT USED)

2.04 FINISHING AND EDGE-PROTECTION PROFILES FOR WALLS AND COUNTERTOPS

A. Schluter®-JOLLY

1. Description: L-shaped profile with 1/8" (3.2 mm) wide top section and vertical wall section that together form the visible surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
2. Anchoring Leg:
   a. Provide with straight anchoring leg
   b. Provide with special radius anchoring leg for radius applications
3. Material and Finish:
   a. AC - Color-coated Aluminum:
      1) TSC – Cream
4. Height: Height as required

J. Schluter®-RONDEC

1. Description: bullnose-type profile with symmetrically rounded visible surface with 1/4" (6 mm) radius, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
2. Corners:
   a. Provide with matching inside corners
   b. Provide with matching outside corners
   c. Provide with internal connectors
3. Material and Finish:
   a. AC - Color-coated Aluminum:

1) TSC - Cream color-coated Aluminum
4. Height: Height as required

2.05 FINISHING AND EDGE-PROTECTION PROFILES FOR STAIR NOSINGS (NOT USED)

2.06 COVE-SHAPED PROFILES

J. Schluter®-DILEX-AHK
1. Description: anodized aluminum profile with integrated trapezoid- perforated anchoring leg, connected at a 90-degree angle by a cove- shaped section with 3/8" (10 mm) radius that forms the visible surface.
2. Corners:
a. Provide with matching inside corners
b. Provide with matching outside corners
c. Provide with matching end caps
d. Provide with matching connectors
3. Material and Finish:
a. TSC – Cream
4. Height: Height as required

2.07 MODULAR SCREED SYSTEM

Schluter®-BEKOTEC is a modular screed system that produces permanent flooring assemblies that are free from internal stresses. This allows for the installation of continuous screed surfaces without any saw cuts or control joints. Ceramic and stone tile is set over the screed using the thin-set method, in conjunction with the Schluter®-DITRA uncoupling membrane, while surface coverings not sensitive to cracking, such as parquet or carpet, can be installed directly over the screed as soon as the residual moisture has reached an appropriate level. The system is self- supporting, making it possible to place additional layers of heat and/or sound insulation to obtain the desired effect. The system is also designed to hold hydronic radiant heating tubes without fasteners.

A. Schluter®-BEKOTEC-F Polyethylene Foil
1. Modular Screed System: Schluter®-BEKOTEC 36" x 47 1/4" (90 cm x 120 cm) polyethylene panel, with 7/8" (23 mm) high integrated studs set in a grid pattern spaced 4-1/4" (108 mm) on center.
2. Edge Strip:
a. Provide with matching edge strip

B. Schluter®-BEKOTEC-DRAIN Polyethylene Foil

1. Modular Screed System: Schluter®-BEKOTEC 36" x 47 1/4" (90 cm x 120 cm) polyethylene panel with evenly spaced openings and interconnected drainage channels, with 7/8" (23 mm) high integrated studs set in a grid pattern spaced 4-1/4" (108 mm) on center.
2. Edge Strip:
   a. Provide with matching edge strip

C. Schluter®-BEKOTEC Expanded Polystyrene
1. Description: 24" x 48" x 1-3/8" (610 mm x 1219 mm x 35 mm) expanded polystyrene panel, with 15/16" (24 mm) high integrated studs set in a grid pattern spaced 4-1/4" (108 mm) on center.
2. Edge Strip:
   a. Provide with matching edge strip

2.08 UNCOUPLING MEMBRANE AND SOUND CONTROL MEMBRANE

Schluter®-DITRA is specifically designed to allow the installation of ceramic and stone tile over any even and load-bearing substrate. The integration of DITRA's uncoupling, waterproofing, load- distribution, and vapor management functions makes consistent results viable.

A. Schluter®-DITRA
1. Description: 1/8" (3 mm) thick, orange, high-density polyethylene membrane with a grid structure of 1/2" x 1/2" (12 mm x 12 mm) square cavities, each cut back in a dovetail configuration, and a polypropylene anchoring fleece laminated to its underside. Conforms to definition for uncoupling membranes in the Tile Council of North America Handbook for Ceramic Tile Installation; and meets or exceeds the requirements of the "American national standard specifications for load bearing, bonded, waterproof membranes for thin-set ceramic tile and dimension stone installation A118.10," and is listed by cUPC®, and is evaluated by ICC-ES (see Report No. ESR-2467 and PMG 1204).
2. Waterproofing seaming membrane:
   a. Provide with Schluter®-KERDI-BAND Seams and Corners material 0.004" (4 mil) thick, orange polyethylene

membrane, with polypropylene fleece laminated on both sides.

B. Schluter®-DITRA-XL

1. Description: 9/32" (7 mm) thick, orange, high-density polyethylene membrane with a grid structure of 1/2" x 1/2" (12 mm x 12 mm) square cavities, each cut back in a dovetail configuration, and a polypropylene anchoring fleece laminated to its underside. Conforms to definition for uncoupling membranes in the Tile Council of North America Handbook for Ceramic Tile Installation; and meets or exceeds the requirements of the "American national standard specifications for load bearing, bonded, waterproof membranes for thin-set ceramic tile and dimension stone installation A118.10," and is listed by cUPC®, and is evaluated by ICC-ES (see Report No. ESR-2467 and PMG 1204).
2. Waterproofing seaming membrane:
   a. Provide with Schluter®-KERDI-BAND Seams and Corners material 0.004" (4 mil) thick, orange polyethylene membrane, with polypropylene fleece laminated on both sides.

C. Schluter®-DITRA-DRAIN

1. Description: 5/32" (4 mm) thick, Drainage membrane designed for use with thin bed ceramic and stone tile assemblies in exterior applications. Membrane consists of orange, high-density studded polyethylene sheet with laminated polypropylene filter fabric to the upper side.

2.09 WATERPROOFING MEMBRANE

A. Schluter®-KERDI

1. Description: 0.008" (8 mil) thick, orange polyethylene membrane, with polypropylene fleece laminated on both sides, which meets or exceeds the requirements of the "American national standard specifications for load bearing, bonded, waterproof membranes for thin-set ceramic tile and dimension stone installation A118.10," and is listed by cUPC®, and is evaluated by ICC-ES (see Report No. ESR-2467 and PMG 1204).

2. Waterproofing seaming membrane:
   a. Provide Schluter®-KERDI-BAND Seams and Corners material 0.004" (4 mil) thick, orange polyethylene membrane, with polypropylene fleece laminated on both sides.
3. Waterproofing Accessories:
   a. Provide Schluter®-KERD-SEAL Mixing Valve seals
   b. Provide Schluter®-KERD-SEAL pipe seals

B. Schluter®-KERDI-DS
1. Description: 0.020" (20 mil) thick, orange polyethylene membrane, with polypropylene fleece laminated on both sides, which meets or exceeds the requirements of the "American national standard specifications for load bearing, bonded, waterproof membranes for thin-set ceramic tile and dimension stone installation A118.10," and is listed by cUPC®, and is evaluated by ICC-ES (see Report No. ESR-2467 and PMG 1204).
2. Waterproofing seaming membrane:
   a. Provide Schluter®-KERDI-BAND Seams and Corners material 0.004" (4 mil) thick, orange polyethylene membrane, with polypropylene fleece laminated on both sides.
3. Waterproofing Accessories:
   a. Provide Schluter®-KERD-SEAL Mixing Valve seals
   b. Provide Schluter®-KERD-SEAL pipe seals

Notes:

1. KERDI is available in 0.004" (4 mil) thick, 5" (125 mm), 7-1/4" (185 mm), and 10" (250 mm) wide bands for seams, corners and pre-fabricated seals (Schluter®-KERDI-BAND and Schluter®-KERDI-SEAL-PS/-MV).

2.10 FLOOR DRAIN WITH INTEGRATED BONDING FLANGE

The Schluter®-KERDI-DRAIN was designed specifically to ensure a simple and secure connection to bonded waterproof membranes, such as Schluter®-KERDI, at the top of the assembly rather than below it, thereby reducing the risk of leakage, efflorescence, and mold growth.

A. Schluter®-KERDI-DRAIN [Stainless Steel]
1. Description: stainless steel floor drain 9-27/32" (250 mm) diameter integrated bonding flange with no-hub outlet, and grate assembly. Grate assembly includes stainless steel

grate, height adjustment collar, and lateral adjustment ring with trapezoid perforations. Drain listed by UPC® to meet requirements of "International Association of Plumbing and Mechanical Officials Interim Guide Criteria for Floor Drain with Integrated Bonding Flange" (IGC 195), listed by CSA to meet requirements of the Canadian Standards Association standard, "Floor, Area, and Shower Drains, and Cleanouts for Residential Construction" (CSA B79), Drain type as referenced in methods B422, B422C and B422 STONE of the Tile Council of North America Handbook for Ceramic Tile Installation.

2. Drain Housing Material:
   a. Stainless Steel
3. Grate Design, Material and Finish:
   a. Design 1 – Arc-shaped and trapezoid-shaped openings
      1) E –Stainless Steel Type 304
4. Nominal Grate Size:
   a. 4" (100 mm) x 4" (100 mm) square
   b. 6" (150 mm) x 6" (150 mm) square
   c. 6" (150 mm) round
5. Drain Outlet:
   a. 2" (50 mm) outlet
   b. 2" (50 mm) Threaded stainless steel outlet
   c. 3" (75 mm) outlet

Notes:

1. *Select grate material and finish based on anticipated mechanical and/or chemical stresses.*
2. *Please Consult Schluter®-Systems' Illustrated Price List for product selection and availability.*
3. *Consult Schluter®-Systems to confirm that your selected drain configuration meets the appropriate listing.*

B. Schluter®-KERDI-DRAIN ADAPTOR KIT

1. Description: floor drain adaptor kit consisting of stainless steel adaptor ring with over-molded rubber gasket, 11-13/16" (300 mm) diameter sloped integrated bonding flange with thermally laminated polypropylene fleece, and grate assembly. Grate assembly includes grate, height adjustment collar, and lateral adjustment ring with

trapezoid perforations. Drain type as referenced in methods B422, B422C and B422 STONE of the Tile Council of North America Handbook for Ceramic Tile Installation.

2. Grate Material and Finish:
   a. Design 1 – Arc-shaped and trapezoid-shaped openings
      1) E –Stainless Steel Type 304
      2) EP –Stainless Steel Type 304, Polished
   b. Curve – Alternating arc-shaped openings
      1) EB –Stainless Steel Type 304, Brushed
   c. Pure – Circular opening with central slot opening
      1) EB –Stainless Steel Type 304, Brushed
   d. ECS - Tileable Covering Support, Stainless Steel Type 304 Nominal Grate Size:
      1) 4" (100 mm) x 4" (100 mm) square
      2) 6" (150 mm) x 6" (150 mm) square
      3) 6" (150 mm) round
3. Adapter Ring Size:
   a. 5-1/4" (133.4 mm)
   b. 7-1/2" (191 mm)
4. Bonding Flange Length:
   a. 2-1/16" (77.8 mm)
   b. 3-41/64" (92.4 mm)

Notes:

1. *Select drain housing material according to drain pipe material.*
2. *Select grate material and finish based on anticipated mechanical and/or chemical stresses.*
3. *6" grates are only available in stainless steel.*
4. *Not all drains configurations are included in the above listings; please consult Schluter®- Systems to confirm that your selected drain configuration meets the appropriate listing*

2.11 PREFABRICATED SHOWER COMPONENTS

The Schluter®-Systems shower assembly eliminates the risk of failures due to both vapor and water penetration, is maintenance-free, and dramatically reduces total installation time. The integrated Schluter® Shower System ensures success and makes shower installation easier than ever.

A. Schluter®-KERDI-SHOWER--T/-TS/-TT

1. Description: Trapezoid-imprinted, prefabricated, sloped tiled shower tray base, made of lightweight, self-extinguishing (HF-1 rating per UL-94) expanded polystyrene (PS 40), with 12-5/16 inch (313 mm) diameter removable recessed section and bonded Schluter KERDI Membrane 0.008 inch (0.2 mm) thick, which meet or exceed the requirements of the American National Standard Specifications for load bearing, bonded, waterproof membranes for thin-set ceramic tile and dimension stone installation A118.10, and is listed by cUPC, and is evaluated by ICC-ES (see Report No. ESR-2467). Meeting ANSI A118.10 as detail as referenced in method B422 of the Tile Council of North America Handbook for Ceramic Tile Installation.

4. Tray with Center Drain Placement:
   a. KST-965/1525 - 38 inch by 60 inch by 1-1/8 inch (97 cm by 152 cm by 29 mm).
   b. KST-1220/1525 - 48 inch by 60 inch by 1-3/32 inch (122 cm by 152 cm by 28 mm).
   c. KST-1220/1830 - 48 inch by 72 inch by 1-1/4 inch (122 cm by 183 cm by 32 mm).
   d. KST-1525 - 60 inch by 60 inch by 1-3/16 inch (152 cm by 152 cm by 30 mm).
   e. KST-1830 - 72 inch by 72 inch by 1-1/2 inch (183 cm by 183 cm by 32 mm).
5. Tray with Off Center Drain Placement:
   a. KST-965/1525S - 38 inch by 60 inch by 1-1/2 inch (97 cm by 152 cm by 38 mm).
6. Thin Tray:
   a. KST-965/810BF - 32 inch by 38 inch by 29/32 inch (81 cm by 97 cm by 23 mm).
   b. KST-915/1220BF - 36 inch by 48 inch by 1 inch (91cm by 122 cm by 25 mm).
   c. KST- 915BF - 36 inch by 36 inch by 7/8 inch (91 cm by 91 cm by 22 mm).
   d. KST- 965BF - 38 inch by 38 inch by 29/32 inch (97 cm by 97 cm by 23 mm).

e. KST-1220BF - 48 inch by 48 inch by 1 inch (122 cm by 122 cm by 25 mm)

f. KST-965NA/BF - 38 inch by 38 inch by 1 1/32 inch Neo Angle Off Center (97 cm by 97 cm by 26 mm).

B. Schluter-KERDI-SHOWER-LT/-LTS

1. Description: trapezoid-imprinted, prefabricated, sloped tiled shower tray base, made of 2.75 lb/ft3 (44 kg/m3) density, self-extinguishing (HF-1 rating per UL-94) expanded polystyrene, with removable recessed section and bonded Schluter KERDI Membrane 0.008 inch (0.2 mm) thick, which meet or exceed the requirements of the American National Standard Specifications for load bearing, bonded, waterproof membranes for thin-set ceramic tile and dimension stone installation A118.10, and is listed by cUPC, and is evaluated by ICC- ES (see Report No. ESR-2467). Meeting ANSI A118.10 as detail as referenced in method B422 of the Tile Council of North America Handbook for Ceramic Tile Installation.

2. Tray for Center Linear Drain Placement:

a. KSLT1000 - 39 inch by 39 inch by 32 by 1-1/4 inch (100 cm by 100 cm by 32 mm).

b. KSLT1220 - 48 inch by 48 inch by 1-3/8 inch (122 cm by 122 cm by 34 mm).

c. KSLT1395 - 55 inch by 55 inch by 1-7/16 inch (140 cm by 140 cm by 36 mm).

3. Tray for Wall or Entrance Linear Drain Placement:

a. KSLT-1000S - 39 inch by 39 inch by 21/32 inch (100 cm by 100 cm by 42 mm).

b. KSLT-1220S - 48 inch by 48 inch by 1 13/16 inch (122 cm by 122 cm by 46 mm).

c. KSLT-1395S - 55 inch by 55 inch by 2 inch (140 cm by 140 cm by 50 mm).

d. KSLT-915/1395S - 36 inch by 55 inch by 2 inch (91 cm by 140 cm by 50 mm).

e. KSLT-965/1830S - 36 inch by 72 inch by 2-5/16 inch (91 cm by 183 cm by 58 mm).

f. KSLT-965/1930S - 38 inch by 76 inch by 2-3/8 inch (97

cm by 193 cm by 60 mm).

g. KSLT1930/965S - 76 inch by 38 inch by 1-5/8 inch (193 cm by 97 cm by 41 mm).

C. Schluter®-SHOWERPROFILE-S

1. Description: two-part profile with an exposed brushed stainless steel tapered edge and recycled PVC support section with integrated trapezoid-perforated anchoring leg for lateral transitions between sloped shower floors and walls.
2. Profile Height:
   a. Height as required to coordinate with tile selection and tile setting system selected
3. Profile Length:
   a. Length as required

D. Schluter®-SHOWERPROFILE-R

1. Description: two-part profile with an adjustable brushed stainless steel exposed surface for transitions between the tiled floors and the KERDI- LINE Drain.
2. Profile Height:
   a. Height as required
3. Profile Length:
   a. Length as required

Notes:

1. *Coordinated profiles are available for the Schluter®- KERDI-LINE System; please consult Schluter®-Systems' Illustrated Price List for product selection and availability.*
2. *Schluter®-KERDI-Shower-LT prefabricated tray is designed for drain placement at the perimeter or wall; KERDI-Shower-LTS prefabricated tray is designed for drain placement at the center of the shower floor.*

E. Schluter®-SHOWERPROFILE-WS

1. Description: two-part splashguard profile with a 3/4" (19 mm) wide anodized aluminum support section and PVC insert that together form the visible surface between the tiled floors and walls.
2. Splashguard Insert:
   a. Semi-circular Lip

b. Collapsible Straight Lip

F. Schluter®-SHOWERPROFILE-WSK

1. Description: two-part splashguard profile with a 2-1/6" (52 mm) wide 5/16" (8 mm) tall anodized aluminum support section and PVC insert that together form the visible surface.
2. Splashguard Insert:
   a. Semi-circular Lip
   b. Collapsible Straight Lip

G. Schluter®- KERDI-BOARD-SC

1. Description: Prefabricated waterproof Shower Curb, constructed of rigid extruded polystyrene foam building element panel, with reinforcement material and polypropylene fleece webbing laminated on both sides for thin-set ceramic tile and dimension stone Installations.
   a. KBSC 115 150 970 – 38″ by 6″ by 4-1/2″ (970 mm by 150 mm by 115 mm).
   b. KBSC 115 150 1220 – 48″ by 6″ by 4-1/2″ (122 cm by 150 mm by 115 mm).
   a. KBSC 115 150 1524 - 60 inch by 6 inch by 4-1/2 inch (152 cm by 150 mm by 115 mm).

H. Schluter®-KERDI-BOARD-SN

1. Description: Prefabricated waterproof niche, constructed of rigid extruded polystyrene foam building element panel, with reinforcement material and polypropylene fleece webbing laminated on both sides for thin-set ceramic tile and dimension stone Installations.
2. Nominal Niche Size:
   a. KB 12 SN 305 152 A – 12″ by 6″ by 3 1/2″ (305 mm by 152 mm by 89 mm)
   b. KB 12 SN 305 305 A – 12″ by 12″ by 3 1/2″ (305 mm by 305 mm by 89 mm)
   c. KB 12 SN 305 508 A1 – 12″ by 20″ by 3 1/2″ (305 mm by 508 mm by 89 mm)
   d. KB 12 SN 305 711 A1 – 12″ by 28″ by 3 1/2″ (305 mm by 711 mm by 89 mm)

I. Schluter®-KERDI-BOARD-SB

1. Description: Prefabricated waterproof bench, constructed of rigid extruded polystyrene foam building element panel, with reinforcement material and polypropylene fleece webbing laminated on both sides for thin-set ceramic tile and dimension stone Installations.
2. Size:
   a. KBSB 410 TA – 16″ by 16″ by 20″ (41 cm by 41 cm by 51 cm)
   b. KBSB 610 TA – 24″ by 24″ by 20″ (61 cm by 61 cm by 51 cm)
   c. KBSB 290 970 RA – 38″ by 11-1/2″ by 20″ (97 cm by 29 cm by 51 cm)
   d. KBSB 410 1220 RA – 48″ by 16″ by 20″ (122 cm by 41 cm by 51 cm)

J. Schluter®-KERDI-SHOWER-SR
1. Description: trapezoid-imprinted, prefabricated, tiled shower ramp base, made of 2.75 lb/ft^3 (44 kg/m^3) density, self-extinguishing (HF-1 rating per UL-94) expanded polystyrene. Ramp dimensions are 48" x 15-7/8" (122 cm x 40 cm) with slope from maximum thickness of 1-1/2" (38 mm) to minimum thickness of 1/4" (6 mm).

K. Schluter®-KERDI-FIX
1. Description: single-component, elastomeric, waterproof sealing and bonding compound with a silane-modified polymer base. Compound is free of solvents and odorless.
2. Color:
   a. BW - Bright White
   b. G - Grey

2.12 WALL SHELF FOR CERAMIC AND STONE TILE (NOT USED)

2.13 WATERPROOF BUILDING PANEL FOR CERAMIC AND STONE TILE

Schluter®-KERDI-BOARD is a multifunctional tile substrate and building panel, which can also be used for creating bonded waterproofing assemblies with tile coverings. It consists of extruded

polystyrene foam panel, with a special reinforcement material on both sides and fleece webbing for effective anchoring in thin-set mortar.

A. Schluter®-KERDI-BOARD
1. Description: Rigid extruded polystyrene foam building element panel, with reinforcement material and polypropylene fleece webbing laminated on both sides for thin-set ceramic tile and dimension stone installations.

2. Panel Thickness:
    a. 3/16" (5 mm)
    b. 3/8" (10 mm)
    c. 1/2" (12.5 mm)
    d. 5/8" (15 mm)
    e. 3/4" (20 mm)
    f. 1" (25 mm)
    g. 1-1/2 " (38 mm
    h. 2" (50 mm)
3. Panel Format:
    a. 32" x 48" (81 cm x 122 cm)
    b. 48" x 64" (122 cm x 162.5 cm)
    c. 48" x 96" (122 cm x 244 cm)
    d. 24-1/2" x 96" (62.5 cm x 244 cm)

B. Schluter®-KERDI-BOARD Prefabricated Accessories:
1. Description: Prefabricated stainless steel profiles and accessories designed to fasten and stabilize structures made of KERDI BOARD Panels.
2. Prefabricated Schluter®-KERDI-BOARD Profiles:
    a. Provide with corresponding stainless steel profiles
3. Corners:
    a. Provide with matching outside corners
    b. Provide with matching connectors
4. Fasteners:
    a. Provide with matching anchors
    b. Provide with matching washers and screws for stud framing
5. Reinforcing Joint Tape:
    a. Provide matching reinforcing joint tape

2.14 DRAINAGE MEMBRANES

Proper drainage is an essential feature of exterior tile assemblies where water is allowed to infiltrate a mortar setting bed. Water expands when it freezes and can exert great pressure and cause damage to its surroundings. Thus, any moisture that enters a setting bed must be allowed to leave the system quickly. Schluter drainage membranes are designed to provide a simple and effective means to allow seepage water to exit the tile assembly quickly and avoid permanent saturation of the mortar bed.

A. Schluter®-TROBA-PLUS
1. Description: orange polyethylene sheet with 5/16" (8 mm)

high, truncated cone-shaped studs, covered with a polypropylene water-permeable filter fabric.

Notes:

1. *Schluter®-TROBA-PLUS drainage membrane is to be installed over sloped waterproofing layers.*

2.15 EDGE-PROTECTION AND TRANSITION PROFILES FOR RESILIENT COVERINGS (NOT USED)

2.16 SETTING MATERIALS

To be determined by installation method(s), environment(s), and associated materials (e.g., tile type, underlayments, etc.)

A. Schluter®-SET
   1. Description: premium unmodified sag-resistant thin-set mortar specifically formulated for use with Schluter membranes and boards. Schluter®-SET is suitable for use with ceramic, porcelain, and stone tile, including large and heavy tile, in conjunction with Schluter®-Systems' uncoupling and waterproofing membranes. Meets the requirements of ANSI A118.1T.
   2. Color:
      a. White
      b. Grey

B. Schluter®-ALL-SET
   1. Description: specialized sag-resistant modified thin-set mortar specifically formulated for use with Schluter membranes and boards. It is engineered for use both under and over all DITRA and KERDI products. ALL-SET is suitable for use with ceramic, porcelain, and stone tile, including large and heavy tile, in conjunction with Schluter®-Systems' uncoupling and waterproofing membranes. Meets the requirements of ANSI A118.4T, A118.11, and A118.15T.
   2. Color:
      a. White
      b. Grey

C. Schluter®-FAST-SET
   1. Description: specialized rapid-setting sag-resistant modified thin-set mortar specifically formulated for use with Schluter membranes and boards. It is engineered for use both under and over all DITRA and KERDI products.

FAST-SET is suitable for use with ceramic, porcelain, and stone tile, including large and heavy tile, in conjunction with Schluter®-Systems' uncoupling and waterproofing membranes. Meets the requirements of ANSI A118.4TF, A118.11, and A118.15TF.

2. Color:
   a. White
   b. Grey

PART 3 EXECUTION

3.01 APPLICATION

A. Consult Schluter®-Systems' current technical literature for proper design and installation instructions.

END OF SECTION

SECTION 09 30 13
CERAMIC/PORCELAIN TILING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies interior ceramic and porcelain tile, waterproofing membranes for thin-set applications, crack isolation membranes, and tile backer board.

1.2 RELATED WORK

A. Section 01 60 00 PRODUCT REQUIREMENTS: Sustainable Design Requirements.

B. Section 07 92 00, JOINT SEALANTS: Sealing of Joints.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 30 00 ADMINISTRATIVE REQUIREMENTS.

B. Sustainable Design Submittals as described below:

1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.

C. Samples:

1. Base tile, each type, each color, each size.
2. Mosaic floor tile panels, 228 by 228 mm (9 by 9 inches), each type, color, size and pattern.
3. Porcelain tile, each type, color, patterns and size.
4. Wall (or wainscot) tile, each color, size and pattern.
5. Trim shapes and cove including base pieces at internal and external corners of vertical surfaces, each type, color, and size.

D. Product Data:

1. Ceramic and porcelain tile, marked to show each type, size, and shape required.
2. Chemical resistant grout (epoxy).
3. Cementitious backer unit.
4. Dry-set portland cement mortar and grout.
5. Divider strip.
6. Elastomeric membrane and bond coat.
7. Reinforcing tape.
8. Leveling compound.
9. Latex-portland cement mortar and grout.
10. Commercial portland cement grout.
11. Organic adhesive.
12. Slip resistant tile.

13. Waterproofing isolation membrane.
14. Fasteners.

E. Certification:
1. Master grade certificate, ANSI A137.1.
2. Manufacturer's certificates indicating that the following materials comply with specification requirements:
a. Chemical resistant mortar and grout (epoxy).
b. Modified epoxy emulsion.
c. Cementitious backer unit.
d. Elastomeric membrane and bond coat.
e. Reinforcing tape.
f. Latex-portland cement mortar and grout.
g. Leveling compound.
h. Organic adhesive.
i. Waterproof isolation membrane.
j. Factory back mounted tile documentation for suitability for application in wet area.

F. Installer Qualifications:
1. Submit letter stating installer’s experience.

1.4 DELIVERY AND STORAGE

A. Deliver materials in containers with labels legible and intact and grade-seals unbroken.
B. Store material to prevent damage or contamination.

1.5 QUALITY ASSURANCE

A. Installers to be from a company specializing in performing installation of products specified and have a minimum of three (3) years’ experience.
B. Each type and color of tile to be provided from a single source.
C. Each type and color of mortar, adhesive, and grout to be provided from the same source.

1.6 WARRANTY

A. Construction Warranty: Comply with FAR clause 52.246-21, “Warranty of Construction”.

1.7 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in text by basic designation only.

B. American National Standards Institute (ANSI):

A10.20-06(R2016).....Safe Operating Practices for Tile, Terrazzo and Marble Work

A108/A118/A136.1:2019...Installation of Ceramic Tile

A108.01-18.....Subsurfaces and Preparations by Other Trades

A108.02-19.....Materials, Environmental, and Workmanship

A108.1A-17.....Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar

A108.1B-17.....Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar

A108.1C-17.....Contractors Option; Installation of Ceramic Tile in the Wet-Set method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar

A108.4-09.....Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive

A108.5-10 .....Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar

A108.6-10.....Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy

A108.8-10.....Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout

A108.9-10.....Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout

A108.10-17.....Grout in Tilework

A108.11-18.....Interior Installation of Cementitious Backer Units

A108.12-10.....Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar

A108.13-16.....Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone

A108.14-10.....Paper-Faced Glass Mosaic Tile

A108.15-19.....Alternate Method: Paper-Faced Glass Mosaic Tile

A108.17-16.....Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone

A118.1-19.....Dry-Set Portland Cement Mortar

A118.3-13.....Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive

A118.4-19.....Modified Dry-Set Cement Mortar

A118.5-16.....Chemical Resistant Furan Mortars and Grouts

A118.6-19.....Standard Cement Grouts for Tile Installation

A118.7-1.....High Performance Cement Grouts for Tile Installation

A118.8-16.....Modified Epoxy Emulsion Mortar/ Grout

A118.9-19.....Cementitious Backer Units

A118.10-14.....Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation

A118.11-17.....EGP (Exterior Glue Plywood) Modified Dry-set Mortar

A118.12-14.....Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation

A118.13-14.....Bonded Sound Reduction Membranes for Thin-Set Ceramic Tile Installation

A118.15-19.....Improved Modified Dry-Set Cement Mortar

A136.1-13.....Organic Adhesives for Installation of Ceramic Tile

A137.1-17.....American National Standard Specifications for Ceramic Tile

C. ASTM International (ASTM):

A666-15.....Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar

A1064/A1064M-18a.....Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

C109/C109M-20b.....Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch. or [50-mm] Cube Specimens)

C241/C241M-15e1.....Abrasion Resistance of Stone Subjected to Foot Traffic

C348-20.....Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars

C627-18.....Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester

C954-18.....Steel Drill Screws for the Application of Gypsum Board on Metal Plaster Base to Steel Studs from 0.033 in (0.84 mm) to 0.112 in (2.84 mm) in thickness

C979/C979M-16.....Pigments for Integrally Colored Concrete

C1002-18.....Steel Self-Piercing Tapping Screws for the Application of Panel Products

C1027-19.....Test Method for Determining Visible Abrasion Resistance of Glazed Ceramic Tile

C1127/C1127M-15.....Standard Guide for Use of High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane with an Integral Wearing Surface

C1178/C1178M-18.....Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel

C1325-19.....Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units

C1353/C1353M-20e1.....Abrasion Resistance of Dimension Stone Subjected to Foot Traffic Using a Rotary Platform, Double-Head Abraser

D1204-14(2020).....Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature

D2240-15e1.....Test Method for Rubber Property - Durometer Hardness

D2497-07(2018).....Tolerances for Manufactured Organic-Base Filament Single Yarns

D3045-2018.....Heat Aging of Plastics Without Load

D4397-16.....Standard Specification for Polyethylene Sheeting for Construction, Industrial and Agricultural Applications

D5109-12(Withdrawn2020).Standard Test Methods for Copper-Clad Thermosetting Laminates for Printed Wiring Boards (recommend deletion)

D. Code of Federal Regulation (CFR):

40 CFR 59.....Determination of Volatile Matter Content, Water Content, Density Volume Solids, and Weight Solids of Surface Coating

E. Marble Institute of America (MIA)/ Building Stone Institute (BSI): Dimension Stone Design Manual VIII-2016

F. Tile Council of North America, Inc. (TCNA): Handbook for Ceramic Tile Installation (2020)G. TCNA DCOF AcuTest-2012,Dynamic Coefficient of Friction Test

PART 2 - PRODUCTS

2.1 TILE

A. Comply with ANSI A137.1, Standard Grade, except as modified:
   1. Inspection procedures listed under the Appendix of ANSI A137.1.
   2. Abrasion Resistance Classification:
      a. Tested in accordance with values listed in Table 1, ASTM C1027.
      b. Class V, 12000 revolutions for floors in Corridors, Kitchens, Storage including Refrigerated Rooms
      c. Class IV, 6000 revolutions for remaining areas.
   3. Slip Resistant Tile for Floors:
      a. Coefficient of friction, when tested in accordance with ANSI A137.1 and measured per the TCNA DCOF AcuTest.
         1) Equal to or greater than .42 for level interior tile floors that will be walked on when wet.
      b. Porcelain Paver Tile: Matte surface finish and exterior finish with abrasive grains.
   4. Mosaic tile may be mounted or joined by a resinous bonding material along tile edges.
   5. Back mounted tiles in showers. Provide certification that the factory mounted tile has been used successfully in service at three (3) projects and is suitable for wet locations.
   6. Factory Blending: For tile with color variations, within the ranges selected during sample submittals blend tile in the factory and package so tile units taken from one (1) package show the same range in colors as those taken from other packages and match approved samples.
   7. Factory-Applied Temporary Protective Coating:
      a. Protect exposed face surfaces (top surface) of tile against adherence of mortar and grout by pre-coating with a continuous film of hot applied petroleum paraffin wax.
      b. Do not coat unexposed tile surfaces.
      c. Pre-wax tiles set or grouted with epoxy or latex modified mortars.

B. Unglazed Ceramic Mosaic Tile: Nominal 6 mm (1/4 inch) thick with cushion edges.

C. Glazed Wall Tile: Cushion edges, glazing.

D. Porcelain Paver Tile: Nominal 8 mm (5/16 inch) thick, with cushion edges. Porcelain tile produced by the dust pressed method are to be made of approximately 50 percent feldspar; the remaining 50 percent is to be made up of various high-quality light firing ball clays yielding a tile with a water absorption rate of 0.5 percent or less and a breaking strength of between 176 to 181 kg (390 to 400 pounds).

E. Trim Shapes:

1. Conform to applicable requirements of adjoining floor and wall tile.
2. Use slip resistant trim shapes for horizontal surfaces of showers.
3. Use trim shapes sizes conforming to size of adjoining field wall tile unless detailed on construction documents or specified otherwise.
4. Internal and External Corners:
   a. Square internal and external corner joints are not acceptable.
   b. External corners including edges: Use bullnose shapes. See Finish Schedule for Schluter profile.
   c. Internal corners: Use cove shapes. See Finish Schedule for Schluter profile.
   d. Base to floor internal corners: Use special shapes providing integral cove vertical and horizontal joint.
   e. Base to floor external corners: Use special shapes providing bullnose vertical edge with integral cove horizontal joint. Use stop at bottom of openings having bullnose return to wall.
   f. Wall top edge internal corners: Use special shapes providing integral cove vertical joint with bullnose top edge.
   g. Wall top edge external corners: Use special shapes providing bullnose vertical and horizontal joint edge.
   h. For unglazed ceramic mosaic and glazed wall tile installed in portland cement mortar setting bed, use cove and bullnose shapes as applicable. When ceramic mosaic wall and base tile is required, use C Series cove and bullnose shapes.
   i. For unglazed ceramic mosaic and glazed wall tile installed in dry-set portland cement mortar, latex-portland cement mortar, and organic adhesive (thin set methods), use cove and surface bullnose shapes as applicable.

j. Provide cove and bullnose shapes where indicated in construction documents, and required to complete tile work.

2.2 BACKER UNITS

A. Cementitious Backer Units:
   1. Use in showers or wet areas.
   2. Conform to ASTM C1325; Type A.
   3. Use in maximum lengths available to minimize end to end butt joints.

B. Glass Mat Water Resistant Backing Board:
   1. Use in showers or wet areas.
   2. Conform to ASTM C1178/C1178M.
   3. Use in maximum lengths available to minimize end to end butt joints.

2.3 JOINT MATERIALS FOR CEMENTITIOUS BACKER UNITS

A. Reinforcing Tape: Vinyl coated woven glass fiber mesh tape, open weave, 50 mm (2 inches) wide. Tape with pressure sensitive adhesive backing will not be permitted.

B. Tape Embedding Material: Latex-portland cement mortar complying with ANSI A108.01.

C. Joint material, including reinforcing tape, and tape embedding material, are to be as specifically recommended by the backer unit manufacturer.

2.4 FASTENERS

A. Screws for Cementitious Backer Units.
   1. Standard screws for gypsum board are not acceptable.
   2. Minimum 11 mm (7/16 inch) diameter head, corrosion resistant coated, with washers.
   3. ASTM C954 for steel 1 mm (0.033 inch) thick.
   4. ASTM C1002 for steel framing less than 0.0329 inch thick.

B. Washers: Galvanized steel, 13 mm (1/2 inch) minimum diameter.

2.5 SETTING MATERIALS OR BOND COATS

A. Conform to TCNA Handbook for Ceramic Tile Installation.

B. Portland Cement Mortar: ANSI A108.02.

C. Latex-Portland Cement Mortar: ANSI A118.4.
   1. For wall applications, provide non-sagging, latex-portland cement mortar complying with ANSI A118.4.
   2. Prepackaged Dry-Mortar Mix: Factory-prepared mixture of portland cement; dry, redispersible, ethylene vinyl acetate additive; and other ingredients to which only water needs to be added at Project site.

D. Dry-Set Portland Cement Mortar: ANSI A118.1. For wall applications, provide non-sagging, latex-portland cement mortar complying with ANSI A118.1.

E. Organic Adhesives: ANSI A136.1, Type 1.

F. Chemical-Resistant Bond Coat:

1. Epoxy Resin Type: ANSI A118.3.

G. Elastomeric Waterproofing Membrane and Bond Coat:

1. TCNA F122-14 (on ground concrete) and TCNA F112A-14 (above ground concrete).
2. ANSI A118.10.
3. One component polyurethane, liquid applied material having the following additional physical properties:
   a. Hardness: Shore "A" between 40-60.
   b. Elongation: Between 300-600 percent.
   c. Tensile strength: Between .27 - .41 Newton per square millimeter (40-60 pounds per square inch gauge).
   d. No volatile compounds (VOC).
4. Coal tar modified urethanes are not acceptable.

H. Waterproofing Isolation Membrane:

1. Sheet System TCNA F122-14 (on-ground concrete) and TCNA F122A-14 (above-ground concrete).
2. Composite sheet consisting of ASTM D5109, Type II, Grade I Chlorinated Polyethylene (CM) sheet reinforced on both sides with a non-woven polyester fiber.
3. Designed for use in wet areas as an isolation and positive waterproofing membranes for thin-set bonding of sheet to substrate and thin-set bonding of ceramic and porcelain tile or marble to sheet. Suited for both horizontal and vertical applications.
4. Conform to the following additional physical properties:

Property	Units	Results	Test Method
Hardness Shore A	Points	70-80	ASTM D2240 (10 Second Reading)
Shrinkage	Percent	5 maximum	ASTM D1204
Brittleness		No crack remains flexible at temperature -37 degrees C	ASTM D2497 13 mm (1/2-inch) Mandrel Bend

		(-35 degrees F)	
Retention of Properties after Heat Aging	Percent of original	80 Tensile 80 Breaking 80 Elongation	ASTM D3045, 90 degrees C (194 degrees F) for 168 hours

5. Manufacturer’s standard sheet size with prefabricated or preformed inside and outside corners.
6. Sheet manufacturer’s solvent welding liquid or xylene and edge sealant.

2.6 GROUTING MATERIALS

A. Coloring Pigments:
   1. Pure mineral pigments, lime proof and nonfading, complying with ASTM C979/C979M.
   2. Coloring pigments may only be added to grout by the manufacturer.
   3. Job colored grout is not acceptable.
   4. Use is required in Commercial Portland Cement Grout, Dry-Set Grout, and Latex-Portland Cement Grout.

B. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59 (EPA Method 24).
   1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 60 and 100 degrees C (140 and 212 degrees F), respectively, and certified by manufacturer for intended use.

2.7 PATCHING AND LEVELING COMPOUND

A. Portland cement base, polymer-modified, self-leveling compound, manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.

B. Provide a patching and leveling compound with the following minimum physical properties:
   1. Compressive strength - 25 MPa (3500 psig) per ASTM C109/C109M.
   2. Flexural strength - 7 MPa (1000 psig) per ASTM C348 (28 day value).
   3. Tensile strength – 4.1 MPa (600 psi) per ANSI 118.7.
   4. Density – 1.9.

C. Capable of being applied in layers up to 38 mm (1-1/2 inches) thick without fillers and up to 101 mm (4 inches) thick with fillers, being brought to a feather edge, and being troweled to a smooth finish.

D. Primers, fillers, and reinforcement as required by manufacturer for application and substrate condition.

E. Ready for use in 48 hours after application.

2.8 MARBLE (NOT USED)

2.9 METAL DIVIDER STRIPS (NOT USED)

2.10 WATER

A. Clean, potable and free from salts and other injurious elements to mortar and grout materials.

2.11 CLEANING COMPOUNDS

A. Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and leveling compounds and elastomeric waterproofing membrane and coat.

B. Materials containing acid or caustic Material are not acceptable.

2.12 FLOOR MORTAR BED REINFORCING

A. ASTM A1064/A1064M welded wire fabric without backing, MW3 x MW3 (2 x 2-W0.5 x W0.5).

2.13 POLYETHYLENE SHEET

A. Polyethylene sheet conforming to ASTM D4397.

B. Nominal thickness: 0.15 mm (6 mils).

PART 3 - EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperature of work areas at not less than 16 degrees C (60 degrees F), without interruption, for not less than 24 hours before installation and not less than three (3) days after installation.

B. Maintain higher temperatures for a longer period of time where required by manufacturer's recommendation and ANSI Specifications for installation.

C. Do not install tile when the temperature is above 38 degrees C (100 degrees F).

D. Do not install materials when the temperature of the substrate is below 16 degrees C (60 degrees F).

E. Do not allow temperature to fall below 10 degrees C (50 degrees F) after third day of completion of tile work.

3.2 ALLOWABLE TOLERANCE

A. Variation in plane of sub-floor, including concrete fills leveling compounds and mortar beds:

1. Not more than 6 mm in 3048 mm (1/4 inch in 10 feet) from required elevation where portland cement mortar setting bed is used.

2. Not more than 3 mm in 3048 mm (1/8 inch in 10 feet) where dry-set portland cement, and latex-portland cement mortar setting beds and chemical-resistant bond coats are used.

B. Variation in Plane of Wall Surfaces:

1. Not more than 6 mm in 2438 mm (1/4 inch in 8 feet) from required plane where portland cement mortar setting bed is used.
2. Not more than 3 mm in 2438 mm (1/8 inch in 8 feet) where dry-set or latex-portland cement mortar or organic adhesive setting materials is used.

3.3 SURFACE PREPARATION

A. Cleaning New Concrete or Masonry:

1. Chip out loose material, clean off all oil, grease dirt, adhesives, curing compounds, and other deterrents to bonding by mechanical method, or by using products specifically designed for cleaning concrete and masonry.
2. Use self-contained power blast cleaning systems to remove curing compounds and steel trowel finish from concrete slabs where ceramic tile will be installed directly on concrete surface with thin-set materials.
3. Steam cleaning or the use of acids and solvents for cleaning will not be permitted.

B. Patching and Leveling:

1. Mix and apply patching and leveling compound in accordance with manufacturer's instructions.
2. Fill holes and cracks and align concrete floors that are out of required plane with patching and leveling compound.
   a. Thickness of compound as required to bring finish tile system to elevation shown on construction documents.
   b. Float finish except finish smooth for elastomeric waterproofing.
   c. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
3. Apply patching and leveling compound to concrete and masonry wall surfaces that are out of required plane.
4. Apply leveling coats of material compatible with wall surface and tile setting material to wall surfaces, other than concrete and masonry that are out of required plane.

C. Mortar Bed for Slopes to Drains:
   1. Slope compound to drain where drains are shown on construction documents.
   2. Install mortar bed in depressed slab sloped to drains not less than 3.2 mm in 305 mm (1/8 inch per foot).
   3. Allow not less than 50 mm (2 inch) depression at edge of depressed slab.
   4. Screed for slope to drain and float finish.
   5. Cure mortar bed for not less than seven (7) days. Do not use curing compounds or coatings.
   6. Perform flood test to verify mortar bed slopes to drain before installing tile. Project Contracting Officer Representative (COR) to be present during flood test.

D. Additional preparation of concrete floors for tile set with epoxy is to be in accordance with the manufacturer's printed instructions.

E. Cleavage Membrane:
   1. Install polythene sheet as cleavage membrane in depressed slab when waterproof membrane is not scheduled or indicated.
   2. Turn up at edge of depressed floor slab to top of floor.

F. Walls:
   1. In showers or other wet areas cover studs with polyethylene sheet.
   2. Apply patching and leveling compound to concrete and masonry surfaces that are out of required plane.
   3. Apply leveling coats of material compatible with wall surface and tile setting material to wall surfaces, other than concrete and masonry that are out of required plane.
   4. Apply metal lath to framing in accordance with ANSI A108.1:
      a. Use fasteners specified in paragraph "Fasteners." Use washers when lath opening is larger than screw head.
      b. Apply scratch and leveling coats to metal lath in accordance with ANSI A108.1C.
      c. Total thickness of scratch and leveling coats:
         1) Apply 9 mm to 16 mm (3/8 inch to 5/8 inch) thick over solid backing.
         2) 16 mm to 19 mm (5/8 to 3/4 inch) thick on metal lath over studs.
         3) Where wainscots are required to finish flush with wall surface above, adjust thickness required for flush finish.

d. Apply scratch and leveling coats more than 19 mm (3/4 inch) thick in two (2) coats.

G. Existing Floors and Walls:

1. Remove existing composition floor finishes and adhesive. Prepare surface by grinding, chipping, self-contained power blast cleaning or other suitable mechanical methods to completely expose uncontaminated concrete or masonry surfaces. Follow safety requirements of ANSI A10.20.
2. Remove existing concrete fill or topping to structural slab. Clean and level the substrate for new setting bed and waterproof membrane or cleavage membrane.
3. Where new tile bases are required to finish flush with plaster above or where they are extensions of similar bases in conjunction with existing floor tiles, cut channel in floor slab and expose rough wall construction sufficiently to accommodate new tile base and setting material.

3.4 CEMENTITIOUS BACKER UNITS

A. Remove polyethylene wrapping from cementitious backer units and separate to allow for air circulation. Allow moisture content of backer units to dry down to a maximum of 35 percent before applying joint treatment and tile.

B. Install in accordance with ANSI A118.9 except as specified otherwise.

C. Install units horizontally or vertically to minimize joints with end joints over framing members. Units with rounded edges; face rounded edge away from studs to form a “V” joint for joint treatment.

D. Secure cementitious backer units to each framing member with screws spaced not more than 203 mm (8 inches) on center and not closer than 13 mm (1/2 inch) from the edge of the backer unit or as recommended by backer unit manufacturer. Install screws so that the screw heads are flush with the surface of the backer unit.

E. Where backer unit joins shower pans or waterproofing, lap backer unit over turned up waterproof system. Install fasteners only through top one-inch of turned up waterproof systems.

F. Do not install joint treatment for seven (7) days after installation of cementitious backer unit.

G. Joint Treatment:
   1. Fill horizontal and vertical joints and corners with latex-portland cement mortar. Apply fiberglass tape over joints and corners and embed with same mortar.
   2. Leave 6 mm (1/4 inch) space for sealant at lips of tubs, sinks, or other plumbing receptors.

3.5 GLASS MAT WATER-RESISTANT BACKING BOARD

A. Install in accordance with manufacturer's instructions. TCNA Systems W245-1.

B. Treat joints with tape and latex-portland cement mortar or adhesive.

3.6 MARBLE (NOT USED)

3.7 METAL DIVIDER STRIPS (NOT USED)

3.8 CERAMIC TILE – GENERAL

A. Comply with ANSI A108/A118/A136 series of tile installation standards applicable to methods of installation and TCNA Installation Guidelines.

B. Installing Mortar Beds for Floors:
   1. Install mortar bed in a manner that does not damage cleavage or waterproof membrane; 32 mm (1-1/2 inch) minimum thickness.
   2. Install floor mortar bed reinforcing centered in mortar fill.
   3. Screed finish to level plane or slope to drains shown on construction documents, float finish.
   4. For thin set systems cure mortar bed not less than seven (7) days. Do not use curing compounds or coatings.
   5. For tile set with portland cement paste over plastic mortar bed coordinate to set tile before mortar bed sets.

C. Setting Beds or Bond Coats:
   1. Where recessed or depressed floor slabs are filled with portland cement mortar bed, set ceramic mosaic floor tile in either portland cement paste over plastic mortar bed or latex-portland cement mortar over cured mortar bed except as specified otherwise, ANSI A108-1C, TCNA System F121-14 or F111-14.
   2. Set floor tile in elastomeric bond coat over elastomeric membrane per ANSI 108.13, TCNA System F122-14 where indicated on construction documents.
   3. Set wall tile installed over concrete or masonry in latex-portland cement mortar, ANSI 108.1B and TCNA System W211-14, W221-14 or W222-14.

4. Set wall tile installed over concrete backer board in latex-portland cement mortar, ANSI A108.1B.
5. Set wall tile installed over portland cement mortar bed on metal lath base in portland cement paste over plastic mortar bed, or dry-set portland cement mortar or latex-portland cement mortar over a cured mortar bed, ANSI A108.1C, TCNA System W231-14, W241-14.
6. Set tile installed over gypsum board and gypsum plaster in organic adhesive, ANSI A108.1, TCNA System W242-14.
7. Set trim shapes in same material specified for setting adjoining tile.

D. Workmanship:
1. Lay out tile work so that no tile less than one-half full size is used. Make all cuts on the outer edge of the field.
2. Set tile firmly in place with finish surfaces in true planes. Align tile flush with adjacent tile unless shown otherwise on construction documents.
3. Form intersections and returns accurately.
4. Cut and drill tile neatly without marring surface.
5. Cut edges of tile abutting penetrations, finish, or built-in items:
   a. Fit tile closely around electrical outlets, piping, fixtures and fittings, so that plates, escutcheons, collars and flanges will overlap cut edge of tile.
   b. Seal tile joints water tight as specified in Section 07 92 00, JOINT SEALANTS, around electrical outlets, piping fixtures and fittings before cover plates and escutcheons are set in place.
6. Completed work is to be free from hollow sounding areas and loose, cracked or defective tile.
7. Remove and reset tiles that are out of plane or misaligned.
8. Floors:
   a. Extend floor tile beneath casework and equipment, except those units mounted in wall recesses.
   b. Align finish surface of new tile work flush with other and existing adjoining floor finish where indicated in construction documents.
   c. In areas where floor drains occur, slope tile to drains.
   d. Push and vibrate tiles over 203 mm (8 inches) square to achieve full support of bond coat.

9. Walls:
   a. Cover walls and partitions, including pilasters, furred areas, and freestanding columns from floor to ceiling, or from floor to nominal wainscot heights as indicated in construction documents with tile.
   b. Finish reveals of openings with tile, except where other finish materials are indicated in construction documents.
   c. Finish wall surfaces behind and at sides of casework and equipment, except those units mounted in wall recesses, with same tile as scheduled for room proper.
10. Joints:
   a. Keep all joints in line, straight, level, perpendicular and of even width unless shown otherwise on construction documents.
   b. Make joints 2 mm (1/16 inch) wide for glazed wall tile and mosaic tile work.
   c. Make joints in paver tile, porcelain type; maximum 3 mm (1/8 inch) wide.
11. Back Buttering: For installations indicated below, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108/A118/A136 series of tile installation standards:
   a. Tile wall installations in wet areas, including showers.
   b. Tile installed with chemical-resistant mortars and grouts.
   c. Tile wall installations composed of tiles 203 by 203 mm (8 by 8 inches) or larger.
   d. Exterior tile wall installations.

3.9 CERAMIC TILE INSTALLED WITH PORTLAND CEMENT MORTAR

A. Mortar Mixes for Floor, Wall and Base Tile (including Showers): ANSI A108.1A. except specified otherwise.

B. Installing Wall and Base Tile: ANSI A108.1A, except specified otherwise.

C. Installing Floor Tile: ANSI A108.1A, except as specified otherwise. Slope mortar beds to floor drains at a minimum of 3 mm in 305 mm (1/8 inch per foot).

3.10 PORCELAIN TILE INSTALLED WITH LATEX PORTLAND CEMENT BONDING MORTAR

A. Due to the denseness of porcelain tile use latex portland cement bonding mortar that meets the requirements of ANSI A108.01. Mix bonding mortars in accordance with manufacturer’s instructions. Provide liquid

ratios and comply with dwell times during the placement of bonding mortar and tile.

3.11 THIN SET CERAMIC AND PORCELAIN TILE INSTALLED WITH DRY-SET PORTLAND CEMENT AND LATEX-PORTLAND CEMENT MORTAR

A. Installation of Tile: ANSI A108.1B, except as specified otherwise.

B. Slope tile work to drains at not less than 3 mm in 305 mm (1/8 inch per foot).

3.12 THIN SET CERAMIC AND PORCELAIN TILE INSTALLED WITH ORGANIC ADHESIVE

A. Installation of Tile: ANSI A108.4.

3.13 THIN SET CERAMIC AND PORCELAIN TILE INSTALLED WITH CHEMICAL-RESISTANT BOND COAT

A. Epoxy Resin Type: Install tile in accordance with Installation of Tile with Epoxy Mortar; ANSI A108.6.

3.14 CERAMIC AND PORCELAIN TILE INSTALLED WITH ELASTOMERIC BOND COAT

A. Surface Preparation: Prepare surfaces as specified.

B. Installation of Elastomeric Membrane: ANSI A108.10 and TCNA F122-14 (on ground concrete) and F122A-14 (above-ground concrete).

1. Prime surfaces, where required, in accordance with manufacturer's instructions.
2. Install first coat of membrane material in accordance with manufacturer's instructions, in thickness of 0.76 to 1.3 mm (30 to 50 mils).
3. Extend material over flashing rings of drains and turn up vertical surfaces not less than 101 mm (4 inches) above finish floor surface.
4. When material has set, recoat areas with a second coat of elastomeric membrane material for a total thickness of 1.3 to 1.9 mm (50 to 75 mils).
5. After curing test for leaks with 25 mm (1 inch) of water for 24 hours.

C. Installation of Tile in Elastomeric Membrane:

1. Spread no more material than can be covered with tile before material starts to set.
2. Apply tile in second coat of elastomeric membrane material in accordance with the coating manufacturer's instructions in lieu at aggregate surfacing specified in ASTM C1127. Do not install top coat over tile.

3.15 GROUTING

A. Grout Type and Location:

1. Grout for glazed wall and base tile, paver tile and unglazed mosaic tile portland cement grout, latex-portland cement grout, or commercial portland cement grout.

B. Workmanship:

1. Install and cure grout in accordance with the applicable standard.
2. Epoxy Grout: ANSI A108.6.
3. Water-Cleanable Epoxy Grout: ANSI A118.3.
4. Commercial Portland Cement Grout: ANSI A118.5 and in accordance with the manufacturer's printed instructions.

3.16 MOVEMENT JOINTS

A. Prepare tile expansion, isolation, construction and contraction joints for installation of sealant. Refer to Section 07 92 00, JOINT SEALANTS.

B. TCNA details EJ 171-14.

C. At expansion joints, rake out joint full depth of tile and setting bed and mortar bed. Do not cut waterproof or isolation membrane.

D. Rake out grout at joints between tile, at toe of base, and where indicated in construction documents not less than 6 mm (1/4 inch) deep.

3.17 CLEANING:

A. Thoroughly sponge and wash tile. Polish glazed surfaces with clean dry cloths.

B. Methods and materials used are not permitted to damage or impair appearance of tile surfaces.

C. The use of acid or acid cleaners on glazed tile surfaces is prohibited.

D. Clean tile grouted with epoxy and commercial portland cement grout and tile set in elastomeric bond coat as recommended by the manufacturer of the grout and bond coat.

3.18 PROTECTION

A. Keep traffic off tile floor, until grout and setting material is fully set and cured.

B. Where traffic occurs over tile floor is unavoidable, cover tile floor with not less than 9 mm (3/8 inch) thick plywood, wood particle board, or hardboard securely taped in place. Do not remove protective cover until time for final inspection. Clean tile of any tape, adhesive and stains.

3.19 TESTING FINISH FLOOR

A. Test floors in accordance with ASTM C627 to show compliance with codes 1 through 10.

- - - E N D - - -

SECTION 09 91 00
PAINTING

PART 1-GENERAL

1.1 DESCRIPTION

A. Section specifies field painting.

B. Section specifies prime coats which may be applied in shop under other sections.

C. Painting includes shellacs, stains, varnishes, and coatings specified.

1.2 RELATED WORK

A. Shop prime painting of steel and ferrous metals: Division 05 - METALS, Division 08 - OPENINGS, Division 10 - SPECIALTIES, Division 11 - EQUIPMENT, Division 12 - FURNISHINGS, Division 13 – SPECIAL CONSTRUCTION, Division 21 – FIRE SUPPRESSION, Division 22 - PLUMBING, Division 23 – HEATING, VENTILATION AND AIR-CONDITIONING, Division 26 - ELECTRICAL, Division 27 - COMMUNICATIONS, and Division 28 – ELECTRONIC SAFETY AND SECURITY sections.

B. Type of Finish, Color, and Gloss Level of Finish Coat: See Finish Schedule in Drawings.

1.3 SUSTAINABILITY REQUIREMENTS

A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 01 60 00 PRODUCT REQUIRMENTS, for project local/regional materials, low-emitting materials, recycled content, certified wood requirements.

B. Biobased Material: For products designated by the USDA’s BioPreferred® program, provide products that meet or exceed USDA recommendations for biobased content, subject to the products compliance with performance requirements in this Section. For more information regarding the product categories covered by the BioPreferred® program, visit http://www.biopreferred.gov.

1.4 REGULATORY REQUIREMENTS FOR RECYCLED CONTENT (NOT USED)

1.5 SUBMITTALS

A. Submit in accordance with Section 01 30 00 ADMINISTRATIVE REQUIREMENTS.

B. Manufacturer's Literature and Data:

1. Before work is started, or sample panels are prepared, submit manufacturer's literature, the current Master Painters Institute (MPI) "Approved Product List" indicating brand label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this

specification. The Contractor may choose to use subsequent MPI "Approved Product List", however, only one list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI "Approved Product List" where applicable is acceptable.

C. Samples:
   1. After painters' materials have been approved and before work is started submit samples showing each type of finish and color specified.
   2. Samples to show color: Composition board, 150 by 150 (6 inch by 6 inch).

D. Manufacturers' Certificates indicating compliance with specified requirements:
   1. Manufacturer's paint substituted for Federal Specification paints meets or exceeds performance of paint specified.
   2. High temperature aluminum paint.
   3. Epoxy coating.
   4. Intumescent clear coating or fire-retardant paint.
   5. Plastic floor coating.

1.6 DELIVERY AND STORAGE

A. Deliver materials to site in manufacturer's sealed container marked to show following:
   1. Name of manufacturer.
   2. Product type.
   3. Batch number.
   4. Instructions for use.
   5. Safety precautions.

B. In addition to manufacturer's label, provide a label legibly printed as following:
   1. Federal Specification Number, where applicable, and name of material.
   2. Surface upon which material is to be applied.
   3. If paint or other coating, state coat types; prime, body or finish.

C. Maintain space for storage, and handling of painting materials and equipment in a neat and orderly condition to prevent spontaneous combustion from occurring or igniting adjacent items.

D. Store materials at site at least 24 hours before using, at a temperature between 18 and 30 degrees C (65 and 85 degrees F).

1.7 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

B. American Conference of Governmental Industrial Hygienists (ACGIH):

ACGIH TLV-BKLT-2009	Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)
ACGIH TLV-DOC-2009	Documentation of Threshold Limit Values and Biological Exposure Indices, (Seventh Edition)

C. Master Painters Institute (MPI):

No. 4-13	Interior/ Exterior Latex Block Filler
No. 5-13	Exterior Alkyd Wood Primer
No. 7-13	Exterior Oil Wood Primer
No. 8-13	Exterior Alkyd, Flat MPI Gloss Level 1 (EO)
No. 9-13	Exterior Alkyd Enamel MPI Gloss Level 6 (EO)
No. 10-13	Exterior Latex, Flat (AE)
No. 11-13	Exterior Latex, Semi-Gloss (AE)
No. 31-13	Polyurethane, Moisture Cured, Clear Gloss (PV)
No. 36-13	Knot Sealer
No. 43-13	Interior Satin Latex, MPI Gloss Level 4
No. 44-13	Interior Low Sheen Latex, MPI Gloss Level 2
No. 45-13	Interior Primer Sealer
No. 46-13	Interior Enamel Undercoat
No. 47-13	Interior Alkyd, Semi-Gloss, MPI Gloss Level 5 (AK)
No. 48-13	Interior Alkyd, Gloss, MPI Gloss Level 6 (AK)
No. 50-13	Interior Latex Primer Sealer
No. 51-13	Interior Alkyd, Eggshell, MPI Gloss Level 3
No. 52-13	Interior Latex, MPI Gloss Level 3 (LE)
No. 53-13	Interior Latex, Flat, MPI Gloss Level 1 (LE)
No. 54-13	Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)
No. 60-13	Interior/Exterior Latex Porch & Floor Paint, Low Gloss

No. 68-13	Interior/ Exterior Latex Porch & Floor Paint, Gloss
No. 71-13	Polyurethane, Moisture Cured, Clear, Flat (PV)
No. 90-13	Interior Wood Stain, Semi-Transparent (WS)
No. 94-13	Exterior Alkyd, Semi-Gloss (EO)
No. 95-13	Fast Drying Metal Primer
No. 114-13	Interior Latex, Gloss (LE) and (LG)
No. 119-13	Exterior Latex, High Gloss (acrylic) (AE)
No. 134-13	Primer, Galvanized, Water Based
No. 138-13	Interior High-Performance Latex, MPI Gloss Level 2 (LF)
No. 139-13	Interior High-Performance Latex, MPI Gloss Level 3 (LL)
No. 140-13	Interior High-Performance Latex, MPI Gloss Level 4
No. 141-13	Interior High-Performance Latex (SG) MPI Gloss Level 5

D. Steel Structures Painting Council (SSPC):

SSPC SP 1-04	Solvent Cleaning
SSPC SP 2-04	Hand Tool Cleaning
SSPC SP 3-04	Power Tool Cleaning

PART 2 - PRODUCTS

2.1 MATERIALS

A. Wood Sealer: Thinned with thinner recommended by manufacturer at rate of about one part of thinner to four parts of varnish.

B. Plastic Tape:
   1. Pigmented vinyl plastic film in colors as specified in Finish Schedule in Drawings.
   2. Pressure sensitive adhesive back.
   3. Widths as shown.

C. Interior/Exterior Latex Block Filler: MPI 4.

D. Exterior Alkyd Wood Primer: MPI 5.

E. Exterior Oil Wood Primer: MPI 7.

F. Exterior Alkyd, Flat (EO): MPI 8.

G. Exterior Alkyd Enamel (EO): MPI 9.

H. Exterior Latex, Flat (AE): MPI 10.

I. Exterior Latex, Semi-Gloss (AE): MPI 11.

J. Polyurethane, Clear Gloss: MPI 31.

K. Knot Sealer: MPI 36.

L. Interior Satin Latex: MPI 43.

M. Interior Low Sheen Latex: MPI 44.

N. Interior Primer Sealer: MPI 45.

O. Interior Enamel Undercoat: MPI 46.

P. Interior Alkyd, Semi-Gloss (AK): MPI 47.

Q. Interior Latex Primer Sealer: MPI 50.

R. Interior Alkyd, Eggshell: MPI 51

S. Interior Latex, MPI Gloss Level 3 (LE): MPI 52.

T. Interior Latex, Flat, MPI Gloss Level 1 (LE): MPI 53.

U. Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE): MPI 54.

V. Interior/ Exterior Latex Porch & Floor Paint, Low Gloss: MPI 60.

W. Interior/ Exterior Latex Porch & Floor Paint, gloss: MPI 68.

X. Polyurethane, Moisture Cured, Clear, Flat (PV): MPI 71.

Y. Interior Wood Stain, Semi-Transparent (WS): MPI 90.

Z. Exterior Alkyd, Semi-Gloss (EO): MPI 94.

AA. Fast Drying Metal Primer: MPI 95.

BB. Interior latex, Gloss (LE) and (LG): MPI 114.

CC. Exterior Latex, High Gloss (acrylic) (AE): MPI 119.

DD. Waterborne Galvanized Primer: MPI 134.

EE. Interior High-Performance Latex, MPI Gloss Level 2(LF): MPI 138.

FF. Interior High-Performance Latex, MPI Gloss Level 3 (LL): MPI 139.

GG. Interior High-Performance Latex, MPI Gloss Level 4: MPI 140.

HH. Interior High-Performance Latex (SG), MPI Gloss Level 5: MPI 141.

2.2 PAINT PROPERTIES

A. Use ready-mixed (including colors), except two component epoxies, polyurethanes, polyesters, paints having metallic powders packaged separately and paints requiring specified additives.

B. Where no requirements are given in the referenced specifications for primers, use primers with pigment and vehicle, compatible with substrate and finish coats specified.

2.3 REGULATORY REQUIREMENTS

A. Paint materials must conform to the restrictions of the local Environmental and Toxic Control jurisdiction or the requirements of this section, whichever is most stringent.

1. Lead-Based Paint:

a. Lead based paint is not permitted to be used.

2. Asbestos: Materials must not contain asbestos.
3. Chromate, Cadmium, Mercury, and Silica: Materials must not contain zinc-chromate, strontium-chromate, Cadmium, mercury or mercury compounds or free crystalline silica.
4. Human Carcinogens: Materials must not contain any of the ACGIH-BKLT and ACGHI-DOC confirmed or suspected human carcinogens.
5. Use high performance acrylic paints in place of alkyd paints, where possible.
6. VOC content for solvent-based paints must not exceed specified performance requirement; aromatic hydro carbons contained in solvent-based paints must not exceed one percent by weight.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

A. Safety: Observe required safety regulations and manufacturer's warning and instructions for storage, handling and application of painting materials.
   1. Take necessary precautions to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion, or other harm.
   2. Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at end of each day’s work.

B. Atmospheric and Surface Conditions:
   1. Do not apply coating when air or substrate conditions are:
      a. Less than 3 degrees C (5 degrees F) above dew point.
      b. Below 10 degrees C (50 degrees F) or over 35 degrees C (95 degrees F), unless specifically pre-approved by the Contracting Officer and the product manufacturer.
   2. Do not exceed application conditions recommended by the manufacturer.
   3. Maintain interior temperatures until paint dries hard.
   4. Do no exterior painting when it is windy and dusty.
   5. Do not paint in direct sunlight or on surfaces that the sun will soon warm.
   6. Apply only on clean, dry and frost-free surfaces except as follows:
      a. Apply water thinned acrylic and cementitious paints to damp (not wet) surfaces where allowed by manufacturer's printed instructions.

b. Dampened with a fine mist of water on hot dry days concrete and masonry surfaces to which water thinned acrylic and cementitious paints are applied to prevent excessive suction and to cool surface.

7. Varnishing:
   a. Apply in clean areas and in still air.
   b. Before varnishing vacuum and dust area.
   c. Immediately before varnishing wipe down surfaces with a tack rag.

3.2 SURFACE PREPARATION

A. Method of surface preparation is optional, provided results of finish painting produce solid even color and texture specified with no overlays.

B. General:
   1. Remove prefinished items not to be painted such as lighting fixtures, escutcheon plates, hardware, trim, and similar items for reinstallation after paint is dried.
   2. Remove items for reinstallation and complete painting of such items and adjacent areas when item or adjacent surface is not accessible or finish is different.
   3. See other sections of specifications for specified surface conditions and prime coat.
   4. Clean surfaces for painting with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used. Do not use solvents, acid, or steam on concrete and masonry.

C. Wood:
   1. Sand to a smooth even surface and then dust off.
   2. Sand surfaces showing raised grain smooth between each coat.
   3. Wipe surface with a tack rag prior to applying finish.
   4. Surface painted with an opaque finish:
      a. Coat knots, sap and pitch streaks with Knot Sealer before applying paint.
      b. Apply two coats of Knot Sealer over large knots.
   5. After application of prime or first coat of stain, fill cracks, nail and screw holes, depressions and similar defects with wood filler paste. Sand the surface to make smooth and finish flush with adjacent surface.

6. Before applying finish coat, reapply wood filler paste if required, and sand surface to remove surface blemishes. Finish flush with adjacent surfaces.
7. Fill open grained wood such as oak, walnut, ash and mahogany with Wood Filler Paste, colored to match wood color.
   a. Thin filler in accordance with manufacturer's instructions for application.
   b. Remove excess filler, wipe as clean as possible, dry, and sand as specified.

D. Ferrous Metals:
1. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign matter in accordance with SSPC-SP 1 (Solvent Cleaning).
2. Remove loose mill scale, rust, and paint, by hand or power tool cleaning, as defined in SSPC-SP 2 (Hand Tool Cleaning) and SSPC-SP 3 (Power Tool Cleaning). Exception: where high temperature aluminum paint is used, prepare surface in accordance with paint manufacturer's instructions.
3. Fill dents, holes and similar voids and depressions in flat exposed surfaces of hollow steel doors and frames, access panels, roll-up steel doors and similar items specified to have semi-gloss or gloss finish with TT-F-322D (Filler, Two-Component Type, For Dents, Small Holes and Blow-Holes). Finish flush with adjacent surfaces.
   a. This includes flat head countersunk screws used for permanent anchors.
   b. Do not fill screws of item intended for removal such as glazing beads.
4. Spot prime abraded and damaged areas in shop prime coat which expose bare metal with same type of paint used for prime coat. Feather edge of spot prime to produce smooth finish coat.
5. Spot prime abraded and damaged areas which expose bare metal of factory finished items with paint as recommended by manufacturer of item.

E. Zinc-Coated (Galvanized) Metal, Aluminum, Copper and Copper Alloys Surfaces Specified Painted:
1. Clean surfaces to remove grease, oil and other deterrents to paint adhesion in accordance with SSPC-SP 1 (Solvent Cleaning).

2. Spot coat abraded and damaged areas of zinc-coating which expose base metal on hot-dip zinc-coated items with Organic Zinc Rich Coating. Prime or spot prime with MPI 134 (Waterborne Galvanized Primer) depending on finish coat compatibility.

F. Masonry, Concrete, Cement Board, Cement Plaster and Stucco:

1. Clean and remove dust, dirt, oil, grease efflorescence, form release agents, laitance, and other deterrents to paint adhesion.
2. Use emulsion type cleaning agents to remove oil, grease, paint and similar products. Use of solvents, acid, or steam is not permitted.
3. Remove loose mortar in masonry work.
4. Replace mortar and fill open joints, holes, cracks and depressions with new mortar specified in Section 04 05 13, MASONRY MORTARING Section 04 05 16, MASONRY GROUTING. Do not fill weep holes. Finish to match adjacent surfaces.
5. Neutralize Concrete floors to be painted by washing with a solution of 1.4 Kg (3 pounds) of zinc sulfate crystals to 3.8 L (1 gallon) of water, allow to dry three days and brush thoroughly free of crystals. Achieve appropriate CSP (Concrete Surface Profile as recommended by manufacturer based on the system being applied.
6. Repair broken and spalled concrete edges with concrete patching compound to match adjacent surfaces as specified in CONCRETE Sections. Remove projections to level of adjacent surface by grinding or similar methods.

G. Gypsum Plaster and Gypsum Board:

1. Remove efflorescence, loose and chalking plaster or finishing materials.
2. Remove dust, dirt, and other deterrents to paint adhesion.
3. Fill holes, cracks, and other depressions with CID-A-A-1272A [Plaster, Gypsum (Spackling Compound) finished flush with adjacent surface, with texture to match texture of adjacent surface. Patch holes over 25 mm (1-inch) in diameter as specified in Section for plaster or gypsum board.

3.3 PAINT PREPARATION

A. Thoroughly mix painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.

B. Do not thin unless necessary for application and when finish paint is used for body and prime coats. Use materials and quantities for thinning as specified in manufacturer's printed instructions.

C. Remove paint skins, then strain paint through commercial paint strainer to remove lumps and other particles.

D. Mix two component and two-part paint and those requiring additives in such a manner as to uniformly blend as specified in manufacturer's printed instructions unless specified otherwise.

E. For tinting required to produce exact shades specified, use color pigment recommended by the paint manufacturer.

3.4 APPLICATION

A. Start of surface preparation or painting will be construed as acceptance of the surface as satisfactory for the application of materials.

B. Unless otherwise specified, apply paint in three coats; prime, body, and finish. When two coats applied to prime coat are the same, first coat applied over primer is body coat and second coat is finish coat.

C. Apply each coat evenly and cover substrate completely.

D. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by VA COR.

E. Finish surfaces to show solid even color, free from runs, lumps, brush marks, laps, holidays, or other defects.

F. Apply by brush, roller or spray, except as otherwise specified.

G. Do not spray paint in existing occupied spaces unless approved by VA COR, except in spaces sealed from existing occupied spaces.

1. Apply painting materials specifically required by manufacturer to be applied by spraying.
2. In areas, where paint is applied by spray, mask or enclose with polyethylene, or similar air tight material with edges and seams continuously sealed including items specified in WORK NOT PAINTED, motors, controls, telephone, and electrical equipment, fronts of sterilizes and other recessed equipment and similar prefinished items.

H. Do not paint in closed position operable items such as access doors and panels, window sashes, overhead doors, and similar items except overhead roll-up doors and shutters.

3.5 PRIME PAINTING

A. After surface preparation, prime surfaces before application of body and finish coats, except as otherwise specified.

B. Spot prime and apply body coat to damaged and abraded painted surfaces before applying succeeding coats.

C. Additional field applied prime coats over shop or factory applied prime coats are not required except for exterior exposed steel. Apply an additional prime coat.

D. Prime rebates for stop and face glazing of wood, and for face glazing of steel.

E. Metals:

1. Steel and Iron: MPI 95 (Fast Drying Metal Primer). Use MPI #107 where a water-based alternative is needed in VOC restricted areas.
2. Zinc-coated Steel and Iron: MPI 134 (Waterborne Galvanized Primer).
3. Machinery Not Factory Finished: MPI 9 (Exterior Alkyd Enamel (EO)).

G. Gypsum Board:

1. Surfaces scheduled to have MPI 53 (Interior Latex, Flat), MPI Gloss Level 1 LE, MPI 52 (Interior Latex, MPI Gloss Level 3 (LE)), MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)), MPI 114 (Interior Latex, Gloss (LE) and (LG)) finish: Use MPI 53 (Interior Latex, MPI Gloss Level 3 (LE)), MPI 52 (Interior Latex, MPI Gloss Level 3 (LE)), MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)), MPI 114 (Interior Latex, Gloss (LE) and (LG)) respectively.
2. Primer: MPI 50(Interior Latex Primer Sealer) except use MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) in shower and bathrooms. Use MPI #254 as a topcoat where a water-based alternative is needed for bathrooms in VOC restricted areas.

J. CEMENT PLASTER 3.6 EXTERIOR FINISHES

A. Apply following finish coats where specified: See Finish Schedule in Drawings.

B. Steel and Ferrous Metal, Including Tern:

1. Two coats of MPI 94 (Exterior Alkyd, Semi-Gloss (EO)) on exposed surfaces, except on surfaces over 94 degrees C (200 degrees 2. Use MPI #161, #163, and #164 as Light Industrial topcoats where a water-based alternative is needed in VOC restricted areas.

C. Machinery without factory finish except for primer: One coat MPI 94 (Exterior Alkyd, Semi-Gloss (EO)).

3.7 INTERIOR FINISHES

A. Apply following finish coats over prime coats in spaces or on surfaces specified in Finish Schedule in Drawings.

B. Metal Work:

1. Apply to exposed surfaces.
2. Omit body and finish coats on surfaces concealed after installation except electrical conduit containing conductors over 600 volts.
3. Ferrous Metal, Galvanized Metal, and Other Metals Scheduled:
   a. Apply two coats of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) unless specified otherwise. Use MPI #153 as a topcoat where a water-based alternative is needed in VOC restricted areas.
   b. Two coats of MPI 48 (Interior Alkyd Gloss (AK)). Use MPI #154 (Gloss) or MPI #151 (Eg-Shel) as topcoats where a water-based alternative is needed in VOC restricted areas.

C. Gypsum Board:
1. One coat of MPI 45 (Interior Primer Sealer). Use MPI #50 as a primer where a water-based alternative is needed in VOC restricted areas, plus one coat of MPI 139 (Interior High-Performance Latex, MPI Gloss level 3 (LL)).
2. Two coats of MPI 138 (Interior High-Performance Latex, MPI Gloss Level 2 (LF)).
3. One coat of MPI 45 (Interior Primer Sealer). Use MPI #50 as a primer where a water-based alternative is needed in VOC restricted areas, plus one coat of MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)) or MPI 114 (Interior Latex, Gloss (LE) and (LG)).

D. Plaster:
1. One coat of MPI 50 (Interior Latex Primer Sealer).
2. Two coats of MPI 51 (Interior Alkyd, Eggshell) (AK). Use MPI #52 as a topcoat where a water-based alternative is needed in VOC restricted areas.

E. Masonry and Concrete Walls:
1. Over MPI 4 (Interior/Exterior Latex Block Filler) on CMU surfaces. Use MPI #3 as a primer for non-porous masonry (concrete other than block/cmu).
2. Two coats of MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)).

F. Wood:
1. Sanding:
   a. Use 220-grit sandpaper.
   b. Sand sealers and varnish between coats.
   c. Sand enough to scarify surface to assure good adhesion of subsequent coats, to level roughly applied sealer and varnish,

and to knock off "whiskers" of any raised grain as well as dust particles.

2. Sealers:
   a. Apply sealers specified except sealer may be omitted where pigmented, penetrating, or wiping stains containing resins are used.
   b. Allow manufacturer's recommended drying time before sanding, but not less than 24 hours or 36 hours in damp or muggy weather.
   c. Sand as specified.
3. Paint Finish:
   a. One coat of MPI 45 (Interior Primer Sealer). Use MPI #39 as a primer where a water-based alternative is needed in VOC restricted areas. Plus one coat of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) (SG). Use MPI #153 as a topcoat where a water-based alternative is needed in VOC restricted areas.
   b. One coat of MPI 45 Interior Primer Sealer. Use MPI #39 as a primer where a water-based alternative is needed in VOC restricted areas.
   c. Two coats of MPI 51 (Interior Alkyd, Eggshell) (AK)). Use MPI #153 as a topcoat where a water-based alternative is needed in VOC restricted areas.
4. Transparent Finishes on Wood Except Floors.
   a. Natural Finish:
      1) One coat of sealer as written in 2.1 E.
      2) Two coats of MPI 71 Polyurethane, Moisture Cured, Clear Flat (PV). There are zero products listed in this category in MPI.
   b. Stain Finish:
      1) One coat of MPI 90 Interior Wood Stain, Semi-Transparent (WS).
      2) Use wood stain of type and color required to achieve finish specified. Do not use varnish type stains.
      3) One coat of sealer as written in 2.1 E.
      4) Two coats of MPI 71 Polyurethane, Moisture Cured, Clear Flat (PV) MPI 31 Polyurethane Moisture Cured, Clear Gloss (PV). Use MPI #128 (Satin) or MPI#129 (Semi-Gloss) as a topcoat where a water-based alternative is needed in VOC restricted areas.
   c. Varnish Finish:
      1) One coat of sealer as written in 2.1 E.

2) Two coats of MPI 71 Polyurethane, Moisture Cured, Clear Flat (PV). Use MPI #128 (Satin) or MPI#129 (Semi-Gloss) as a topcoat where a water-based alternative is needed in VOC restricted areas.

3.8 REFINISHING EXISTING PAINTED SURFACES

A. Clean, patch and repair existing surfaces as specified under surface preparation.
B. Remove and reinstall items as specified under surface preparation.
C. Remove existing finishes or apply separation coats to prevent non-compatible coatings from having contact.
D. Patched or Replaced Areas in Surfaces and Components: Apply spot prime and body coats as specified for new work to repaired areas or replaced components.
E. Except where scheduled for complete painting apply finish coat over plane surface to nearest break in plane, such as corner, reveal, or frame.
F. In existing rooms and areas where alterations occur, clean existing stained and natural finished wood retouch abraded surfaces and then give entire surface one coat of Polyurethane, Moisture Cured, Clear Flat (PV).
G. Refinish areas as specified for new work to match adjoining work unless specified or scheduled otherwise.
H. Coat knots and pitch streaks showing through old finish with Knot Sealer before refinishing.
I. Sand or dull glossy surfaces prior to painting.
J. Sand existing coatings to a feather edge so that transition between new and existing finish will not show in finished work.

3.9 PAINT COLOR

A. Color and gloss of finish coats is specified: See Finish Schedule in Drawings.
B. For additional requirements regarding color see Articles, REFINISHING EXISTING PAINTED SURFACE and MECHANICAL AND ELECTRICAL FIELD PAINTING SCHEDULE.
C. Coat Colors:
   1. Color of priming coat: Lighter than body coat.
   2. Color of body coat: Lighter than finish coat.

3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.

D. Painting, Caulking, Closures, and Fillers Adjacent to Casework:
1. Paint to match color of casework where casework has a paint finish.
2. Paint to match color of wall where casework is stainless steel, plastic laminate, or varnished wood.

3.10 PROTECTION CLEAN UP, AND TOUCH-UP

A. Protect work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.

B. Upon completion, clean paint from hardware, glass and other surfaces and items not required to be painted of paint drops or smears.

C. Before final inspection, touch-up or refinished in a manner to produce solid even color and finish texture, free from defects in work which was damaged or discolored.

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APPENDIX

Coordinate the following abbreviations used in Section 09 91 00, PAINTING, with other Sections, See Finish Schedule in Drawings and other COATING SECTIONS listed. Use the same abbreviation and terms consistently.

Paint or coating	Abbreviation
Acrylic Emulsion	AE (MPI 10 – flat/MPI 11 – semigloss/MPI 119 - gloss)
Alkyd Gloss Enamel	G (MPI 48)
Alkyd Semigloss Enamel	SG (MPI 47)
Aluminum Paint	AP)
Cementitious Paint	CEP (TT-P-1411)
Exterior Latex	EL?? (MPI 10 / 11 / 119)
Exterior Oil	EO (MPI 9 – gloss/MPI 8 – flat/MPI 94 – semigloss)
Fire Retardant Paint	FR
Fire Retardant Coating (Clear)	FC (intumescent type)
Heat Resistant Paint	HR
Latex Emulsion	LE (MPI 53, flat/MPI 52, eggshell/MPI 54, semigloss/MPI 114, gloss Level 6
Latex Flat	LF (MPI 138)
Latex Gloss	LG (MPI 114)
Latex Semigloss	SG (MPI 141)
Latex Low Luster	LL (MPI 139)
Plastic Floor Coating	PL
Polyurethane Varnish	PV
Rubber Paint	RF (CID-A-A-3120 - Paint for Swimming Pools (RF))
Water Paint, Cement	WPC (CID-A-A-1555 - Water Paint, Powder).
Wood Stain	WS

- - - E N D - - -

SECTION 10 14 00
SIGNAGE

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies interior signage for room numbers, directional signs, exterior signage, and code required signs.

B. This section specifies exterior signage.

1.2 RELATED WORK

A. Section 03 30 53, MISCELLANEOUS CAST-IN-PLACE CONCRETE: Concrete Post Footings.

B. Division 26, ELECTRICAL Lighted EXIT signs for egress purposes are specified under and Electrical Work.

1.3 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Provide signage that is the product of one manufacturer, who has provided signage as specified for a minimum of three (3) years. Submit manufacturer’s qualifications.

B. Installer’s Qualifications: Minimum three (3) years’ experience in the installation of signage of the type as specified in this Section. Submit installer’s qualifications.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 30 00 ADMINISTRATIVE REQUIREMENTS .

B. Exterior Sign Samples: 152 x 152 mm (6 x 6 inches) samples of each color and material.

C. Manufacturer's Literature:

1. Showing the methods and procedures proposed for the anchorage of the signage system to each surface type.
2. Manufacturer’s printed specifications and maintenance instructions.

D. Sign Location Plan, showing location, type and total number of signs required.

E. Shop Drawings: Scaled for manufacture and fabrication of sign types. Identify materials, show joints, welds, anchorage, accessory items, mounting and finishes.

F. Full size layout patterns for dimensional letters.

G. Manufacturer’s qualifications.

H. Installer’s qualifications.

1.5 DELIVERY AND STORAGE

A. Deliver materials to job in manufacturer's original sealed containers with brand name marked thereon. Protect materials from damage.

B. Package to prevent damage or deterioration during shipment, handling, storage and installation. Maintain protective covering in place and in good repair until removal is necessary.

C. Deliver signs only when the site and mounting services are ready for installation work to proceed.

D. Store products in dry condition inside enclosed facilities.

1.6 WARRANTY

A. Construction Warranty: Comply with FAR clause 52.246-21, “Warranty of Construction”.

1.7 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Architectural Manufacturers Association (AAMA):

611-14.....Anodized Architectural Aluminum

2603-13.....Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels

C. American National Standards Institute (ANSI):

A117.1-09.....Accessible and Usable Buildings and Facilities

D. ASTM International (ASTM):

A36/A36M-19.....Carbon Structural Steel

A240/A240M-20.....Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

A666-15.....Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar

A1011/A1011M-18a.....Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

B36/B36M-18.....Brass Plate, Sheet, Strip, and Rolled Bar

B152/B152M-19.....Copper Sheet, Strip, Plate, and Rolled Bar

B209-14.....Aluminum and Aluminum-Alloy Sheet and Plate

B209M-14.....Aluminum and Aluminum-Alloy Sheet and Plate (Metric)

B221-14.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

B221M-13.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes (Metric)

C1036-16.....Flat Glass

C1048-18.....Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass

C1349-17.....Architectural Flat Glass Clad Polycarbonate

D1003-13.....Test Method for Haze and Luminous Transmittance of Transparent Plastics

D4802-16.....Poly(Methyl Methacrylate) Acrylic Plastic Sheet

E. Code of Federal Regulation (CFR):

40 CFR 59.....Determination of Volatile Matter Content, Water Content, Density Volume Solids, and Weight Solids of Surface Coating

F. Federal Specifications (Fed Spec):

MIL-PRF-8184F.....Plastic Sheet, Acrylic, Modified.

MIL-P-46144C.....Plastic Sheet, Polycarbonate

G. National Fire Protection Association (NFPA):

70-14.....National Electrical Code

H. USDA Forest Service Design and Construction Standards for Southern Region Facilities - 2021

PART 2 - PRODUCTS

2.1 SIGNAGE GENERAL

A. Provide signs of type, size and design shown on the construction documents.

B. Provide signs complete with lettering, framing and related components for a complete installation.

C. Provide graphics items as completed units produced by a single manufacturer, including necessary mounting accessories, fittings and fastenings.

D. Do not scale construction documents for dimensions. Verify dimensions and coordinate with field conditions. Notify Contracting Officer

Representative (COR) of discrepancies or changes needed to satisfy the requirements of the construction documents.

2.2 EXTERIOR SIGNAGE PERFORMANCE REQUIREMENTS

A. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes 67 degrees C (120 degrees F) ambient and 100 degrees C (180 degrees F) material surfaces.

B. Provide installed electrical components and sign installations bearing the label and certifications of Underwriter's Laboratories, Inc., and comply with NFPA 70 as well as applicable federal codes for installation techniques, fabrication methods and general product safety.

2.3 INTERIOR SIGN MATERIALS – NOT USED

2.4 EXTERIOR SIGN MATERIALS

A. All new signage to match existing in color, type and materials. See construction drawings set for details.

2.5 INTERIOR SIGN TYPES

A. Lighted exit signs. Reference Electrical drawings.

B. Tactile Sign:

1. Tactile sign made from a material that provides for letters, numbers and Braille to be integral with sign. Photopolymer etched metal, sandblasted phenolic or embossed material. Do not apply letters, numbers and Braille with adhesive.
2. Numbers, letters and Braille to be raised 0.8 mm (1/32 inches) from the background surface. The draft of the letters, numbers and Braille to be tapered, vertical and clean.
3. Braille Dots: Conform with ANSI A117.1 for Braille position and layout; (a) Dot base diameter: 1.5 mm (.059 inches) (b) Inter-dot spacing: 2.3 mm (.090 inches) (c) Horizontal separation between cells: 6.0 mm (.241 inches) (d) Vertical separation between cells: 10.0 mm (.395 inches)

2.6 EXTERIOR SIGN TYPES

A. General:

1. Fabricate signs that comply with USDA Forest Service Design and Construction Standards.

B. All new signage to match existing in color, type and materials. See construction drawings set for details.

1.

2.7 FABRICATION

A. Design signage components to allow for expansion and contraction for a minimum material temperature range of 38 degrees C (100 degrees F), without causing buckling, excessive opening of joints or over stressing of adhesives, welds and fasteners.

B. Form work to required shapes and sizes, with true curve lines and angles. Provide necessary rebates, lugs and brackets for assembly of units. Provide concealed fasteners wherever possible.

C. Shop fabricate so far as practicable. Fasten joints flush to conceal reinforcement, or weld joints, where thickness or section permits.

D. Level and assemble contract surfaces of connected members so joints will be tight and practically unnoticeable, without applying filling compound.

E. Signs: Fabricate with fine, even texture to be flat and sound.
   1. Maintain lines and miters sharp, arises unbroken, profiles accurate and ornament true to pattern.
   2. Plane surfaces to be smooth, flat and without oil-canning, free of rack and twist.
   3. Maximum variation from plane of surface plus or minus 0.3 mm (0.015 inches). Restore texture to filed or cut areas.

F. Finish extruded members to be free from extrusion marks. Fabricate square turns, sharp corners, and true curves.

G. Finish hollow signs with matching material on all faces, tops, bottoms and ends. Miter edge joints to give appearance of solid material.

H. Do not manufacture signs until final sign message schedule and location review has been completed by the COR and forwarded to contractor.

I. Drill holes for bolts and screws. Mill smooth exposed ends and edges with corners slightly rounded.

J. Form joints exposed to weather to exclude water.

K. Movable Parts, Including Hardware: Cleaned and adjusted to operate as designed without binding or deformation of members. Center doors and covers in opening or frame.
   1. Align contact surfaces fit tight and even without forcing or warping components.

L. Pre-assemble items in shop to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling

limitations. Clearly mark units for re-assembly and coordinated installation.

M. Prime painted surfaces as required. Apply finish coating of paint for complete coverage with no light or thin applications allowing substrate or primer to show.
   1. Finish surface smooth, free of scratches, gouges, drips, bubbles, thickness variations, foreign matter and other imperfections.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate signs as shown on the construction documents.

B. Where not otherwise indicated conform to the USDA Forest Service Design and Construction Standards.

C. At each sign location there are no utility lines behind each sign location that will be affected by installation of signs.
   1. Correct and repair damage done to utilities during installation of signs at no additional cost to Government.

D. Provide inserts and anchoring devices which must be set in concrete or other material for installation of signs. Submit setting drawings, templates, instructions and directions for installation of anchorage devices, which may involve other trades.

E. Touch up exposed fasteners and connecting hardware to match color and finish of surrounding surface.

F. At completion of sign installation, clean exposed sign surfaces. Clean and repair adjoining or adjacent surfaces that became soiled or damaged as a result of installation of signs.

- - - END - - -

SECTION 10 21 00
TOILET COMPARTMENTS
BASIS OF DESIGN: HINY HIDERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Solid plastic toilet compartments including the following: (Hiny Hiders)
   1. Floor mounted overhead-braced toilet compartments.
   2. Privacy screens.
   3. Shower and dressing compartments.

1.2 RELATED SECTIONS

A. Section 05 50 00 - Metal Fabrications.
B. Section 06 10 00 - Rough Carpentry.

1.3 REFERENCES

A. ASTM A666 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
D. National Fire Protection Association (NFPA) 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
C. Shop Drawings: Provide layout drawings and installation details with location and type of hardware required.
D. Verification Samples: For each finish product specified, two samples representing actual product, color, and patterns.

E. Sustainable Design Submittals:
   1. Recycled Content: Certify percentages of post-consumer and pre-consumer recycled content.
   2. Regional Materials: Certify distance between manufacturer and Project.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A company regularly engaged in manufacture of products specified in this section, and whose products have been in satisfactory use under similar service conditions for not less than 5 years.

B. Installer Qualifications: A company regularly engaged in installation of products specified in this Section, with a minimum of 5 years experience.

C. Materials: Doors, panels and pilasters, constructed from high density polyethylene (HDPE) resins. Partitions to be fabricated from polymer resins compounded under high pressure, forming a single component which is waterproof, nonabsorbent and has a self-lubricating surface that resists marks from pens, pencils, markers and other writing instruments. Cover all plastic components with a protective plastic masking.

D. Performance Requirements:
   1. Fire Resistance: Partition materials shall comply with the following requirements, when tested in accordance with NFPA 286:
      a. Tested to Meet NFPA, Class A flame spread/smoke developed rating.
   2. Material Fire Ratings:
      a. National Fire Protection Association (NFPA) 286: Pass.
      b. International Code Council (ICC): Class A.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 WARRANTY

A. Manufacturer guarantees its plastic against breakage, corrosion, and delamination under normal conditions for 25 years from the date of receipt by the customer. If materials are found to be defective during that period for reasons listed above, the materials will be replaced free of charge. Labor not included in warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Scranton Products, which is located at: 801 E. Corey St.; Scranton, PA 18505; Toll Free Tel: 800-445-5148; Fax: 855-376-6161; Email: request info (info@scrantonproducts.com); Web: http://www.scrantonproducts.com

1. Fabricator: Santana Toilet Partitions.
2. Fabricator: Comtec Toilet Partitions.
3. Fabricator: Capitol Toilet Partitions.

B. Substitutions: Requires Forest Service and designer approval.

C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 MATERIAL

A. Plastic Panels: High density polyethylene (HDPE) suitable for exposed applications, waterproof, non-absorbent, and graffiti-resistant textured surface.

1. Recycled Content; Post Industrial: 25 percent.
2. Recycled Content; Post Industrial: 100 percent.
3. Recycled Content; Post Consumer: 100 percent.

B. Zinc Aluminum Magnesium and Copper Alloy (Zamac): ASTM B 86.

C. Stainless Steel Castings: ASTM A167, Type 304.

D. Aluminum: ASTM 6463-T5 alloy.

2.3 SOLID PLASTIC TOILET COMPARTMENTS

A. Basis of Design: Hiny Hiders Toilet Partitions as manufactured by and supplied by Scranton Products.

1. Style: Floor mounted overhead-braced toilet compartments.

B. Doors, Panels, and Pilasters: 1 inch (25 mm) thick with all edges rounded to a radius. Mount doors and dividing panels based on height of specified system.

1. Door and Panel Height: 66 inches (1676 mm).
2. Door Design: Traditional 2600.

3. Panel Edge: Shiplap.
4. Pilasters: 82 inches (2083 mm) high and fastened to floor.

C. Panel Color: Traditional series.
1. Shale - Orange Peel.

D. Pilaster Shoes: 3 inches (76 mm) high one-piece molded HDPE. Secured to pilasters with a stainless steel tamper resistant Torx head sex bolt.
1. Pilaster Plastic Shoe Color: Silver (Matches Stainless/Aluminum Hardware).

E. Headrail: Heavy-duty extruded 6463-T5 alloy aluminum with anti-grip design. Finish to be clear anodized. Fastened to headrail brackets with stainless steel tamper resistant Torx head sex bolt, and fastened at the top of the pilaster with stainless steel tamper resistant Torx head screws.
1. Headrail Brackets: 20 gauge stainless steel with satin finish. Secured to the wall with stainless steel tamper resistant Torx head screws.

F. Wall Brackets:
1. Stainless Steel Brackets: Stainless steel type 201.
2. Brackets are fastened to pilasters with stainless steel tamper resistant Torx head screws and fastened to the panels with stainless steel tamper resistant Torx head sex bolts.
3. Bracket Type: Stirrup stainless steel double ear.

G. Door Hardware:
1. Continuous Stainless Steel Helix Hinge:
a. Length: 54 inches (1372 mm).
2. Door Strike/Keeper: Heavy-duty extruded aluminum 6436-T5 alloy with a clear anodized finish. Secured to pilasters with stainless steel tamper resistant Torx head sex bolts. Bumper shall be made of extruded black vinyl.
a. Style: 6 inches (152 mm) aluminum.
3. Latch Mechanism: Stainless Steel Slide Bolt Latch and Housing: Heavy-duty stainless steel type 304. The latch and housing to have a bright finish. The slide bolt and button to have a black anodized finish.
4. Doors supplied with one coat hook/bumper and door pull, clear anodized aluminum or stainless steel.

5. Equip outswing handicapped doors with second door pull and door stop.

2.4 SOLID PLASTIC PRIVACY SCREENS

A. Provide plastic privacy screens in urinal and entry toilet room applications as indicated or scheduled.

B. Panels, and pilasters, if required, 1 inch (25 mm) thick with edges rounded to a radius. Screens to be mounted at 14 inches (356 mm) above the finished floor. Color as selected by Architect from manufacturer's full line of current colors. See Finish Schedule in drawing set for color.

1. Recycled Content: Minimum 25 percent.

C. Screen Type: Wall mounted.

1. Urinal Screens: 24 inches (610 mm) wide by 55 inches (1397 mm) high.

D. Screen Type: Pilaster supported.

1. Configuration: Floor pilaster supported screen.
2. Urinal Screens: 24 inches (610 mm) wide by 55 inches (1397 mm) high.
3. Pilaster: Pilaster screens shall be 82 inches (2083 mm) high.
4. Headrail Brackets: 20 gauge stainless steel with a satin finish. Secured to the wall with stainless steel tamper resistant Torx head screws.
5. Pilaster Sleeves: 20 gauge stainless steel secured to pilaster with a stainless steel tamper resistant Torx head sex bolt.
6. Pilaster Shoes: One-piece molded HDPE secured to the pilaster with a stainless steel tamper resistant Torx head sex bolt.
   a. Pilaster Shoes Color: Silver; matches clear anodized hardware.

E. Wall Brackets: Extruded PVC plastic. Fastened to the panel/pilaster with stainless steel tamper resistant torx head screws and fastened to wall with stainless steel tamper resistant torx head sex bolts.

1. Length of Wall Brackets: 54 inches (1327 mm).
2. Bracket Color: Grey.

F. Aluminum Slide Bolt Latch and Housing: Heavy-duty extruded 6463-T5 alloy aluminum. Latch and housing to have a clear anodized finish. Slide bolt and button to have a black anodized finish.

2.5 SOLID PLASTIC SHOWER AND DRESSING COMPARTMENTS

A. Plastic privacy screens in shower room applications as indicated or scheduled.

B. Panels and Pilasters: 1 inch (25 mm) thick with edges rounded to a radius. Mount screens at 14 inches (356 mm) above the finished floor. Color as selected by Architect from manufacturer's full line of current colors.

C. Type: Floor mounted pilaster supported screen.

1. Panel Screens: 76 inches (1930 mm) high.
2. Pilaster Screens: 82 inches (2083 mm) high.
3. Headrail: Heavy-duty extruded 6463-T5 alloy aluminum with anti-grip design and integrated curtain track. Clear anodized finish. Fastened to the headrail bracket with a stainless steel tamper resistant Torx head sex bolt, and fastened at the top of the pilaster with stainless steel tamper resistant Torx head screws.
4. Headrail Brackets: 20 gauge stainless steel with a satin finish. Secured to the wall with stainless steel tamper resistant Torx head screws.
5. Pilaster Sleeves: 20 gauge stainless steel. 3 inches (76 mm) high. Secured to pilaster with stainless steel tamper resistant Torx head sex bolt.
6. Wall Brackets: Continuous, heavy-duty 6463-T5 alloy aluminum. Clear anodized finish. Fastened to panel/pilaster with stainless steel tamper resistant Torx head sex bolts.
7. Shower Curtains (WxH): 42 x 72 inches (1067 x 1829 mm), white non PVC, hung with aluminum curtain hooks with self-lubricating Delrin slides.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer

for achieving the best result for the substrate under the project conditions.

C. Examine areas to receive toilet partitions, screens, and shower compartments for correct height and spacing of anchorage/blocking and plumbing fixtures that affect installation of partitions. Report discrepancies to the architect.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install partitions rigid, straight, plumb, and level manor, with plastic laid out as shown on shop drawings.

C. Clearance at vertical edges of doors shall be uniform top to bottom and shall not exceed 3/8 inch (9.5 mm).

D. No evidence of cutting, drilling, and/or patching shall be visible on the finished work.

E. Finished surfaces shall be cleaned after installation and be left free of imperfections.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 10 28 00
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. SUMMARY:

1. Section Includes: Toilet and bath accessories at dressing rooms, toilets, baths, and other areas indicated on drawings.

1.2 RELATED WORK

A. FINISH SCHEDULE in drawings: Color of finishes.

B. Section 09 30 13, CERAMIC/PORCELAIN TILING: Ceramic Toilet and Bath Accessories.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American Society of Mechanical Engineers (ASME):

1. B18.6.4-98(R2005) Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws inch.

C. American Welding Society (AWS):

D10.4-86(2000).....Welding Austenitic Chromium-Nickle Stainless Steel Piping and Tubing.

D. ASTM International (ASTM):

A269/A269M-15a(2019)....Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

A312/A312M-19.....Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.

A653/A653M-20.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

A666-15.....Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

A1011/A1011M-18a.....Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

B30-20.....Copper Alloys in Ingot Form.

B75/B75M-20.....Seamless Copper Tube.

B221-14.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

B221M-13.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

B456-17.....Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

B824-17.....General Requirements for Copper Alloy Castings.

C1036-16.....Flat Glass.

C1048-18.....Heat-Strengthened and Fully Tempered Flat Glass.

D635-18.....Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.

F446-19.....Grab Bars and Accessories Installed in the Bathing Area.

E. Federal Specifications (Fed. Spec.):

A-A-3002.....Mirror, Glass.

FF-S-107C(2).....Screws, Tapping and Drive.

WW-P-541/8B(1).....Plumbing Fixtures (Accessories, Land Use).

F. National Architectural Metal Manufacturers(NAAMM):

AMP 500-06.....Metal Finishes Manual.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 30 00 ADMINISTRATIVE REQUIREMENTS.

B. Submittal Drawings:

1. Show size, configuration, and fabrication, anchorage and installation details.
2. Show mounting locations and heights.

C. Manufacturer's Literature and Data:

1. Description of each product.
2. Installation instructions.

D. Samples:

1. Full sized, complete assembly of each product specified.
2. Approved samples may be incorporated into project.

E. Certificates: Certify each product complies with specifications.

1. Soap dispensers: Certify soap dispensers are fabricated of material that will not be affected by liquid soap, aseptic detergents, and hexachlorophene solutions.

F. Qualifications: Substantiate qualifications comply with specifications.

1. Manufacturer with project experience list.

G. Operation and Maintenance Data:

1. Care instructions for each exposed finish product.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Regularly manufactures specified products.

1.6 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight facility.

B. Protect products from damage during handling and construction operations.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum: ASTM B221M (ASTM B221), Alloy 6063-T5 and Alloy 6463-T5.

B. Stainless Steel:

1. Plate Or Sheet: ASTM A666, Type 304, 0.8 mm (0.031 inch) thick unless otherwise specified.
2. Tubing: ASTM A269/A269M, Grade TP 304, seamless or welded.
3. Pipe: ASTM A312/A312M; Grade TP 304.

C. Steel Sheet: ASTM A653/A653M, zinc-coated (galvanized) coating designation G90.

D. Chrome Plating (Service Condition Number SC 2): ASTM B456.

E. Brass Castings: ASTM B30.

F. Copper:

1. Tubing: ASTM B75/B75M.
2. Castings: ASTM B824.

G. Glass:

1. ASTM C1036, Type 1, Class 1, Quality q2, for mirrors.

2.2 PRODUCTS - GENERAL

A. Basis of Design: See FINISH SCHEDULE in drawings.

B. Provide each product from one manufacturer.

1. Design accessories for attachment with tamper resistant hardware.

2.3 PAPER TOWEL DISPENSERS

A. Surface mounted type with sloping top.

B. Dispensing capacity for 300 sheets of any type of paper toweling.

C. Fabricate of stainless steel.

D. Provide door with continuous hinge at bottom, and spring tension cam lock or tumbler lock, keyed alike, at top, and refill sight slot in front.

2.4 COMBINATION PAPER TOWEL DISPENSER AND DISPOSAL UNITS

A. Semi-recessed type.

B. Dispensing capacity for 400 sheets of any type of paper toweling.

C. Fabricate of stainless steel.

D. Form face frames, from one piece.

E. Provide each door with continuous stainless steel piano hinge and tumbler lock, keyed alike.

F. Provide removable waste receptacle approximately 40 L (10.5 gal.) capacity, fabricated of 0.45 mm (0.02 inch) thick stainless steel.

2.5 WASTE RECEPTACLES

A. Semi-recessed type, without doors. Fed. Spec. WW-P-541, Type II.

B. Fabricate of stainless steel.

C. Form face frame from one piece.

D. Provide removable waste receptacle of approximately 45 L (12 gal.) capacity, fabricated of stainless steel.

E. Waste receptacle key locked in place.

2.6 TOILET TISSUE DISPENSERS

A. Triple roll surface mounted type.

B. Mount on continuous backplate.

C. Removable spindle ABS plastic or chrome plated plastic.

D. Wood rollers are not acceptable.

2.7 GRAB BARS

A. Fed. Spec. WW-P-541/8B, Type IV, bars, surface mounted, Class 2, grab bars and complying with ASTM F446.

B. Fabricate from stainless steel, use one type throughout project:

1. Stainless steel: Grab bars, flanges, mounting plates, supports, screws, bolts, and exposed nuts and washers.

C. Mounting:

1. Metal Toilet, Dressing and Shower Partitions Mounted Grab Bars: Exposed type.
2. Other Types and Locations: Concealed type.

D. Bars:
1. Fabricate to 38 mm (1-1/2 inch) outside diameter.
   a. Stainless steel, minimum 1.2 mm (0.05 inch) thick.
2. Fabricate in one continuous piece with ends turned toward walls.
   a. Grab bars continuous around three sides of showers may be fabricated in two sections, with concealed slip joint between.
3. Continuously weld intermediate support to grab bar.

E. Flange for Concealed Mounting:
1. Minimum 2.65 mm (0.1 inch) thick, maximum 79 mm (3-1/8 inch) diameter by 13 mm (1/2 inch) deep, with minimum three set screws for securing flange to back plate.
2. Insert grab bar through center of flange and continuously weld perimeter of grab bar flush to back side of flange.
3. In lieu of providing flange for concealed mounting, and back plate as specified, grab bar may be welded to back plate covered with flange.

F. Flange for Exposed Mounting:
1. Minimum 5 mm (3/16 inch) thick, maximum 79 mm (3-1/8 inch) diameter.
2. Insert grab bar through flange and continuously weld perimeter of grab bar flush to backside of flange.
3. Where mounted on toilet, dressing or shower partitions, provide three equally spaced, countersunk holes, sized to accommodate 5 mm (3/16 inch) diameter bolts.

G. Back Plates:
1. Minimum 2.65 mm (0.1046 inch) thick metal.
2. Fabricate in one piece, maximum 6 mm (1/4 inch) deep, with diameter sized to fit flange. Provide slotted holes to accommodate anchor bolts.
3. Provide spreaders, through bolt fasteners, and cap nuts, where grab bars are mounted on partitions.

2.8 CLOTHES HOOKS, ROBE OR COAT

A. Fabricate hook units from chromium plated brass with satin finish, or stainless steel, using 6 mm (1/4 inch) minimum thick stock, with edges

and corners rounded smooth to thickness of metal, or 3 mm (1/8 inch) minimum radius.

B. Fabricate each unit as a double hook on a single shaft, integral with or permanently fastened to wall flange, provided with concealed fastenings.

2.9 TOWEL BARS – NOT USED

2.10 METAL FRAMED MIRRORS

A. Fed. Spec. A-A-3002 metal frame; stainless steel.

B. Mirror Glass:

1. Minimum 6 mm (1/4 inch) thick.
2. Set mirror in a protective vinyl glazing tape.

C. Frames:

1. Channel or angle shaped section with face of frame minimum 9 mm (3/8 inch) wide. Fabricate with square corners.
2. Metal Thickness 0.9 mm (0.035 inch).
3. Filler:
   a. Where mirrors are mounted on walls having ceramic tile wainscots not flush with wall above, provide fillers contoured to conceal void between back of mirror and wall surface.
   b. Fabricate fillers from same material and finish as mirror frame.

D. Back Plate:

1. Fabricate backplate for concealed wall hanging from zinc-coated, or cadmium plated 0.9 mm (0.036 inch) thick sheet steel, die cut to fit face of mirror frame.
2. Provide set screw type theft resistant concealed fastening system for mounting mirrors.

E. Mounting Bracket:

1. Designed to support mirror tight to wall.
2. Designed to retain mirror with concealed set screw fastenings.

2.11 SOAP DISHES – NOT USED

2.12 MOP RACKS

A. Minimum 1016 mm (40 inches) long with five holders.

B. Clamps:

1. Minimum of 1.3 mm (0.05 inch) thick stainless steel bracket retaining channel with hard rubber serrated cam; pivot mounted to channel.

2. Clamps to hold handles from 13 mm (1/2 inch) minimum to 32 mm (1-1/4 inch) maximum diameter.

C. Support:

1. Minimum 1 mm (0.04 inch) thick stainless steel hat shape channel to hold clamps away from wall as indicated.
2. Drill wall flange for 3 mm (1/8 inch) fasteners above and below clamp locations.

D. Secure clamps to support with oval head machine screws or rivets into continuous reinforcing back of clamps.

2.13 FABRICATION - GENERAL

A. Welding, AWS D10.4.

B. Grind, dress, and finish welded joints to match finish of adjacent surface.

C. Form exposed surfaces from one sheet of stock, free of joints.

D. Provide steel anchors and components required for secure installation.

E. Form flat surfaces without distortion. Keep exposed surfaces free from scratches and dents. Reinforce doors to prevent warp or twist.

F. Isolate aluminum from dissimilar metals and from contact with building materials as required to prevent electrolysis and corrosion.

G. Hot-dip galvanized steel or stainless steel, anchors and fastening devices.

H. Shop assemble accessories and package with components, anchors, fittings, fasteners and keys.

I. Key items alike.

J. Provide templates and rough-in measurements.

K. Round and deburr edges of sheets to remove sharp edges.

2.14 FINISH

A. Stainless Steel: NAAMM AMP 500; No. 4 polished finish.

B. Aluminum Anodized Finish: NAAMM AMP 500.

1. Clear Anodized Finish: AA-C22A41; Class I Architectural, 0.018 mm (0.7 mil) thick.
2. Color Anodized Finish: AA-C22A42 or AA-C22A44; Class I Architectural, 0.018 mm (0.7 mil) thick.

C. Chromium Plating: ASTM B456, satin or bright as specified, Service Condition No. SC2.

2.15 ACCESSORIES

A. Fasteners:

1. Exposed Fasteners: Stainless steel or chromium plated brass, finish to match adjacent surface.
2. Concealed Fasteners:
   a. Shower and High Moisture Areas: Stainless steel.
   b. Other Locations: Steel, hot-dipped galvanized.
3. Toggle Bolts: For use in hollow masonry or frame construction.
4. Sex bolts: For through bolting on thin panels.
5. Expansion Shields: Lead or plastic for solid masonry and concrete substrate as recommended by accessory manufacturer to suit application.
6. Screws:
   a. ASME B18.6.4.
   b. Fed. Spec. FF-S-107, Stainless steel Type A.

B. Adhesive: As recommended by manufacturer to suit application.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.
   1. Verify blocking to support accessories is installed and located correctly.

B. Verify location of accessories with Contracting Officer's Representative.

3.2 INSTALLATION

A. Install products according to manufacturer's instructions and approved submittal drawings.
   1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

B. Install grab bars according to ASTM F446.

C. Set work accurately, in alignment and where indicated, parallel or perpendicular as required to line and plane of surface. Install accessories plumb, level, free of rack and twist.

D. Toggle bolt to steel anchorage plates in frame partitions and hollow masonry. Expansion bolt to concrete or solid masonry.

E. Install accessories to function as designed. Perform maintenance service without interference with performance of other devices.

F. Position and install dispensers, and other devices in countertops, clear of drawers, permitting ample clearance below countertop between devices, and ready access for maintenance.

G. Align mirrors, dispensers and other accessories even and level, when installed in battery.

H. Install accessories to prevent striking by other moving, items or interference with accessibility.

3.3 CLEANING

A. After installation, clean toilet accessories according to manufacturer’s instructions.

3.4 PROTECTION

A. Protect accessories from damage until project completion.

3.5 SCHEDULE OF ACCESSORIES

A. See Accessories Schedule in construction drawings set.

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SECTION 12 36 00
COUNTERTOPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies restroom countertops with integral accessories.

B. Integral accessories include:

1. Sinks with traps and drains.

C. Basis of Design: see Finish Schedule in drawing set for manufacturer, product and color.

1.2 RELATED WORK

A. Manufacturer, Color and Patterns of solid surface: See Finish Schedule.

B. DIVISION 22, PLUMBING.

C. DIVISION 26, ELECTRICAL.

D. Equipment Reference Manual for SECTION 12 36 00, COUNTERTOPS.

1.3 SUBMITTALS

A. Submit in accordance with SECTION 01 30 00 ADMINISTRATIVE REQUIREMENTS.

B. Shop Drawings

1. Show dimensions of section and method of assembly.
2. Show details of construction at a scale of ½ inch to a foot.

C. Samples:

1. 150 mm (6 inch) square samples each top.
2. Front edge, back splash, end splash and core with surface material and booking.

1.4 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. American Hardboard Association (AHA):

A135.4-95.....Basic Hardboard

C. Composite Panel Association (CPA):

A208.1-09.....Particleboard

D. American Society of Mechanical Engineers (ASME):

A112.18.1-12.....Plumbing Supply Fittings

A112.1.2-12.....Air Gaps in Plumbing System

A112.19.3-08(R2004).....Stainless Steel Plumbing Fixtures (Designed for Residential Use)

E. American Society for Testing and Materials (ASTM):

A167-99 (R2009).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip

A1008-10.....Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength, Low Alloy

D256-10.....Pendulum Impact Resistance of Plastic

D570-98(R2005).....Water Absorption of Plastics

D638-10.....Tensile Properties of Plastics

D785-08.....Rockwell Hardness of Plastics and Electrical Insulating Materials

D790-10.....Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

D4690-99(2005).....Urea-Formaldehyde Resin Adhesives

F. Federal Specifications (FS):

A-A-1936.....Adhesive, Contact, Neoprene Rubber

G. U.S. Department of Commerce, Product Standards (PS):

PS 1-95.....Construction and Industrial Plywood

H. National Electrical Manufacturers Association (NEMA):

LD 3-05.....High Pressure Decorative Laminates

PART 2 - PRODUCTS

2.1 MATERIALS

A. Solid Polymer Material:

1. Filled Methyl Methacrylic Polymer.
2. Performance properties required:

Property	Result	Test
Elongation	0.3% min.	ASTM D638
Hardness	90 Rockwell M	ASTM D785
Gloss (60^0 Gordon)	5-20	NEMA LD3.1
Color stability	No change	NEMA LD3 except 200 hour
Abrasion resistance	No loss of pattern Max wear depth 0.0762 mm (0.003 in) - 10000 cycles	NEMA LD3
Water absorption weight (5 max)	24 hours 0.9	ASTM D-570
Izod impact	14 N·m/m (0.25 ft-lb/in)	ASTM D256 (Method A)

Property	Result	Test
Impact resistance	No fracture	NEMA LD-3 900 mm (36") drop 1 kg (2 lb.) ball
Boiling water surface resistance	No visible change	NEMA LD3
High temperature resistance	Slight surface dulling	NEMA LD3

3. Cast into sheet form and bowl form.
4. Color throughout with subtle veining through thickness.
5. Joint adhesive and sealer: Manufacturers silicone adhesive and sealant for joining methyl methacrylic polymer sheet.
6. Bio-based products will be preferred.

2.2 SINKS

A. Sinks of Methyl Methacrylic Polymer:
1. Minimum 19 mm (3/4 inch) thick, cast into bowl shape with overflow to drain.
2. Provide for underhung installation to countertop.
3. Provide openings for drain.
4. See Finish Schedule for Basis of Design.

2.3 TRAPS AND FITTINGS

A. Material as specified in DIVISION 22, PLUMBING.

B. Methyl Methacrylic Polymer Sink Traps:
1. Cast or wrought brass with flat grid strainer, off-set tail piece, adjustable 38 x 32 mm (1-1/2 x 1 1/4-inch) P trap.
2. Chromium plated finish.

2.4 WATER FAUCETS

A. ASME A112.18.1.
1. Cast or forged brass, compression type with replaceable seat and stem assembly or replaceable cartridge.
2. Indexed lever handles either with or without head.
3. Gooseneck minimum clearance above countertop of 190 mm (7-1/2 inches), bent 180 degrees for vertical discharge.
4. Swing spouts elevated to clear handles.
5. Exposed brass surfaces chromium plated.
6. Cast combination hot and cold fixture with one piece body for multiple outlets.

7. Adapter type connection which will permit field conversion of swing spouts to fixed or gooseneck grouts or vice versa.

B. Automatic Controlled Faucets.
1. Infra-red photocell sensor and a solenoid valve to control water flow automatically.
2. Breaking light beam activates water flow.
3. Water stops when user moves away from light beam.

C. Vanity or Lavatory Faucets in Methyl Methacrylic Polymer tops:
1. Extra long center set single lever handle control.
2. Cast or wrought copper alloy, vandal resistant.
3. Stainless steel ball type with replaceable non-metallic seats, stainless steel lined sockets.
4. Handle always returning to the neutral position or cartridge body construction.
5. Provide laminar flow control device.

2.10 COUNTERTOPS

A. Fabricate in largest sections practicable.
B. Fabricate with joints flush on top surface.
C. Fabricate countertops to overhang front of cabinets and end of assemblies 25 mm (one inch) except where against walls or cabinets.
D. Provide 1 mm (0.039 inch) thick metal plate connectors or fastening devices (except epoxy resin tops).
E. Join edges in a chemical resistant waterproof cement or epoxy cement, except weld metal tops.
F. Fabricate with end splashes where against walls or cabinets.
G. Splash Backs and End Splashes:
1. Not less than 19 mm (3/4 inch) thick.
2. Height 100 mm (4 inches) unless noted otherwise.

H. Drill or cutout for sinks, and penetrations.
1. Accurately cut for size of penetration.
2. Configure cut-out for sink per sink manufacturer’s guidelines to ensure ADA-compliance.

I. Methyl Methacrylic Polymer Tops:
1. Fabricate countertop of methyl methacrylic polymer cast sheet, 13 mm (1/2 inch) thick.
2. Fabricate back splash and end splash to height shown.
3. Fabricate skirt to depth shown.
4. Fabricate with marine edge where sinks occur.

5. Fabricate in one piece for full length from corner to corner up to 3600 mm (12 feet).
6. Join pieces with adhesive sealant.
7. Cut out countertop for lavatories, plumbing trim.
8. Provide concealed fasteners and epoxy cement for anchorage of sinks to countertop.

J. Countertop products shall comply with following standards for biobased materials:

Material Type	Percent by Weight
Composite Panel	89 percent biobased material
Hardwood	89 percent biobased material
Particleboard	89 percent biobased material
Plywood	89 percent biobased material

The minimum-content standards are based on the weight (not the volume) of the material in the insulating core only.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Before installing countertops verify that wall surfaces have been finished as specified and that mechanical and electrical service locations are as required.

B. Secure countertops to supporting rails of cabinets with metal fastening devices, or screws through pierced slots in rails.
   1. Where type, size or spacing of fastenings is not shown or specified, submit shop drawings showing proposed fastenings and method of installation.
   2. Use round head bolts or screws.

C. Sinks
   1. Install methyl methacrylic polymer sinks in manufacturers recommended adhesive sealer or epoxy compound to underside of methyl methacrylic polymer countertop.
      a. Bolt or screw to countertop to prevent separation of bowl and fracture of adhesive sealant joint.
      b. Install drain and traps to sink.

D. Faucets, Fixtures, and Outlets:
   1. Seal opening between fixture and top.
   2. Secure to top with manufacturers standard fittings.

3.2 PROTECTION AND CLEANING

A. Tightly cover and protect against dirt, water, and chemical or mechanical injury.

B. Clean at completion of work.

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SECTION 22 00 10

GENERAL PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Division requires the furnishing and installing of complete functioning systems, and each element thereof, as specified or indicated on the Drawings and Specifications or reasonably inferred; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include materials, labor, supervision, supplies, equipment, transportation, and utilities.

B. Contractor to coordinate delivery, receive & warranty Owner furnished items. The Contractor’s warranty to include material & installation for a one year term from Store turn over

C. Division 22 of the Specifications and Drawings numbered with prefixes P, MP and EP generally describe these systems, but the scope of the Plumbing work includes all such work indicated in the Contract Documents: Instructions to Bidders; Proposal Form; General Conditions; Supplementary General Conditions; Architectural, Structural, Plumbing, Plumbing and Electrical Drawings and Specifications; and Addenda.

D. The Drawings have been prepared diagrammatically intended to convey the scope of work, indicating the intended general arrangement of the equipment, fixtures, piping, etc. without showing all the exact details as to elevations, offsets, control lines, and other installation requirements. The Contractor shall use the Drawings as a guide when laying out the work and shall verify that materials and equipment will fit into the designated spaces, and which, when installed per manufacturers requirements, will ensure a complete, coordinated, satisfactory and properly operating system.

1.2 QUALITY ASSURANCE

A. Execute all Work under this Division in a thorough and professional manner by competent and experienced workmen duly trained to perform the Work specified.

B. Install all Work in strict conformance with all manufacturers' requirements and recommendations, unless these Documents exceed those requirements. Install all equipment and materials in a neat and professional manner, aligned, leveled, and adjusted for satisfactory operation, in accordance with NECA guidelines.

C. Unless indicated otherwise on the Drawings, provide all material and equipment new, of the best quality and design, free from defects and imperfections and with markings or a nameplate identifying the manufacturer and providing sufficient reference to establish quality,

size and capacity. Provide all material and equipment of the same type from the same manufacturer whenever practicable.

D. Unless specified otherwise, manufactured items of the same types specified within this Division shall have been installed and used, without modification, renovation, or repair for not less than one year prior to date of bidding for this Project.

1.3 CODES, REFERENCES AND STANDARDS

A. Execute all Work in accordance with National Fire Protection Association (NFPA) codes, state and local building codes, and all other applicable codes and ordinances in force, governing the particular class of Work involved, for performance, workmanship, equipment, and materials. Additionally, comply with rules and regulations of public utilities and municipal departments affected by connection of services. Where conflicts between various codes, ordinances, rules, and regulations exist, comply with the most stringent. Wherever requirements of these Specifications, Drawings, or both, exceed those of the above items, the requirements of these Specifications, Drawings, or both, shall govern. Code compliance, at a minimum, is mandatory. Construe nothing in these Construction Documents as permitting work not in compliance, at a minimum, with these codes. Bring all conflicts observed between codes, ordinances, rules, regulations and these documents to the Architect's and Engineer's attention in sufficient time, prior to the opening of Bids, to prepare the Supplementary Drawings and Specifications Addenda required to resolve the conflict.

B. If the conflict is not reported in a timely manner, prior to the opening of bids, resolve the conflict and provide the installation in accordance with the governing codes and to the satisfaction of the Architect and Engineer, without additional compensation. Contractor will be held responsible for any violation of the law.

C. Obtain timely inspections by the constituted authorities having jurisdiction; and, upon final completion of the Work, obtain and deliver to the Owner executed final certificates of acceptance from these authorities having jurisdiction.

D. All material, manufacturing methods, handling, dimensions, methods of installation and test procedures shall conform to industry standards, acts, and codes, including, but not limited to the following, except where these Drawings and Specifications exceed them:

VBC	Virginia Building Code: Building Code
VMC	Virginia Building Code: Mechanical Code
VPC	Virginia Building Code: Plumbing Code
UPC	Uniform Plumbing Code
VECC	Virginia Building Code: Energy Conservation Code
VFC	Virginia Building Code: Fire Code
VFGC	Virginia Building Code: Fuel Gas Code
ADA	Americans with Disabilities Act
AIA	Guidelines for Design and Construction of Hospital and Healthcare Facilities
AMCA	Air Movement and Control Association, Inc.

ANSI	American National Standards Institute
ASHRAE	American Society of Heating Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASSE	American Society of Sanitary Engineering
ASTM	American Society of Testing Materials
AWS	American Welding Society
AWWA	American Water Works Association
CISPI	Cast Iron Soil Pipe Institute
NBFU	National Board of Fire Underwriters
NEC	National Electrical Code, NFPA 70
NFPA	National Fire Protection Association
NEMA	National Electrical Manufacturer’s Association
OSHA	Occupational Safety and Health Act
PDI	Plumbing and Drainage Institute
UL	Underwriter's Laboratories

E. Comply with rules and regulations of public utilities and municipal departments affected by connections of services.

F. Perform all plumbing work in compliance with applicable safety regulations, including OSHA regulations. All safety lights, guards, and warning signs required for the performance of the plumbing work shall be provided by the Contractor.

G. Obtain and pay for all permits, licenses and fees that are required by the governing authorities for the performance of the plumbing work.

1.4 DEFINITIONS

A. Whenever used in these Specifications or Drawings, the following terms shall have the indicated meanings:

1. Furnish: “To supply and deliver to the project site, ready for unloading, unpacking, assembling, installing, and similar operations.”
2. Install: “To perform all operations at the project site, including, but not limited to, and as required: unloading, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, testing, commissioning, starting up and similar operations, complete, and ready for the intended use.”
3. Provide: “To furnish and install complete, and ready for the intended use.”
4. Furnished by Owner (or Owner-Furnished) or Furnished by Others: “An item furnished by the Owner or under other Divisions or Contracts and installed under the requirements of this Division by the job Contractor, complete, and ready for the intended use, including all items and services incidental to the Work necessary for proper installation and operation. Include the installation under the warranty required by this Division.
5. Engineer: Where referenced in this Division, “Engineer” is the Engineer of Record and the Design Professional for the Work under this Division, and is a Consultant to, and an authorized representative of, the Architect, as defined in the General and/or Supplementary Conditions. When used in this Division, it

means increased involvement by, and obligations to, the Engineer, in addition to involvement by, and obligations to, the "Architect".

6. AHJ: The local code and/or inspection agency (Authority) Having Jurisdiction over the Work.
7. NRTL: Nationally Recognized Testing Laboratory, as defined and listed by OSHA in 29 CFR 1910.7 (e.g., UL, ETL, CSA, etc.), and acceptable to the Authority having Jurisdiction (AHJ) over this project. Nationally Recognized Testing Laboratories and standards listed are used only to represent the characteristics required and are not intended to restrict the use of other NRTLs that are acceptable to the AHJ, and standards that meet the specified criteria.

B. The terms "approved equal," "equivalent" or "equal" are used synonymously and shall mean "accepted by or acceptable to the Engineer as equivalent to the item or manufacturer specified". The term "approved" shall mean labeled, listed or both, by an NRTL and acceptable to the AHJ over this project.

C. The following definitions apply to excavation operations:

1. Additional Excavation: Where excavation has reached required subgrade elevations, if unsuitable bearing materials are encountered, continue excavation until suitable bearing materials are reached. The Contract Sum may be adjusted by an appropriate Contract Modification.
2. Subbase: as used in this Section refers to the compacted soil layer used in pavement systems between the subgrade and the pavement base course material.
3. Subgrade: as used in this Section refers to the compacted soil immediately below the slab or pavement system.
4. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction from the Architect.

1.5 COORDINATION

A. Visit the site and ascertain the conditions to be encountered in installing the Work under this Division, verify all dimensions and locations before purchasing equipment or commencing work, and make do provisions for same in the bid. Failure to comply with this requirement shall not be considered justification for omission, alteration, and incorrect or faulty installation of any of the Work under this Division or for additional compensation for any Work covered by this Division.

B. Refer to Drawings and Divisions of the other trades and to relevant equipment drawings and shop drawings to determine the extent of clear spaces. Make all offsets required to clear equipment, beams and other structural members, and to facilitate concealing conduit in the manner anticipated in the design.

C. Provide materials with trim that will fit properly the types of ceiling, wall, or floor finishes actually installed.

D. The contractor shall maintain a foreman on the jobsite at all times to coordinate his work with other contractors and subcontractors so that various components of the plumbing systems will be installed at the proper time, will fit in the available space, and will allow proper service access to the equipment. Carry on the work in such a manner that the work of the other contractors and trades will not be handicapped, hindered, or delayed at any time.

E. Work of this Division shall progress according to the "Construction Schedule" as established by the Prime Contractor and his subcontractors and as approved by the Owner. Cooperate in establishing these schedules and perform the work under this Division in a timely manner in conformance with the construction schedule so as to insure successful achievement of schedule dates.

1.6 MEASUREMENTS AND LAYOUTS

A. The Drawings are schematic in nature but show the various components of the systems approximately to scale and attempt to indicate how they are to be integrated with other parts of the Work. Figured dimensions take precedence to scaled dimensions. Determine exact locations by job measurements, by checking the requirements of other trades, and by reviewing all Contract Documents. Correct, at no additional costs to the Owner, errors that could have been avoided by proper checking and inspection.

1.7 SUBMITTALS

A. Refer to Division 01 and General Conditions for submittal requirements.

B. Assemble and submit for review, manufacturers product literature for material and equipment to be furnished, installed, or both, under this Division, including shop drawings, manufacturers' product data and performance sheets, samples, and other submittals required by this Division.

C. Shop drawings shall be submitted for plumbing fixtures, equipment, and major components of the plumbing systems in sufficient detail so as to demonstrate compliance with these Contract Documents and the design concept. Highlight, mark, list or indicate the materials, performance criteria and accessories that are being proposed.

D. Refer to individual Sections for additional submittal requirements.

E. Transmit submittals as early as required to support the project schedule. Allow for two weeks Engineer review time, plus to/from mailing time via the Architect, plus a duplication of this time for resubmittals, if required. Transmit submittals as soon as possible after Notice to Proceed and before construction starts.

F. Before transmitting submittals and material lists, verify that the equipment submitted is mutually compatible with and suitable for the intended use. Verify that the equipment will fit the available space and allow ample room for maintenance. If the size of equipment

furnished makes necessary any change in location, or configuration, submit a shop drawing showing the proposed layout.

G. Submittals shall contain the following information. Submittals not so identified will be returned to the Vendor without action:

1. The project name.
2. The applicable Specification Section and paragraph.
3. Equipment identification acronym as used on the drawings.
4. The submittal date.
5. The Contractor’s stamp, which shall certify that the stamped drawings have been checked by the Contractor, comply with the Drawings and Specifications, and have been coordinated with other trades.

H. The Engineer’s checking and subsequent acceptance of such submittals shall not relieve the Vendor from responsibility for deviations from Drawings or Specifications unless Vendor has, in writing, called the Engineer’s and Architect’s attention to such deviations at the time of submission, and secured written acceptance; nor shall it relieve Vendor from responsibility for errors in dimensions, details, sizes of members, or quantities; or for omissions of components or fittings; or for not coordinating items with actual building conditions and adjacent work.

1.8 ELECTRONIC DRAWINGS FILES

A. In preparation of shop drawings or record drawings, Contractor may, at his option, obtain electronic drawing files in AutoCAD or DXF format from the Engineer. Contact the Architect for Architect’s written authorization. In addition to payment, Architect’s written authorization and data licensing agreement form must be received before electronic drawing files will be sent.

1. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.

2. Contractor shall indicate the desired shipping method and drawing format with the request.

1.9 SUBSTITUTIONS

A. Refer to Bid Documents, General and Supplementary Conditions and Division 01 Specification Sections for limitations and restrictions on substitutions.

B. Materials, products and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by the proposed substitution.

C. No substitutions will be considered with receipt of Bids, unless the Architect and Engineer have received from the Vendor a written request for approval to bid a substitution at least ten calendar days prior to the date for receipt of Bids, and have approved the substitution request. Include, with each such request, the name of the material or

equipment for which substitution is being requested, and a complete description of the proposed substitution, including drawings, cut sheets, performance and test data, and all other information necessary for an evaluation. Include also a statement setting forth changes in other materials, equipment or other work that would be required to incorporate the substitution. The burden of proof of the merit of the proposed substitute is upon the proposer. The Architect's or Engineer’s decision to approve or disapprove a substitution in a Bid is final.

D. If the proposed substitution is approved prior to receipt of Bids, such approval will be stated in an Addendum. Bidders shall not rely upon approvals made in any other manner, including verbal.

E. No substitutions will be considered after receipt of Bids and before award of the Contract.

F. No substitutions will be considered after the Contract is awarded unless specifically provided in the Contract Documents.

1.10 OPERATION AND MAINTENANCE MANUALS

A. Submit manual prior to requesting the final punch list.

B. Instruct the Owner’s permanent personnel in the proper operation of, startup and shutdown procedures and maintenance of the equipment and components of the systems installed under this Division.

C. At the completion of the project, furnish to the Architect for the Owner, four (4) copies of brochures in three-ring, loose-leaf, hard-back notebook form, divided and tabbed, containing equipment data, approved shop drawings, diagrams, capacities, spare part numbers, manufacturer’s service and maintenance data, warranties, guarantees, etc. Include local contacts complete with address and telephone number for equipment, apparatus and system components furnished and installed under this Division of specifications.

1.11 SPARE PARTS AND EXTRA MATERIALS

A. Furnish spare parts and extra materials specified in the individual sections of this Division and as specified.

1.12 RECORD DRAWINGS

A. Keep a set of jobsite work prints of the Issued for Construction Drawings on the jobsite during construction, for the purpose of annotating changes. During the course of construction, indicate on these Documents, changes made from the Conformed Contract Documents. Pay particular attention to those items that require locating for servicing.

B. At the completion of the project, incorporate changes noted on the jobsite work prints onto a complete set of Drawings to serve as Record Drawings. Mark each sheet "Record Drawing", along with the date, and deliver these Record Drawings to the Architect as outlined in Drawings in Division 01, Section “Project Record Documents”.

1.13 TRAINING

A. Provide training as indicated in each specific section. Schedule training with the owner at least 7 days in advance. Video tape the training session in format as agreed to with the Owner. Provide three copies of each session to the Owner and obtain written receipt from the Owner.

1.14 PAINTING

A. Exposed ferrous surfaces, including pipe, pipe hangers, equipment stands and supports and exposed insulated piping shall be painted using materials and methods as specified under Division 9 of the Specifications; colors shall be as selected by the Architect.

B. Factory finishes, shop priming and special finishes are specified in the individual equipment specification sections.

C. Where factory finishes are provided and no additional field painting is specified, marred or damaged surfaces shall be touched up or refinished so as to leave a smooth, uniform finish.

1.15 DELIVERY, STORAGE AND HANDLING

A. Refer to Division 01 and General Conditions for Delivery, Storage and Handling.

B. Deliver equipment and material to the job site in their original containers with labels intact, fully identified with manufacturer's name, make, model, model number, type, size, capacity and Underwriter's Laboratories, Inc. labels and other pertinent information necessary to identify the item.

C. Deliver, receive, handle and store equipment and materials at the job site in the designated area and in such a manner as to prevent equipment and materials from damage and loss. Store equipment and materials delivered to the site on pallets and cover with waterproof, tear resistant tarp or plastic or as required to keep equipment and materials dry. Follow manufacturer's recommendations, and at all times, take every precaution to properly protect equipment and material from damage, including the erection of temporary shelters to adequately protect equipment and material stored at the Site. Equipment and/or material which becomes rusted or damaged shall be replaced or restored by the Contractor to a condition acceptable to the Architect and Engineer.

D. The Contractor shall be responsible for the safe storage of his own tools, material and equipment.

1.16 GUARANTEES AND WARRANTIES

A. Refer to Division 01 and General Conditions for Warranties.

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

C. Warrant each system and each element thereof against all defects due to faulty workmanship, design or material for a period of 12 months from date of Substantial Completion, unless specific items are noted to carry a longer warranty in these Construction Documents or manufacturer's standard warranty exceeds 12 months. Remedy all defects, occurring within the warranty period(s), as stated in the General Conditions and Division 01

D. Also warrant the following additional items:

1. Piping shall be free of obstructions, holes or breaks of any nature.
2. Insulation shall be effective.
3. Proper circulation of fluid in each piping system.

E. The above warranties shall include labor and material. Make repairs or replacements without any additional costs to the Owner.

F. Perform the remedial work promptly, upon written notice from the Architect or Owner.

G. At the time of Substantial Completion, deliver to the Owner all warranties, in writing and properly executed, including term limits for warranties extending beyond the one year period, each warranty instrument being addressed to the Owner and stating the commencement date and term.

1.17 TEMPORARY FACILITIES

A. Refer to Division 01 and General Conditions for Temporary Facilities requirements.

B. Temporary Utilities: The types of services required include, but are not limited to, water, sewerage, surface drainage and gas. When connecting to existing franchised utilities for required services, comply with service companies' recommendations on materials and methods, or engage service companies to install services. Locate and relocate services (as necessary) to minimize interference with construction operations.

1. Water: Premises are supplied with existing water services which will be used in this work:
2. If premises are not supplied with water services, provide the necessary backflow prevention devices where connecting to the potable water system. Protect water service from freezing by draining system or by providing adequate heat. Where non-potable water is used, mark each outlet with health hazard warning signs.
3. Sewer Sediment: Maintain sewers and temporary connecting sewers in a clean, non-clogged condition during construction period.

C. Construction Facilities: Provide facilities reasonably required to perform construction operations properly and adequately.

1 Enclosures: When temporary enclosures are required to ensure adequate workmanship, weather protection and ambient conditions required for the work, provide fire-retardant treated lumber and

plywood; provide tarpaulins with UL label and flame spread of 15 or less; provide translucent type (nylon reinforced polyethylene) where daylighting of enclosed space would be beneficial for workmanship, and reduce use of temporary lighting.

2 Heating: Provide heat, as necessary, to protect work, materials and equipment from damage due to dampness and cold. In areas where building is occupied, maintain a temperature not less than 65 degrees F. Use steam, hot water, or gas from piped distribution system where available. Where steam, hot water or piped gas are not available, heat with self-contained LP gas or fuel oil heaters, bearing UL, FM or other approval labels appropriate for application. Vent fuel-burning heaters, and equip units with individual-space thermostatic controls. Use electric-resistance space heaters only where no other, more energy-efficient, type of heater is available and allowable.

1.18 PROJECT CONDITIONS

A. Conditions Affecting Excavations: The following project conditions apply:

1. Maintain and protect existing building services that transit the area affected by selective demolition.
2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation operations.

B. Site Information: Subsurface conditions were investigated during the design of the Project. Reports of these investigations are available for information only; data in the reports are not intended as representations or warranties of accuracy or continuity of conditions. The Owner will not be responsible for interpretations or conclusions drawn from this information.

C. Use of explosives is not permitted.

D. Environmental Conditions: Apply joint sealers under temperature and humidity conditions within the limits specified by the joint sealer manufacturer. Do not apply joint sealers to wet substrates.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, or natural or crushed sand.

B. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 percent passing a 1-1/2-inch sieve, and not more than 5 percent passing a No. 4 sieve.

C. Backfill and Fill Materials: Materials complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, and SP; free of clay, rock,

or gravel larger than 2 inches in any dimension; debris; waste; frozen materials; and vegetable and other deleterious matter.

PART 3 - EXECUTION

3.1 PERMITS

A. GC shall secure and pay for permits required in connection with the installation of the Plumbing Work. Arrange with the various utility companies for the installation and connection of required utilities for this facility and pay charges associated therewith including connection charges and inspection fees, except where these services or fees are designated to be provided by others

3.2 EXISTING UTILITIES

A. Schedule and coordinate with the Utility Company, Owner and with the Engineer connection to, or relocation of, or discontinuation of normal utility services from existing utility lines. Premium time required for any such work shall be included in the bid.

B. Existing utilities damaged due to the operations of utility work for this project shall be repaired to the satisfaction of the Owner or Utility Company without additional cost.

C. Utilities shall not be left disconnected at the end of a work day or over a weekend unless authorized by representatives of the Owner or Engineer.

D. Repairs and restoration of utilities shall be made before workmen leave the project at the end of the workday in which the interruption takes place.

E. Contractor shall include in his bid the cost of furnishing temporary facilities to provide services during interruption of normal utility service.

3.3 CUTTING AND PATCHING

A. The Contractor shall do necessary cutting of walls, floors, ceilings and roofs.

B. No structural member shall be cut without permission from Architect.

C. Patch around openings to match adjacent construction.

D. After the final waterproofing membrane has been installed, roofs may be cut only with written permission by the Architect.

3.4 CLEANING

A. Dirt and refuse resulting from the performance of the work shall be removed from the premises as required to prevent accumulation. The Contractor shall maintain reasonably clean premises at all times.

B. Immediately prior to the final inspection, the Contractor shall clean material and equipment Dirt, dust, plaster, stains, and foreign matter shall be removed from surfaces including components internal to equipment. Damaged finishes shall be touched-up and restored to their original condition.

3.5 SUBSTANTIAL COMPLETION REVIEW

A. Prior to requesting inspection for "CERTIFICATE OF SUBSTANTIAL COMPLETION", the Contractor shall complete the following items:

1. Submit complete Operation and Maintenance Manuals.
2. Submit complete Record Drawings.
3. Perform special inspections. Refer to Table 3 at the end of this section for a list of specification sections in Division 22 that contain special inspection requirements.
4. Start-up testing of systems.
5. Removal of temporary facilities from the site.
6. Comply with requirements for Substantial Completion in the "General Conditions”.

B. The Contractor shall request in writing a review for Substantial Completion. The Contractor shall give the Architect/Engineer at least seven (7) days notice prior to the review.

C. The Contractor’s written request shall state that the Contractor has complied with the requirements for Substantial Completion.

D. Upon receipt of a request for review, the Architect/Engineer will either proceed with the review or advise the Contractor of unfulfilled requirements.

E. If the Contractor requests a site visit for Substantial Completion review prior to completing the above mentioned items, He shall reimburse the Architect/Engineer for time and expenses incurred for the visit.

F. Upon completion of the review, the Architect/Engineer will prepare a "final list" of outstanding items to be completed or corrected for final acceptance.

G. Omissions on the "final list" shall not relieve the Contractor from the requirements of the Contract Documents.

H. Prior to requesting a final review, the Contractor shall submit a copy of the final list of items to be completed or corrected. He shall state in writing that each item has been completed, resolved for acceptance or the reason it has not been completed.

END OF SECTION 220010

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic hot-water piping.
2. Domestic cold-water piping.
3. Supplies and drains for handicap-accessible lavatories and sinks.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

B. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Armacell LLC.
   b. Babcock and Wilcox; Insulating Products Div.
   c. Certainteed Corp.
   d. Dow Chemical Co., Building Materials, Div.; Trymer 2000.
   e. Knauf Insulation.
   f. Manville Products Corp.
   g. Nomaco, LLC.
   h. Owens-Corning Corp.
   i. Pittsburgh Corning Corp.
2. Preformed Pipe Insulation with Factory-Applied ASJ or ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.

G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Armacell LLC.
   b. Babcock and Wilcox; Insulating Products Div.
   c. Certainteed Corp.
   d. Dow Chemical Co., Building Materials, Div.; Trymer 2000.
   e. Knauf Insulation.
   f. Manville Products Corp.
   g. Nomaco, LLC.
   h. Owens-Corning Corp.
   i. Pittsburgh Corning Corp.

H. Mineral-Fiber, Preformed Pipe Insulation:

1. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ or ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Armacell LLC.
   b. Babcock and Wilcox; Insulating Products Div.
   c. Certainteed Corp.
   d. Dow Chemical Co., Building Materials, Div.; Trymer 2000.
   e. Knauf Insulation.
   f. Manville Products Corp.

2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.3 ADHESIVES, SEALANTS, AND MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Adhesives:

1. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F
2. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
3. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
4. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
5. PVC Jacket Adhesive: Compatible with PVC jacket.

C. Mastics shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

2.4 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.5 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

2.6 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

C. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

2.8 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

C. Wire: 0.080-inch nickel-copper alloy.

2.9 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers,

1. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and

dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
a. For below-ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.3 PENETRATIONS

A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

D. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies.

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.9 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below

1. Flat Acrylic Finish: finish coat over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
   a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.10 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Underground piping.
2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Hot and Cold Water: Insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. PVC: 20 mils thick.
2. Aluminum,: 0.016 inch thick.

D. Piping, Exposed:

1. PVC: 20 mils thick.
2. Aluminum,: 0.016 inch thick.

END OF SECTION 220719

SECTION 22 11 16

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.

1.2 QUALITY ASSURANCE

A. Installer Qualifications: Installer shall have successfully completed the Uponor Commercial Piping Systems Training Course (formerly Uponor AquaPEX Certification) and is able to provide proof/verification. Course shall be conducted by the manufacturer or a manufacturer's representative.

1.3 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

1. Store PEX tubing in cartons or under cover to avoid dirt or foreign material from entering the tubing.
2. Do not expose PEX tubing to direct sunlight for more than 30 days. IF construction delays are encountered, cover the tubing to prevent exposure to direct sunlight.

1.5 WARRANTY

A. Manufacturer’s Warranty: PEX-a manufacturer system warranty shall cover piping and fittings for a duration of 25 years from the date of installation. Piping system warranty shall apply to potable water distribution and water service systems constructed of pipe and fitting products sourced from the same manufacturer.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw.

2.2 COPPER TUBE AND FITTINGS

A. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.

C. Hard Copper Tube: ASTM B 88, Type L water tube, annealed temper.

2.3 CPVC PIPING AND FITTINGS

A. All pipe and fittings to be manufactured from CPVC compound with a cell class of 24448 for pipe and 23447 for fittings as per ASTM D 1784. Additionally, all pipe and fittings to conform with NSF standards 14 and 61, be listed by NSF International for reclaimed water, and bear the mark “NSF-rw”.

B. ½” through 2” sizes: ReUze™ made with FlowGuard Gold® CPVC Copper Tube Size manufactured to standard dimension ratio (SDR) 11 and shall conform to ASTM D 2846. Pipe to be purple pigmented and labeled “Charlotte Pipe ReUze™ Made With FlowGuard Gold®” and include “Caution: Non-Potable Water. Do Not Drink”. Fittings to be either tan or purple in color. Transition fittings to have brass male or female connections with integral CPVC socket connections as manufactured by Charlotte Pipe and Foundry Company.

C. All pipe and fittings shall be produced by a single manufacturer and to be installed in accordance with manufacturer’s recommendations and local code requirements. Charlotte Pipe ReUze™ with FlowGuard Gold® CPVC Copper Tube Size to be joined using approved one-step solvent cement conforming to ASTM F 493. Pipe and fittings to be manufactured by Charlotte Pipe and Foundry Company and are intended for hot and cold non-potable water distribution systems.

2.4 PEX PIPE AND FITTINGS

A. Manufacturers: Subject to compliance with requirement, provide products by the following:

1. Uponor North America

B. PEX-a (Engel-Method Crosslinked Polyethylene) Piping: ASTM F 876 and F877 (CAN/CSA-B137.5) by Uponor.

C. PEX-a Fittings: elbows, adapters, couplings, plugs, tees and multi-port tees (1/2 inch through 3 inch nominal pipe size): ASTM F1960 cold-expansion fitting manufactured from the following material types:

1. UNS No. C69300 Lead-free (LF) Brass.
2. UNS No. C27453 Lead-free (LF) Brass.
3. 20% glass-filled polysulfone as specified in ASTM D 6394.

4. Unreinforced polysulfone (group 01, class 1, grade 2) as specified in ASTM D 6394.
5. Polyphenylsulfone (group 03, class 1, grade 2) as specified in ASTM D 6394.
6. Blend of polyphenylsulfone (55-80%) and unreinforced polysulfone (rem.) as specified in ASTM D 6394.
7. Reinforcing cold-expansion rings shall be manufactured from the same source as PEX-a piping manufacturer and marked "F1960".

D. Multi-Port Tees: Multiple-outlet fitting complying with ASTM F 877 (CAN/CSA B137.5); with ASTM F 1960 inlets and outlets.

1. Engineered polymer branch multi-port tee.
2. Engineered polymer flow-through multi-port tee.
3. Engineered polymer commercial branch multi-port tee.
4. Engineered polymer commercial branch multi-port elbow.
5. Engineered polymer commercial flow-through multi-port tee.

E. Manifolds: Multiple-outlet assembly complying with ASTM F 877 (CAN/CSA B137.5); with ASTM F 1960 outlets.

1. Engineered polymer valved manifold.
2. Engineered polymer valveless manifold.
3. Lead - free copper branch manifold.
4. Lead-free copper valved manifold.

2.5 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. PEX-to-Metal Transition Fittings:

1. Manufacturers: Provide fittings from the same manufacturer of the piping.
2. PEX-a to Threaded Brass Transition: One-piece brass fitting with male or female threaded adapter and ASTM F 1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.
3. PEX-a to Brass Sweat Transition: One-piece brass fitting with sweat adapter and ASTM F 1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.
4. PEX-a to Flange Transition: Two-piece fitting with one steel flange conforming to ASME B 16.5and one lead free (LF) brass adapter conforming to ASTM F 1960.
5. PEX-a to Groove Transition: One-piece lead free (LF) brass fitting with one CSA B242-05 groove end in either iron pipe size (IPS) or copper tube size (CTS) and one ASTM F1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.
6. PEX-a to Water Meter Transition: Two-piece fitting with one NPSM union thread and one ASTM F 1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.

7. PEX-a to Copper Press Transition: One-piece lead free (LF) brass fitting with one ASME B16.51 copper press end and one ASTM F1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.

2.6 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. A.Y. McDonald Mfg. Co.
   b. Capitol Manufacturing Company.
   c. Central Plastics Company.
   d. HART Industrial Unions, LLC.
   e. Jomar Valve.
   f. Matco-Norca.
   g. Watts; a Watts Water Technologies company.
   h. Wilkins.
   i. Zurn Industries, LLC.
2. Standard: ASSE 1079.
3. Pressure Rating: 125 psig minimum at 180 deg F.
4. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Capitol Manufacturing Company.
   b. Central Plastics Company.
   c. Matco-Norca.
   d. Watts; a Watts Water Technologies company.
   e. Wilkins.
   f. Zurn Industries, LLC.
2. Standard: ASSE 1079.
3. Factory-fabricated, bolted, companion-flange assembly.
4. Pressure Rating: 125 psig minimum at 180 deg F.
5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Advance Products & Systems, Inc.
   b. Calpico, Inc.
   c. Central Plastics Company.
   d. Pipeline Seal and Insulator, Inc.
2. Nonconducting materials for field assembly of companion flanges.
3. Pressure Rating: 150 psig.
4. Gasket: Neoprene or phenolic.
5. Bolt Sleeves: Phenolic or polyethylene.
6. Washers: Phenolic with steel backing washers.

PART 3 - EXECUTION

3.1 PREPARATION FOUNDATION FOR BELOW GRADE WATER DISTRIBUTION PIPE AND FITTINGS

A. Grade trench bottoms to provide a smooth, firm, and stable foundation, free from rock, throughout the length of the pipe.

B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with clean sand or pea gravel to indicated invert elevation.

C. Pipe Beds:

1. Copper Tube: Provide 6” thick sand pipe bed underneath and around sides of pipe, up to middle half of the pipe, including fittings. Tamp bed with mechanical tamper to 85% to 95% compaction. Provide first layer of sand backfill 6” above pipe, tamp backfill with mechanical tamper to 85% to 95% compaction.
2. Ductile Iron Pipe: Shape bottom of trench to fit bottom of pipe for 90-degrees (bottom 1/4 of the circumference). Fill unevenness with tamped sand backfill. At each pipe joint dig bell holes to relieve the bell of the pipe of all loads, and to ensure continuous bearing of the pipe barrel on the foundation. Provide first layer of pea gravel backfill 6” above pipe, tamp backfill with mechanical tamper to 85% to 95% compaction. For piping with rock trench bottoms, provide sand pipe bed 6” underneath and around sides of pipe up to middle half of the pipe, including fittings.

D. Provide backfill above top of pipe bed as required for field conditions. Refer to Division 22 Section "General Plumbing Requirements” for materials and methods for backfill.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."

D. Install shutoff valve immediately upstream of each dielectric fitting.

E. Install domestic water piping level and plumb.

F. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

G. Install seismic restraints on piping.

H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

I. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

K. Install piping to permit valve servicing.

L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

M. Install piping free of sags and bends.

N. Install fittings for changes in direction and branch connections.

O. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

P. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump.

Q. Install thermostats in hot-water circulation piping.

R. Install thermometers on inlet and outlet piping from each water heater.

S. Install sleeves for piping penetrations of walls, ceilings, and floors.

T. Install sleeve seals for piping penetrations of concrete walls and slabs.

U. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

H. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

3.5 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings Use dielectric couplings, nipples, or unions.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger, support products, and installation per NCSPC

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.8 IDENTIFICATION

A. Label pressure piping with system operating pressure.

3.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:
   a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
   b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
      1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
      2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
   c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
   d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
2. Piping Tests:
   a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
   b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
   c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.

d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

1. Refer to the inspection report form at the end of this section for inspection data to be completed for each piping system. Submit completed forms to the Owner and Engineer.

3.10 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
   a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
   b. Adjust calibrated balancing valves to flows indicated.
5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
   a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
   b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Repeat procedures if biological examination shows contamination.
e. Submit water samples in sterile bottles to authorities having jurisdiction.
f. To prevent reduced service life of system components, do not allow disinfection solutions to remain in the system longer than 24 hours. Flush the system with potable water after disinfection.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.12 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Under-slab, domestic water, building-service piping, NPS 2-1/2 and smaller, shall be the following:

1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.

E. Aboveground domestic water piping, NPS 2-1/2 and smaller, shall be the following:

1. PEX-a piping, with engineered polymer (EP) or lead-free brass F1960 cold-expansion fittings.

END OF SECTION 221116

SECTION 22 13 16

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

1.2 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.3 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-DWV" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, class.

B. Gaskets: ASTM C 564, rubber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:

1. Standards: ASTM C 1277 and CISPI 310.
2. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:

1. Standards: ASTM C 1277 and ASTM C 1540.
2. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

D. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.5 PVC PIPE AND FITTINGS

A. Solid-Wall Schedule 40 PVC Pipe: ASTM D 2665, drain, waste, and vent.

B. Solid-Wall Schedule 80 PVC Pipe: ASTM D 1784, drain, waste, and vent.

C. Schedule 40 PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns

D. Schedule 80 PVC Socket Fittings: ASTM D 2467

E. Adhesive Primer: ASTM F 656.

F. Solvent Cement: ASTM D 2564.

2.6 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Unshielded, Non-pressure Transition Couplings:
   a. Standard: ASTM C 1173.
   b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

c. Sleeve Materials:
   1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
   2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
   3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

4. Shielded, Non-pressure Transition Couplings:
   a. Standard: ASTM C 1460.
   b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

I. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

   1. Building Sanitary Drain: 1/4 per ft (2 percent) downward in direction of flow for piping NPS 3 and smaller; 1/8 inch per ft

(1 percent) downward in direction of flow for piping NPS 4 and larger.

2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

J. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

K. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

L. Install aboveground PVC piping according to ASTM D 2665 and ASTM D 1784.

M. Install underground PVC piping according to ASTM D 2321.

N. Plumbing Specialties:

1. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

O. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

P. Install sleeves for piping penetrations of walls, ceilings, and floors.

Q. Install sleeve seals for piping penetrations of concrete walls and slabs.

3.2 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

C. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

D. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

E. Plastic, Non-pressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.

2. PVC Piping: Join according to ASTM D 2855, ASTM D 2665, and ASTM D 1784 Appendixes.

3.3 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: Unshielded or Shielded, non-pressure transition couplings.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:
   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
5. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
3. NPS 2-1/2: 108 inches with 1/2-inch rod.
4. NPS 3 and NPS 5: 10 feet with 1/2-inch rod.
5. NPS 6: 10 feet with 5/8-inch rod.
6. NPS 8: 10 feet with 3/4-inch rod.

H. Install supports for vertical copper tubing every 10 feet.

I. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.

J. Install supports for vertical PVC piping every 48 inches.

K. Support condensate piping located on roof with pre-engineered roof supports, pre-engineered roof supports. Conform to the table above for maximum spacing of supports. Adjust pipe support to maintain minimum pipe slope.

L. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Comply with requirements for cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
6. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.6 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
1. Refer to the inspection report form at the end of this section for inspection data to be completed for each piping system. Submit completed forms to the Owner and Engineer.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15

minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.8 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed PVC Piping: Protect plumbing exposed to sunlight with two coats of water-based latex paint.

3.9 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil/waste and vent piping shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
3. Copper DWV tube, copper drainage fittings, and soldered joints.
4. Solid-wall Schedule 40 PVC pipe, PVC socket fittings, and solvent-cemented joints.
5. Dissimilar Pipe-Material Couplings: Unshielded, non-pressure transition couplings.

C. Underground, soil, waste, and vent shall be any of the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints. Heavy duty to be used on NPS 5 and larger
3. Solid wall Schedule 40 PVC pipe, PVC socket fittings, and solvent-cemented joints.

4. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.

D. Inside condensate piping:

1. Solid wall Schedule 40 PVC pipe, PVC socket fittings, and solvent-cemented joints.

E. Outside condensate piping:

1. Solid wall Schedule 80 PVC pipe, PVC socket fittings, and solvent-cemented joints.

END OF SECTION 221316

SECTION 22 13 19

SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cleanouts.
2. Floor drains / Floor sinks.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Cast-Iron Floor & Wall Cleanouts: As specified in drawings

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company.
   b. Smith, Jay R. Mfg. Co.
   c. Tyler Pipe; a subsidiary of McWane Inc.
   d. Watts; a Watts Water Technologies company.
   e. Zurn Industries, LLC.
2. Standard: ASME A112.36.2M

2.2 FLOOR DRAINS AND FLOOR SINKS

A. Cast-Iron Floor Drains and Floor Sinks: As specified in drawings

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company.
   b. Smith, Jay R. Mfg. Co.
   c. Tyler Pipe; a subsidiary of McWane Inc.
   d. Watts; a Watts Water Technologies company.
   e. Zurn Industries, LLC.
2. Standard: ASME A112.6.3.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

E. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

F. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

G. Install deep-seal traps on floor drains and other waste outlets, if indicated.

H. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

I. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

J. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

K. Install vent caps on each vent pipe passing through roof.

L. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

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SECTION 221353 - FACILITY SEPTIC TANKS

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. This Section includes the following:

1. Septic tanks and septic tank filters.
2. Dosing tanks and siphons.
3. Distribution boxes.
4. Pipe and fittings including cleanouts.
5. Trench absorption fields.

B. Related Sections include the following:

1. Division 22 Section "Facility Sanitary Sewers" for sanitary sewer piping from building to septic tank.

2. Division 22 Section "Sanitary Waste and Vent Piping" for sewer piping from building to septic tank.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. FRP: Fiberglass-reinforced plastic.

C. HDPE: High-density-polyethylene plastic.

D. PE: Polyethylene plastic.

E. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Septic tank filters.
2. Automatic siphons

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3. Distribution boxes.
4. Pipe and fittings, including cleanouts.

B. Shop Drawings: Include manhole openings, covers, risers, pipe connections, and accessories for the following precast concrete structures:

1. Septic tanks.
2. Dosing tanks.
3. Distribution boxes.

4. Wiring diagram for power, signal, and control wiring.

C. Coordination Drawings: Show piping, underground structures, and other utilities. Indicate size and invert elevations of piping and structures.

D. Operation and Maintenance Data: For siphons and effluent filters to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, schematics, and dimensional requirements of septic tank system and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

1.6 PROJECT CONDITIONS

A. Interruption of Existing Septic Tank System 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 service according to requirements indicated:

1. Notify COR no fewer than five working days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without COR's written permission.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

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2.2 SEPTIC TANKS

A. Precast Concrete Septic Tanks: ASTM C 1227, single-chamber, precast, reinforced-concrete tank and covers.

B. Capacity and Characteristics:

1. Capacity: 1,500-gallons
2. Inlet and Outlet Size: **6" NPS (DN).**

2.3 FILTERS

A. Description: Removable, septic-tank-outlet filter that restricts discharge solids to 1/8 inch (3.2 mm).

1. Available Manufacturers:

a. Premier Tech Environment.
b. Tuf-Tite Corp.
c. Zabel Industries International, Ltd.
d. Other manufacturers as approved.

2. Housing: HDPE or PVC.
3. Outlet Size: NPS 4" or 6", per plans

2.4 INSULATION

A. Description: Rigid, cellular polystyrene intended for use as thermal insulation. Comply with ASTM C 578, Type IV or XIII.

1. Thickness: 2-1/2 inches (65 mm) minimum
2. Recycled Content: Not less than 50 percent blend of postconsumer and recovered polystyrene resins.

2.5 DOSING TANKS

A. Dosing Tanks: Comply with ASTM C 913 for precast, reinforced-concrete tank and cover; designed for structural loading according to ASTM C 890.

1. Design: For automatic siphon installation and **A-16 (HS20-44)** traffic loading according to ASTM C 890.

2. Manholes: **24-inch- (610-mm-)** minimum diameter opening with reinforced-concrete risers to grade and access lid with steel lift rings. Include manhole in center of each septic tank compartment top.

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3. Resilient Connectors: ASTM C 923 (ASTM C 923M), of size required for piping, fitted into inlet and outlet openings.

B. Capacity and Characteristics:

1. Type: **Precast concrete** dosing tank.
2. Total Capacity: 1400-gallons
3. Dosing Capacity: 760 gallons (+/- 5 gallons)
4. Inside Dimensions: 12-ft (length); 6-ft (height); 2-2/3' (Height)
5. Inlet Size: NPS 6-inch
6. Outlet Size: NPS 4-inch

2.6 AUTOMATIC SIPHONS

A. Description: Manufactured siphon assembly of molded-HDPE trap, pipe, and bell, with PVC vent piping and stainless-steel bolts.

1. Manufacturers:

a. American Manufacturing Company, Inc.
b. Fluid Dynamic Siphons, Inc.
c. Zabel Industries International, Ltd.
d. Other manufacturers as approved

B. Capacity and Characteristics:

1. Number Required: One
2. Capacity of Each (avg): 150 gpm
3. Effluent Outlet Size: **NPS 4" (DN).**
4. Drawdown Height: 17"
5. Siphon Dose: 760-gallons (+/- 5 gallons)

2.7 DISTRIBUTION PIPES AND FITTIINGS

A. Refer to Part 3 "Piping Applications" Article for identification of systems where piping materials specified below are used.

B. Sewer Pipe and Fittings: ABS, complying with ASTM D 2751, SDR 35, for solvent-cement or elastomeric gasket joints.

1. Solvent Cement: ASTM D 2235.
2. Gaskets: ASTM F 477, elastomeric seal.

C. Sewer Pipe and Fittings: PVC, complying with ASTM D 3034, SDR 35, nonperforated, for solvent-cement or elastomeric gasket joints.

1. Solvent Cement: ASTM D 2564.

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2. Gaskets: ASTM F 477, elastomeric seal.

2.8 LEACHING PIPES AND FITTINGS

A. Pipe and Fittings: PVC, complying with ASTM D 2729, perforated, for solvent-cement joints.

1. Solvent Cement: ASTM D 2564.

2.9 NONPRESSURE-TYPE PIPE COUPLINGS

A. Description: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground non-pressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Sleeve Materials:
   a. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
   b. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

2.10 CLEANOUTS

A. PVC Cleanouts: PVC pipe fitting for solvent-cement or elastomeric gasket joint with PE or PVC threaded cleanout plug.

2.11 TRENCH ABSORPTION-FIELD MATERIALS

A. Filtering Material: ASTM D 448, Size No. 24, 3/4 to 2-1/2 inches (19 to 63 mm), washed, crushed stone or gravel; or broken, hard-burned clay brick.

B. Filter Mat: Geotextile woven or spun filter fabric, in 1 or more layers, for minimum total unit weight of 3 oz./sq. yd. (101 g/sq. m).

C. Joint Covers for Open-Joint Pipe: Geotextile woven filter fabric, in 1 or more layers, for minimum total unit weight of 3 oz./sq. yd. (101 g/sq. m); copper mesh screening; or commercial corrosion-resistant metal clips made for this application.

D. Fill Material: Soil removed from trench.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements and other conditions affecting performance of septic tank systems.

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B. Verify compatibility with and suitability of soil structure and materials.

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

3.2 EARTHWORK

A. Excavating, trenching, and backfilling for piping are specified in Division 31 Section "Earthwork."

1. Stockpile topsoil for reuse in finish grading without intermixing with other excavated material. Stockpile materials away from edge of excavation and do not store within drip line of remaining trees.
2. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

B. Excavating and Backfilling for Septic and Dosing Tanks:

1. Excavate sufficient width and length for tanks to depth determined by tank inlet elevation. Provide level bottom.
2. Backfill with excavated soil, mounding soil above original grade without compacting.

C. Excavating and Backfilling for Trench Absorption Fields:

1. Excavate for trench absorption fields 36 inches wide and 33 inches deep, minimum.
2. Backfill trench absorption fields with excavated soil, mounding soil above original grade without compacting.

3. Excavate for bed absorption fields of width indicated and 33 inches deep, minimum.
4. Backfill bed absorption fields with excavated soil, mounding soil above original grade without compacting.

3.3 SEPTIC TANK INSTALLATION

A. Install precast concrete septic tanks level according to ASTM C 891.

B. Install septic tanks level.

C. Connect septic tank to concrete ballast pad.

D. Install filter in septic tank outlet. Secure filter to septic tank wall. Make direct connections to distribution piping.

E. Install insulation on exterior sides and top of septic tank.

F. Fill septic tank with water.

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3.4 DOSING TANK INSTALLATION

A. Install dosing tanks level and according to ASTM C 891.

B. Install automatic siphons embedded in precast concrete dosing tank. Make direct connections to distribution piping.

C. Set submersible effluent pumps on dosing tank floor. Make direct connections to distribution piping.

D. Fill dosing tanks with water.

3.5 PIPING INSTALLATION

A. Install distribution piping according to the following:

1. PVC Sewer Pipe and Fittings: ASTM D 2321.

B. Install leaching piping according to the following:

1. Use perforated pipe and fittings for trench absorption fields with perforations at on either side of the pipe, alternating sides at each perforation.
2. PVC Sewer Pipe and Fittings: ASTM F 481.

3.6 PIPE JOINT CONSTRUCTION

A. Basic piping joint construction is specified in Division 22 Section "Common Work Results for Plumbing." Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. Join distribution piping according to or with the following:

1. Install distribution pipe and fittings to connect septic tank**,** dosing tank distribution box, and headers for absorption fields with closed joints.
2. PVC Sewer Pipe and Fittings: ASTM F 402 and ASTM D 2855 for solvent-cemented joints, or ASTM D 3212 and ASTM D 3034 for gasketed joints.

C. Join leaching piping with or according to the following:

1. Install leaching pipe and fittings for trench absorption fields with closed joints, unless otherwise indicated.
2. PVC Sewer Pipe and Fittings: With solvent-cemented joints according to ASTM F 402 and ASTM D 2321.

D. Join dissimilar pipe materials according to ASTM D 5926, with couplings and gaskets compatible with pipe materials being joined.

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3.7 CLEANOUT APPLICATIONS

A. Use cleanouts according to the following:

1. Inlet and Outlets of Distribution Boxes: PVC cleanouts.
2. At Each Change in Direction of Distribution Piping: PVC cleanouts.
3. At Each End of Manifold piping: PVC cleanouts

3.8 CLEANOUT INSTALLATION

A. PVC Cleanouts: Install with PVC riser from distribution and leaching piping to PVC cleanout at grade. Use NPS 4 (DN 100) PVC sewer pipe and fittings with solvent-cemented joints for risers and cleanout fitting.

B. Cleanout Support: Set cleanouts in concrete blocks or gravel per details shown in the drawings. Formwork, reinforcement, and concrete are specified in Division 03 Section "Cast-in-Place Concrete"

C. Set top of cleanout **1 inch (25 mm)**above surrounding rough grade, or set flush with grade if installed in pavement.

3.9 TRENCH ABSORPTION-FIELD INSTALLATION

A. Refer to Part 3 "Piping Installation" and "Pipe Joint Construction" articles for specific piping material installation.

B. Install distribution piping at minimum slope of 1 percent.

C. Install leaching piping solidly bedded in filtering material, with full bearing for each pipe section throughout its length. Maintain pipe alignment with no slope.

1. Install perforated pipe with perforations down and joints tightly closed. Install collars and couplings as required.

2. Install open-joint pipe with 1/2-inch (13-mm) space, maximum, between ends, unless otherwise indicated. Cover top two-thirds of joint opening with joint cover, and tie with corrosion-resistant wire. Commercial joint-cover assemblies may be provided.
3. Install elbow fittings with tight joints.
4. Place additional filtering material around sides and on top of pipe as shown on the plans to a minimum compacted depth of4.75 inches above the top of leaching piping.

D. Backfill according to Part 3 "Earthwork" Article.

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3.10 IDENTIFICATION

A. Identification materials and their installation are specified in Division 31 Section "Earthwork." Arrange for installation of green warning tape directly over piping (including absorption-field piping), at outside edges of underground structures, and at outside edges of absorption fields.

B. Use detectable warning tape over piping, over edges of underground structures, and over edges of absorption fields.

3.11 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

3.12 FIELD QUALITY CONTROL

A. System Tests: Perform testing of completed septic tank system piping and structures according to authorities having jurisdiction.

B. Additional Tests: Fill underground structures with water and let stand overnight. If water level recedes, locate and repair leaks and retest. Repeat tests and repairs until no leaks exist.

3.13 CLEANING

A. Clear interior of piping and structures of dirt and other superfluous material as work progresses.

B. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of workday or when work stops.

END OF SECTION 221353

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SECTION 22 33 00

ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Commercial, electric, heat pump, storage, domestic-water heaters.
2. Domestic-water heater accessories.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Commercial domestic-water heaters 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."

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For commercial domestic-water heaters, accessories, and components, from manufacturer.

B. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

C. Source quality-control reports.

D. Field quality-control reports.

E. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex, "Drinking Water System Components - Health Effects."

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Warranty Periods: From date of Substantial Completion.
   a. Commercial, Electric, Storage, Domestic-Water Heaters:
      1) Storage Tank: Five years.
      2) Controls and Other Components: One years.

PART 2 - PRODUCTS

2.1 COMMERCIAL, ELECTRIC, Heat Pump, DOMESTIC-WATER HEATERS

A. Commercial, Electric, Heat Pump, Domestic-Water Heaters:

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. Hubbell
   b. State
   c. A.O. Smith
   d. Bradford White.

2. Standard: UL 1453.

3. Storage-Tank Construction: Steel vertical arrangement.
   a. Tappings: ASME B1.20.1 pipe thread.
   b. Pressure Rating: 150 psig.
   c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.

4. Factory-Installed Storage-Tank Appurtenances:
   a. Anode Rod: Replaceable magnesium.
   b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
   c. Insulation: Comply with ASHRAE/IESNA 90.1.
   d. Jacket: Steel with enameled finish.
   e. Heating Elements: Two; electric, screw-in immersion type; wired for simultaneous operation unless otherwise indicated. Limited to 12 kW total.
   f. Temperature Control: Adjustable thermostat.
   g. Safety Controls: High-temperature-limit device or systems.

h. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

5. Special Requirements: NSF 5 construction.

6. Capacity and Characteristics: as indicated on schedule on drawings

2.2 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

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. AMTROL, Inc.
   b. Flexcon Industries.
   c. Honeywell Water Controls.
   d. Pentair Pump Group.
   e. Smith, A. O. Corporation.
   f. State Industries.
   g. Taco, Inc.

2. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.

3. Construction:
   a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
   b. Interior Finish: Comply with NSF 61 Annex barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
   c. Air-Charging Valve: Factory installed.

4. Capacity and Characteristics: As specified in drawings

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 and as required by local jurisdiction

D. Pressure-Reducing Valves: ASSE 1003 for water. Set at 25-psig-maximum outlet pressure unless otherwise indicated.

E. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-

pressure rating. Select relief valves with sensing element that extends into storage tank.

F. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

G. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Electric, Domestic-Water Heater Mounting: Install electric, tankless, domestic-water heaters on wall bracket as specified in the drawings.

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Anchor domestic-water heaters to substrate.

B. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping.

C. Install commercial, electric, domestic-water heaters with seismic-restraint devices.

D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet,

with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

E. Install combination temperature-and-pressure relief valves in water piping for electric, domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

F. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."

G. Install thermometers on outlet piping of electric, domestic-water heaters.

H. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.

I. Fill electric, domestic-water heaters with water.

J. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Prepare test and inspection reports.

END OF SECTION 223300

SECTION 22 40 00

PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Water closets.
2. Lavatories.
3. Sinks.
4. Service sinks.
5. Water coolers.
6. Emergency equipment
7. Toilet seats.
8. Flush valves
9. Faucets.
10. Supply fittings.
11. Waste fittings.
12. Supports and carriers
13. Insulation kits

1.2 DEFINITIONS

A. Accessible: Describes a plumbing fixture, building, facility, or portion thereof that can be approached, entered, and used by physically handicapped people.

B. Accessory: Device that adds effectiveness, convenience, or improved appearance to a fixture but is not essential to its operation.

C. Appliance: Device or machine designed and intended to perform a specific function.

D. Appurtenance: Device or assembly designed to perform some useful function when attached to or used with a fixture.

E. Equipment: Device used with plumbing fixtures or plumbing systems to perform a certain function for plumbing fixtures but that is not part of the fixture.

F. Fitting: Fitting installed on or attached to a fixture to control the flow of water into or out of the fixture.

G. Fixture: Installed receptor connected to the water distribution system, that receives and makes available potable water and discharges the used liquid or liquid-borne wastes directly or indirectly into the drainage system. The term "Fixture" means the actual receptor, except when used in a general application where terms "Fixture" and "Plumbing Fixture" include associated trim, fittings, accessories, appliances, appurtenances, support, and equipment.

H. Roughing-In: Installation of piping and support for the fixture prior to the actual installation of the fixture.

I. Support: Device normally concealed in building construction, for supporting and securing plumbing fixtures to walls and structural members. Supports for urinals, lavatories, and sinks are made in types suitable for fixture construction and the mounting required. Categories of supports are:

1. Carrier: Floor-mounted support for wall-mounted water closet, and support fixed to wall construction for wall-hung fixture.
2. Chair Carrier: Support for wall-hung fixture, having steel pipe uprights that transfer weight to the floor.
3. Chair Carrier, Heavy Duty: Support for wall-hung fixture, having rectangular steel uprights that transfer weight to the floor.
4. Reinforcement: Steel plate built into wall construction, for securing fixture to wall.

J. Trim: Hardware and miscellaneous parts, specific to a fixture and normally supplied with it required to complete fixture assembly and installation.

1.3 SUBMITTALS

A. Product Data: For each type of product.

B. Maintenance data.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with requirements of ANSI Standard A117.1, "Buildings and Facilities --Providing Accessibility and Useability for Physically Handicapped People," Public Law 90480, "Architectural Barriers Act, 1968," with respect to plumbing fixtures for the physically handicapped and "Americans with Disabilities Act Accessibility Guidelines for Buildings 1991" with respect to plumbing fixtures for the physically handicapped.

B. Regulatory Requirements: Comply with requirements of ATBCB (Architectural and Transportation Barriers Compliance Board) "Uniform Federal Accessibility Standards (UFAS) -1985-494-187" with respect to plumbing fixtures for the physically handicapped.

C. Listing and Labeling: Provide electrically operated fixtures specified in this Section that are listed and labeled.

1. The terms "listed" and "labeled" shall be as defined in the National Electrical Code, Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

D. Faucets and trim in contact with drinking water shall meet or exceed the Safe Water Drinking Act (SWDA) lead free standards of ANSI/NSF Standard 61, section 9.

E. Design Concept: The drawings indicate types of plumbing fixtures and are based on the specific descriptions, manufacturers, models, and numbers indicated. Plumbing fixtures having equal performance characteristics by other manufacturers may be considered provided that deviations in dimensions, operation, color or finish, or other characteristics are minor and do not change the design concept or intended performance as judged by the Architect. Burden of proof for equality of plumbing fixtures is on the proposer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products in each category, equal to one of the following listed for that category:

1. Water Closets:
   a. American Standard, Inc.
2. Urinals:
   a. American Standard, Inc.
3. Lavatories:
   a. Zurn Industries, LLC as called out in the plumbing fixture schedule.
4. Sinks:
   a. Elkay Manufacturing Co.
5. Service Sinks:
   a. Fiat Products.
6. Water Coolers:
   a. Elkay Manufacturing Co.
7. Emergency Equipment:
   a. Bradley Corp.
8. Toilet Seats
   a. Bemis Mfg. Co.
9. Flushometers:
   a. American Standard, Inc.
10. Commercial/Industrial Cast-Brass Faucets:
    a. American Standard, Inc.
    b. Chicago Faucet Co.
11. Sensor-Operated Faucets and Devices
    a. Bradley corp.
12. Stop valves & Supplies:
    a. McGuire Manufacturing Co., Inc.
13. P-traps, Drains & Miscellaneous Fittings:
    a. McGuire Manufacturing Co, Inc.
14. Supports and carriers:
    a. Zurn Industries, Inc.; Hydromechanics Div.
15. Insulation Kits:
    a. Brocar
    b. McGuire
    c. Plumberex
    d. PROFLO
    e. Trap-Wrap
    f. Truebro, Inc.

2.2 FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Sink Faucets: General: As described on the drawings.

2.3 STOP VALVES & SUPPLIES

A. Supplies General: As described on the drawings.

1. Exposed piping and parts shall be polished chrome plated.

2.4 P-TRAPS, DRAINS AND MISCELLANEOUS FITTINGS

A. Fittings General: As described on the drawings, except as listed below:

1. Exposed piping and fittings shall be polished chrome plated.

B. Fittings installed concealed inside a plumbing fixture or within wall construction may be without chrome plate finish.

C. Sink Continuous Wastes: Polished chrome-plated, tubular brass, 1-1/2 inches, 17 gauge, with brass nuts on slip inlets, and of configurations indicated.

D. Escutcheons: Wall flange with set screw.

2.5 FLUSHOMETERS

A. Provide flushometers compatible with fixtures, with features and of consumption indicated as described on drawings.

1. Exposed metal parts shall be polished chrome plated.
2. Flush valves installed with wall construction may be without chrome plate finish.

2.6 TOILET SEATS

A. General: as described on the drawings.

2.7 PLUMBING FIXTURE SUPPORTS AND CARRIERS

A. Supports: ASME A112.6.1M, categories and types as required for wall-hanging fixtures specified, and wall reinforcement.

B. Support categories are:

1. Carriers: Supports for wall-hanging water closets and fixtures supported from wall construction. Water closet carriers shall have an additional faceplate and coupling when used for wide pipe spaces. Provide tiling frames or setting gauge with carriers for wall-hanging water closets.

2. Chair Carriers: Supports with steel pipe uprights for wall-hanging fixtures.
3. Chair Carriers, Heavy Duty: Supports with rectangular steel uprights for wall-hanging fixtures.
4. Reinforcement: ¼-inch by 6-inch steel plates attached to studs, in wall construction, to secure floor-mounted and special fixtures to wall.

C. Support Types: Provide support of category specified, of type having features required to match fixture.

D. Provide supports specified as part of fixture description, in lieu of category and type requirements.

2.8 INSULATION KITS

A. Insulation kits for lavatory and sink waste and supplies of vinyl plastic with reusable fasteners and openings for access to supply stop handles.

PART 3 - EXECUTION

3.1 APPLICATION

A. Install plumbing fixtures and specified components, in accordance with designations and locations indicated on Drawings.

B. Install supports for plumbing fixtures in accordance with categories indicated, and of type required:

1. Carriers for the following fixtures:
   a. Wall-hanging water closets.
   b. Wall-hanging electric water coolers and drinking fountains.
   c. Wall-hanging fixtures supported from wall construction.
2. Chair carriers for the following fixtures:
   a. Wall-hanging drinking fountains and electric water coolers.
3. Heavy-duty chair carriers for the following fixtures:
   a. Accessible lavatories.
   b. Fixtures where specified.

3.2 INSTALLATION

A. Install plumbing fixtures level and plumb according to manufacturer’s written installation instructions, roughing-in drawings and referenced standards.

B. Install wall-hanging, back-outlet water closets with support manufacturer's tiling frame or setting gauge.

C. Install wall-hanging, back-outlet urinals with gasket seals.

D. Fasten wall-hanging plumbing fixtures securely to supports attached to building substrate when supports are specified, and to building wall construction where no support is indicated.

E. Fasten floor-mounted fixtures and special fixtures having holes for securing fixture to wall construction, to reinforcement built into walls.

F. Fasten wall-mounted fittings to reinforcement built into walls.

G. Install counter-mounting fixtures in and attached to casework.

H. Secure supplies behind wall or within wall pipe space, providing rigid installation.

I. Install toilet seats on water closets.

J. Set mop basins in leveling bed of cement grout.

K. Install stop valve in an accessible location in each water supply to each fixture.

L. Install trap on fixture outlet except for fixtures having integral trap.

M. Install wall flanges or escutcheons at piping wall, floor and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings.

N. Seal joints between plumbing fixtures, counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

O. Install insulation kits on ADA compliant sink and lavatory waste, continuous wastes, hot and cold water supplies where indicated on the drawings and as required by the ADA.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other sections of Division 22. The Drawings indicate general arrangement of piping, fittings, and specialties. The following are specific connection requirements:

1. Install piping connections between plumbing fixtures and piping systems and plumbing equipment specified in other sections of Division 22.
2. Install piping connections indicated between appliances and equipment specified in other sections, direct connected to plumbing piping systems.

3.4 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace

malfunctioning fixtures and components, then retest. Repeat procedure until all units operate properly.

3.5 ADJUSTING AND CLEANING

A. After completing installation of plumbing fixtures, inspect and repair damaged finishes.

B. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

C. Operate and adjust disposers, hot water dispensers, and controls. Replace damaged and malfunctioning units and controls.

D. Adjust water pressure at electric water coolers, faucets, and flushometers having controls, to provide proper flow and stream.

E. Adjust water-cooler temperature settings.

F. Install ball or gate valves on water connections to remote water coolers.

G. Replace washers of leaking and dripping faucets and stops.

H. Clean fixtures, fittings, and spout and drain strainers with manufacturers' recommended cleaning methods and materials.

I. Review the data in Operating and Maintenance Manuals. Refer to Division 1 Section "Project Closeout."

J. Provide protective covering for installed plumbing fixtures and fittings.

K. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

3.6 FIXTURE SCHEDULE

A. Provide plumbing fixtures as specified on the drawings.

B. Install rough-in for plumbing fixtures as scheduled on the drawings.

3.7 MOUNTING HEIGHTS SCHEDULE

A. Refer to architectural drawings for plumbing fixture mounting heights unless indicated otherwise.

END OF SECTION 224000

SECTION 230500
HEATING, VENTILATION AND AIR CONDITIONING

PART I - GENERAL

1.01 WORK INCLUDED

A. Work shall include furnishing all labor, materials, tools, equipment and appliances and performing all operations in connection with the installation of the heating, cooling and ventilation systems in the building.

B. Contractor shall include cost of all labor, accessories, tools, equipment and material required to completely execute installation of the entire mechanical system as shown on the drawings and as specified.

C. Work under this contract shall include, but is not limited to, the furnishing, unloading, handling, distribution, setting and installation of all components for the following
1. General exhaust and ventilation systems

1.02 SUBMITTALS

A. Shop drawings shall be submitted as directed.

1.03 QUALITY ASSURANCE

A. Qualification of Installers
1. For the fabrication, installation and testing of work under this section, Contractor shall use only thoroughly trained and experienced workmen completely familiar with the items required and the manufacturer's current recommended methods of installation.

B. Codes and Standards
1. VA State Building Code.
2. VA State Building Code - Mechanical.
3. VA State Building Code - Energy
4. "Duct Manual and Sheet Metal Construction for Ventilating and Air Conditioning System", latest edition as published by the Sheet Metal and Air Conditioning Contractors National Association.

1.04 OBJECTIONABLE NOISES AND VIBRATIONS

A. All equipment shall operate without objectionable noises or vibrations as determined by the Engineer.

PART II - PRODUCTS
A. Refer to Individual Sections.

PART III - EXECUTION

3.01 PLACING IN SERVICE

A. Contractor shall make all necessary tests, trial operation, etc., as may be required or as directed by the Engineer to prove that all work under these plans and specifications is in complete serviceable condition and will function as intended. All costs of the tests shall be borne by this Contractor.

B. Upon completion of all work, the system shall be tested to determine if any excess noise or vibration is apparent during operation of the system. If any such vibrations are detected in the system or noisy equipment found, the Contractor shall be responsible for correcting same.

C. Provide complete Operating Instructions and Maintenance Manual

3.02 GUARANTEE

A. The Contractor shall guarantee the complete heating and ventilating system against defects due to faulty materials, workmanship, or failure due to negligence of the Contractor.

3.03 WARRANTY AND SERVICE

A. Upon completion of all work, the Contractor shall completely check out the system, seeing that all motor bearings are greased as required and all equipment and controls are properly functioning. He shall be responsible for any other maintenance required on the system or service call during the warranty period.

END OF SECTION 23 05 00

SECTION 230593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

1.1 SUMMARY

A. Testing, adjusting, and balancing for the following:

1. Air Systems: Constant-volume

1.2 QUALITY ASSURANCE

A. Testing, Adjusting, and Balancing Agent Qualifications: AABC NEBB or TABB certified.

1.3 EXECUTION

A. Tolerances: Plus or minus 10 percent of design values.

END OF SECTION 230593

SECTION 233113

METAL DUCTS

1.1 MATERIALS

A. Single-wall rectangular ducts and fittings.

B. Single-wall round ducts and fittings.

C. Sheet Metal Materials:

1. Galvanized sheet steel.

D. Sealant Materials:

1. Two-part tape sealing system.
2. Water-based joint and seam sealant.
3. Solvent-based joint and seam sealant.
4. Round duct joint O-ring seals.

1.2 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. Clean the following items:

1. Air outlets and inlets.
2. Exhaust fans.
3. Dedicated exhaust and ventilation components and makeup air systems.

1.3 DUCT SCHEDULE

A. All ducts shall be galvanized steel

END OF SECTION 233113

SECTION 233423

HVAC POWER VENTILATORS

1.1 QUALITY ASSURANCE

A. AMCA-Certified Ratings Seal.

1.2 CENTRIFUGAL ROOF VENTILATORS

A. Direct-drive or belt-driven centrifugal type, with spun-aluminum housing.

1. Variable-speed controller.
2. Disconnect switch inside fan housing.
3. Bird screens.
4. Backdraft dampers.
5. Galvanized-steel roof curbs

1.3 IN-LINE CENTRIFUGAL FANS

A. In-line, direct-drive centrifugal type, with split, spun-aluminum housing, wheel, and outlet guide vanes.

1. Variable-speed controller.
2. Volume-control damper.
3. Companion flanges.
4. Fan guards.
5. Motor and drive cover (belt guard).

END OF SECTION 233423

SECTION 26 01 00

BASIC ELECTRICAL REQUIREMENTS

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. This section expands and supplements requirements specified in Division 01.

B. Related Sections and Codes include the following and supersedes these specifications where there is a conflict:

1. Division 01 in its entirety.
2. The current USDA Forest Service rules and regulations.
3. NFPA 70.

1.2 SUMMARY

A. This Section includes the following:

1. Abbreviations.
2. Allowances.
3. Change Orders.
4. Closeout Documentation.
5. Codes, Permits & Inspections, and Labeling.
6. Color Selections.
7. Contractor Qualifications.
8. Coordination Drawings.
9. Definitions.
10. Deliveries.
11. Discrepancies.
12. Electronic Media.
13. Job Site Safety
14. Job Site Security
15. Keys.
16. Operating and Maintenance Manuals.
17. Record Documents and As-Built Drawings.
18. Requests For Information.
19. Shop Drawings.
20. Spare Parts.
21. Substitutions.
22. Training.
23. Unit Pricing.
24. Warranties.

1.3 ABBREVIATIONS

A. The following is a list of abbreviations that may be found in either the specifications or drawings, including subscripts to equipment connections or junction boxes:

1. A: Ampere, Ammeter
2. AC: Alternating Current
3. ACC: Air Cooled Chiller
4. ACCU: Air Cooled Condensing Unit
5. ADA: Americans with Disabilities Act
6. ADO: Automatic Door Operator
7. AF: Ampere Frame
8. AFC: Above Finished Ceiling
9. AFF: Above Finished Floor
10. AFG: Above Finished Grade
11. AHJ: Authorities Having Jurisdiction
12. AHU: Air Handling Unit
13. AIC: Amperes Interrupting Capacity
14. AL: Aluminum
15. ALT: Alternate
16. ANSI: American National Standards Institute
17. ARCH: Architect or Architectural
18. ASI: Architect’s Supplemental Instruction
19. ASSCP: Auditorium Sound System Control Panel or Rack
20. AT: Ampere Trip
21. ATC: Acoustical Tile Ceiling
22. ATS: Acceptance Testing Specifications or Automatic Transfer Switch
23. AWG: American Wire Gauge
24. BFC: Below Finished Ceiling
25. BFF: Below Finished Floor
26. BFG: Below Finished Grade
27. BL: Bed Locator
28. C: Conduit
29. CATV: Cable Television
30. CCD: Construction Change Directive
31. CCTV: Closed Circuit Television
32. CCTVCP: Closed Circuit Television Control Panel or Rack
33. CD: CanDela
34. CLG: (above or flush with) Ceiling (as necessary)
35. CM: Coffee Machine or Coffee Maker or Construction Manager
36. CO: Certificate of Occupancy or Change Order
37. CON: Contactor
38. CP: Control Panel or Courtesy Phone
39. CSBA: Color Selected By Architect
40. CU: Copper
41. D: Data
42. DC: Direct Current or Door Contact
43. DDC: Direct Digital Controls
44. DFS: (North Carolina) Division of Facility Services
45. DHEC: (South Carolina) Department of Health and Environmental Control
46. DISC: Disconnect (aka Safety Switch)
47. DIST: Distribution
48. DOI: (North Carolina) Department Of Insurance
49. DOL: Department Of Labor

50. DP: Distribution Panel
51. DW: DishWasher
52. EA: Each
53. EC: Electrical Contractor
54. EE: Electrical Engineer
55. EF: Exhaust Fan
56. ES: Electric door Strike
57. ELEV: Elevator (controller)
58. ELEVCL: Elevator Cab Lights
59. EM/EMER: Emergency
60. EMT: Electrical Metallic Tubing
61. EPDM: Ethylene-Propylene-Dieneter polymer rubber Membrane.
62. EWC: Electric Water Cooler
63. EWH: Electrical Wall Heater
64. EP: Explosion Proof
65. EX: Existing (to remain)
66. F: Fixed or Fuse or Fiber
67. FA/FA: Fire Alarm
68. FAAP: Fire Alarm Annunciator Panel
69. FACP: Fire Alarm Control Panel
70. FB: Floor Box or Furnished By
71. FBO: Furnished By Others
72. FH: Fume Hood
73. FLA: Full Load Amps
74. FP: Fire Pump
75. FPC: Fire Protection Contractor
76. FPE: Fire Protection Engineer
77. FSS: Fused Safety Switch
78. FX: Flexible (conduit)
79. G,GND: Ground
80. GC: General Contractor
81. GD: Garbage Disposal
82. GF/GFI: Ground Fault Circuit Interrupter (GFCI)
83. GRAP: Generator Remote Annunciator Panel
84. GRC: Galvanized Rigid Conduit
85. GSSCP: Gymnasium Sound System Control Panel
86. GYP: Gypsum board
87. HH: Hand Hole
88. HP: Horsepower
89. HW: Headwall
90. HZ: Hertz
91. IB: Installed By
92. IBO: Installed By Others
93. ID: Inner Duct or Internal Diameter
94. IDF: Intermediate Distribution Frame
95. IG: Isolated Ground
96. IW: In Wall
97. II,III,IV,V: Lighting reflector distribution types as shown next to fixture symbol
98. IM: Ice Machine or Ice Maker
99. JB: Junction Box
100. JBOX: Junction Box
101. JP: Jockey Pump
102. K: One thousand or Keyed
103. KAIC: Amperes Interrupting Capacity (in Thousands)
104. KVA: Kilovolt-Amperes
105. KW: Kilowatts

106. LC: Lighting Contactor or Load Center
107. LCD: Liquid Crystal Display
108. LED: Light Emitting Diodes
109. LTG: Lighting
110. LPI: Lightning Protection Institute
111. LV: Low Voltage
112. MC: Mechanical Contractor
113. MCB: Main Circuit Breaker
114. MCC: Motor Control Center
115. MD: Motorized Door or Motion Detector
116. MDF: Main Distribution Frame
117. ME: Mechanical Engineer
118. MGA: Medical Gas Outlet
119. MH: ManHole
120. MIC: MICrowave or MICrophone
121. MLO: Main Lugs Only
122. MPS: Motorized Projection Screen
123. N/A: Not Applicable
124. NC: North Carolina or Nurse Call
125. NCCL: Nurse Call Central Logic
126. NCCP: Nurse Call Control Panel
127. NCTC: Nurse Call Terminal Cabinet
128. NEC: National Electrical Code
129. NECA: National Electrical Contractors Association
130. NEMA: National Electrical Manufacturers Association
131. NF: Non Fused
132. NFPA: National Fire Protection Association
133. NFSS: Non Fused Safety Switch
134. NIC: Not In Contract
135. NL: Night Light
136. NTS: Not To Scale
137. O&M: Operation and Maintenance (manuals)
138. OAH: Over All Height
139. OD: Outside Diameter
140. OH: OverHead
141. OHP: OverHead Projector
142. OS: Occupancy Sensor
143. OSHA: Occupational Safety and Health Administration
144. P: Pole, Phase or Pan
145. PAN/PNL: Panelboard
146. PC: Plumbing Contractor
147. PE: Professional Engineer or Plumbing Engineer
148. PIT: (Elevator) Pit
149. PIV: Post Indicator Valve
150. POS: Point Of Service
151. PR: Pair or Proposal Request
152. PROVIDE: Furnish, Install & Connect
153. PS: Plasma Screen
154. PT: Poke Through Assembly or Pan-Tilt
155. PTZ: Pan-Tilt-Zoom
156. PVC: Polyvinyl Chloride (Conduit)
157. REF: Refrigerator
158. RFI: Request For Information
159. RFP: Request For Proposal
160. RI: Rough-In
161. RIO: Rough-In-Only
162. RLA: Running Load Amperes

163. RTU: Roof Top Unit
164. SC: South Carolina
165. SCE&G: South Carolina Electric & Gas
166. SCO: (North Carolina) State Construction Office
167. SCP: Security Control Panel
168. SEC: Security (Junction Box or Door Connection)
169. SN: Solid Neutral
170. SPD: Surge Protection Device (aka TVSS)
171. SSCP: Sound System Control Panel
172. ST: Shunt Trip
173. SW: Switch
174. SWBD: Switchboard
175. TBB: Telephone Back Board
176. T: Transformer
177. TC: Temperature Controls or Trophy Case
178. TCC: Temperature Controls Contractor
179. TOS: Top of (Elevator) Shaft
180. TYP: Typical
181. TV: Television
182. TVSS: Transient Voltage Surge Suppression
183. UCREF: Undercounter Refrigerator
184. UG: Underground
185. UH: Unit Heater
186. UL: Underwriter's Laboratories
187. UNO: Unless Noted Otherwise
188. UON: Unless Otherwise Noted
189. UPS: Uninterruptible Power Supply
190. V: Volt or Voice
191. W/: With
192. WG: Wire Guard
193. WP: WeatherProof
194. WT: Wireless Transmitter
195. XFMR: Transformer

1.4 ALLOWANCES

A. Refer to Section 012100 "Allowances" for a complete listing and description of each allowance pertaining to work of this Contractor.

1.5 CHANGE ORDERS

A. Contractor shall not proceed with work that they consider above and beyond the Contract Documents without written authorization from the Architect and Owner. Change orders will be reviewed by the Engineer, when requested. The format for each change shall consist of the breakout of all labor, material, and equipment rental per unit and extended along with quotations from the respective suppliers for all quoted items. The bottom summary including taxes, labor rates, profit, overhead, etc. shall comply with the Division 01 specifications and local laws. Without this detailed breakdown, the change order cannot be properly evaluate by the Engineer. Any change order that the Contractor proceeds to

complete, without a formally approved written change order from the Architect/Engineer, are taking a risk at their own expense.

1.6 CLOSEOUT DOCUMENTATION

A. Submit in triplicate all of the information listed below at a minimum along with all the requirements stated elsewhere in Division 01 and Division 26:

1. Operations and Maintenance (O&M) manuals as outlined below in this specification.
2. Certification letter that all electrical equipment has been tested and is operational according to the plans and specifications.
3. Certification letter that all punch list items have been corrected.
4. Certification letter that all clean-up relating to electrical work has been performed.
5. Certification letter that no asbestos or any materials containing asbestos have been used in the electrical portion of the work.
6. Contractor’s notarized affidavit of payment of debts and claims.
7. Contractor’s notarized affidavit of release of liens.

1.7 CODES, PERMITS & INSPECTIONS, AND LABELING

A. E.C. shall be responsible for contacting NC Department of Insurance and NC State Construction Office for scheduling all required tests and inspections.

B. All work shall be performed in accordance with the NEC and applicable federal, state, county, and city codes and requirements by the Local Authority Having Jurisdiction NC DOI.

C. Both the Contractor and installing electrician are reminded that since the NEC is by statutory inclusion a part of the laws of the state, they bear a prime responsibility to comply with it even when the plans or specifications denote an apparent violation. This should be observed carefully and continuously, particularly during estimating for proposal, and any discrepancies should be brought to the attention of the engineer for resolution.

D. Contractor shall include in his/her bid all costs for building permits, inspections, and prepays including utility fees unless otherwise noted herein or in Division 01.

E. Contractor shall coordinate and schedule all required State, County, City, and Engineer inspections in a timely manner so as to not “cover up” work to be inspected and to not “hold up” work to be performed by other trades.

F. All electrical equipment, materials, devices, and appliances shall be labeled by a NC approved third party testing agency.

G. Anticipated inspections made by the design engineer:

1. Underground – Contractor to notify Engineer 48 hours prior to backfilling typical trenches and pouring of concrete floors for potential inspections. In the event that the Engineer cannot make it to the job site, the Contractor shall take photographs of typical underground rough-in sections, transformer/generator pad foundation, light pole bases, etc. prior to concealing the work for the Engineer's review.
2. Overhead/In-Wall – Contractor to notify engineer one week prior to installing gypsum board walls/ceilings and acoustical lay-in ceilings and while typical masonry wall rough-in work is being performed for potential inspections. At this time, the following list below shall be ready for the engineer to review. If this phase of the project in given major areas of the building are not complete at this time, engineer reserves the right to be compensated for additional site visits to complete the OH/IW rough-in inspection if necessary.

   a. All raceways, cable tray, fittings, supports, boxes, junction box covers, etc. must be complete.
   b. All power and low voltage wiring must be complete.

3. Final – Contractor to notify engineer one week prior to need for potential final inspections. At this time, the following list below shall be ready for the engineer to review. If project is not complete at this time, engineer reserves the right to be compensated for additional site visits to complete the final inspection if necessary.

   a. Electrical Contractor's own punchlist of outstanding items.
   b. Panelboard covers removed or have pictures taken for Engineer's review.
   c. Transformer enclosures removed or have pictures taken for Engineer's review.
   d. All circuits energized for testing.
   e. All receptacles, switches, lights, equipment, and low voltage systems devices shall be installed, operational, and tested.
   f. Service and transformer grounding connections exposed or have pictures taken for Engineer's review.
   g. All low voltage systems checkout and testing reports by the respective manufacturers.
   h. One receptacle, one light switch outlet box, and one homerun junction box to be open for review, upon request.
   i. Ladder for engineer's use.

H. After site observations are made, the Engineer will provide field reports and generate deficiency logs to the Contractor through the Architect. These items are to be addressed by the Contractor to the Architect within (14) days of receipt, unless otherwise agreed upon in writing. When the items are corrected, the items shall be initialed and dated by the electrical "foreman" and not by the electrical "project manager."

1.8 COLOR SELECTIONS

A. All electrical equipment involving a color selection shall be brought to the attention of the Architect, via a shop drawing submittal, for their direction. Contractor shall provide the Architect with a list full range of colors that can be selected from. Contractor shall provide color chips, samples, color brochures, etc. for the Architect's use.

B. All electrical equipment involving color selection shall be submitted at one time, along with the other finishes for other disciplines needing a color selection so that the Architect has all the information together to make a complete decision.

C. Some examples of electrical equipment needing a color selection are:

1. Non-emergency power wiring devices and telecom outlets.
2. Non-emergency power wiring device and telecom outlet cover plates.
3. Surface raceway.
4. Fire alarm horn/strobe lights.
5. Exposed light fixtures in aesthetic areas.
6. Exterior light fixtures.
7. Floor box or poke through assembly trim plates.

1.9 CONTRACTOR QUALIFICATIONS

A. Contractor shall have been in business for at least five years and have completed at least three projects of similar size and scope.

B. Contractor shall have proper business and employee licenses in order to perform work in the state.

C. Refer to individual specification sections for additional qualifications relevant to each specification section.

D. Contractor to provide sufficient qualified journeyman electricians who are thoroughly experienced with the materials and methods specified and familiar with the design requirement.

E. At least one qualified journeyman, designated as the superintendent, shall be present at all times during the execution of the work.

F. In acceptance or rejection in any portion of the electrical work, no allowance will be made for lack of skill on the part of the workmen.

1.10 COORDINATION DRAWINGS

A. A meeting shall be arranged by the General Contractor and take place prior to the G.C. starting the coordination drawings. This

meeting shall include at a minimum the G.C., the G.C.'s major subcontractors, Architect, Owner's representative, and Engineers such that we can confirm the requirements of the coordination drawings prior to them being submitted.

B. E.C. shall coordinate with the G.C. and other trades so that the following lists of items can be indicated on a common set of plans. Floor plans and sections are to be drawn to scale in all congested areas (such as corridors, chases, and equipment rooms) and specific areas noted in these documents. Also, all equipment connections are to be reviewed between disciplines for equipment locations, disconnect requirements, motor controller requirements, MOCP requirements, control power/panel locations, etc. These shall be submitted collectively from all disciplines into one overall document for review by the Engineer on an as needed basis or where specifically directed within the Contract Documents. **These coordination drawings shall be submitted for review prior to any other individual product data or fabrication drawings.** Show the following at a minimum:

1. Ceiling.
2. Floor.
3. Roof or floor decking above.
4. Structural elements.
5. Cable tray or J-hook layout.
6. Clearances required for access above and to side of cable trays or j-hooks.
7. Light fixtures.
8. Large electrical or telecom conduits and/or pull boxes.
9. HVAC ductwork.
10. HVAC piping.
11. Plumbing piping.
12. Sprinkler piping.
13. Mounting racks and support assemblies for associated piping/ductwork.

C. It is important to note that ductwork/piping/cable tray/panelboards/breakers/disconnects/ motor starters, etc. cannot be fabricated, until the coordination drawings have been compiled, submitted, and approved. Any material procurement or installation work commenced prior to approval is taken at the risk of the Contractor and may have to be modified/moved at their cost.

1.11 DEFINITIONS

A. Where the word "provide" is used relating to a system or piece of equipment, it shall be understood to mean the furnishing and installing of the system or equipment.

B. Where the word "furnish" is used relating to a system or piece of equipment, it shall be understood to mean supply to the project only, for installation under other Divisions as part of this contract.

C. Where the word "install" is used relating to a system or piece of equipment, it shall be understood to mean to place and put in service equipment furnished under other Divisions as part of this contract.

D. Where the phrase "as directed" is used, it shall be understood to mean direction given to the Contractor by the Architect, Engineer, or Owner.

E. Where the phrase "as indicated" is used, it shall be understood to mean as shown on drawings by notes, graphics or schedules, or written into other portions of contract documents. Terms such as "shown", "noted", "scheduled" and "specified" have the same meaning as "indicated", and are used to assist the reader in locating particular information.

F. Where the word "Contractor" is used, it shall be understood to mean the contractor responsible for all Division 26 specifications and electrical drawings, unless otherwise noted. For projects where one prime contract is awarded, the Prime Contractor shall be responsible for all Division 26 work included in these specifications and electrical drawings.

G. Where the term "E.C." is used, it shall be taken as a guide for the scope normally performed by the Electrical SubContractor, whereas when the term "G.C." is used, it shall be taken as a guide for the scope normally performed by the General Contractor. For projects where multiple prime contracts are awarded, the Electrical Contractor shall be responsible for all Division 26 work included in these specifications and electrical drawings.

H. Where the term "switchgear" is used, it shall in general refer to all types of switchgear equipment such as transformers, panelboards, switchboards, load centers, disconnects, motor starters, motor control centers, transfer switches, paralleling gear, medium voltage switching equipment, unit substations, variable frequency drives, etc.

1.12 DELIVERIES

A. All deliveries for equipment ordered by the Contractor shall be accommodated by the Contractor. Contractor shall coordinate deliveries and storage space for equipment during hours that the Contractor is on site. The Owner will not be responsible for receiving/unloading equipment whether during working hours or after hours, unless otherwise closely coordinated up front with the Owner. Contractor shall also provide their own means of unloading equipment.

1.13 DISCREPANCIES

A. Should it appear that there is a discrepancy between or within the Division 26 drawings, and/or Division 26 specifications, and/or the

local Authority Having Jurisdiction's interpretations, and/or local Utility Companies regulations concerning the nature, quality or extent of materials or work to be furnished and/or installed, and such discrepancy is not brought to the Architect/Engineer's attention during Bidding for a formal written Addendum clarification, this Contractor shall base his/her bid on performing the work in the manner having the higher cost or more stringent option. The Architect/Engineer shall then have the option during construction of selecting either of the manners shown and/or specified at no additional cost to the Owner. In the event the lower cost manner is selected, a credit shall be due the Owner in the amount of the difference between the lower cost and higher cost manner. All discrepancies shall be called to the attention of the Architect before proceeding with work affected thereby.

B. This specification section is not meant to contradict other specification sections that describe similar scopes of work. The intent of this section is to clarify any basic issues that may have been omitted in other Divisions or are not entirely clear as to how they affect the Contractor(s) of this Division.

C. The design drawings, as submitted, are diagrammatic and are not intended to show exact location of equipment, light poles, utility poles, electrical devices above and below counters, floor boxes, poke-throughs, power poles, wall mounted lights, television outlets and receptacles, etc. unless dimensions are given. Drawings are not to be scaled. Verify all exact locations with Architect prior to rough-in. Verify mounting heights of all surface raceways in finished areas and heights of wiring devices above or below casework with the Architect prior to rough-in.

1. Equipment shall be installed along the general arrangement indicated on the drawings, and in accordance with the manufacturer's instructions.

   a. Provide at least the minimum manufacturer's recommended and code required clearance around the equipment for normal maintenance.
   b. Locate and arrange equipment in relationship to other system components to assure that the equipment will be operating under the best possible conditions to meet the scheduled performance requirements.

2. Raceways are to be installed along the general plans shown on the drawings keeping in mind the constraints of the available space and the need to coordinate with the work of other trades. Additional bends, pull and splice boxes shall be provided as necessary to meet space constraints and to facilitate the work of other trades.

D. Electrical equipment, specified hereinafter as shown on the drawings shall be furnished and installed by this Contractor, unless specifically indicated to the contrary.

E. Occasionally, certain references may be indicated on the Drawings to items which are suggested to be furnished and/or installed by

various subcontractors. This is done to assist the applicable Prime Contractor in organizing his subcontractor's bids. However, no attempt has been made, nor is it implied, that this specification or plans are attempting to specifically divide all responsibilities for subcontractors. It is the Prime Contractor's responsibility that all items covered on electrical plans and Division 26 specifications are included in his bid and are coordinated with his subcontractors. No consideration will be given for Prime Contractor's failure to include all applicable electrical work in his bid.

F. Where more than one manufacturer is named for major items of equipment, the manufacturer noted on the Drawings has been used as a basis for design. If another manufacturer is used, other than the one named on the Drawings, it shall be the responsibility of this contractor to ensure that the equipment will fit the space with all legal clearances, or bear the expense to change the space and structure to accommodate equipment used.

1.14 ELECTRONIC MEDIA

A. Where the Contractor is required to produce full size drawings for shop drawings, as-builts, or to outline the work involved for his/her use (i.e. fire alarm, lightning protection, voice/data, point-by-point lighting calculations, etc.), the electronic drawings will be available to the contractor. The contractor will have to fill out and sign a waiver/release form from the engineer. The engineer will provide electronic CAD drawings for the fee of $50/sheet or PDF drawings for the fee of $20/sheet. Payment must be received before the release of electronic drawings. This requirement is not intended to restrict the contractor from preparing shop/coordination drawings in a timely fashion. If the contractor deems this requirement to restrictive, then the contractor shall proceed as if the electronic drawings are not available. The file type will be coordinated with the Engineer.

1.15 JOB SITE SAFETY

A. The Contractor and not the Engineer is responsible for all job site safety relating to his or her work. The Contractor shall be familiar with all safety requirements, such as OSHA regulations, and comply accordingly. The Contractor shall coordinate providing of all personal protection equipment with their employees.

1.16 JOB SITE SECURITY

A. The Contractor shall be responsible for all security of their employees, materials, tools, and equipment. Contractor shall lock up and store materials, tools, and equipment accordingly.

1.17 KEYS

A. During construction, this Contractor shall keep the keys for any and all electrical cabinets, panelboards, lockable covers, manual pull stations, keyed switches, etc. As part of the closeout procedures, this Contractor shall turn over to the Owner six identical key rings with a full set of spare keys on each. Each key shall be labeled with its corresponding designation on a hand written or machine printed label. If six keys of each type do not come with the equipment for the project, have the manufacturer produce additional keys to fill the set.

1.18 OPERATING AND MAINTENANCE MANUALS

A. As part of closeout procedures the Contractor shall turn over to the Architect/Engineer for approval a minimum of three (3) copies of operation and maintenance manuals. Refer to Division 01 for quantity of O&M manuals that may exceed the minimum three. The approved manuals shall then be turned over to the Owner, upon review of the Architect/Engineer. These O&M manuals shall consist of 3-ring binders with loose leaf information, permanent covers, clearly identified and indexed with table of contents, tabs for each section, containing the following at a minimum:

1. Complete list of personnel and contact info for any related warranty work.
2. Complete description of the automatic operation, manual operation, and safety features built into the system.
3. Step-by-step procedures for start-up, operation, and shut-down for each system and piece of equipment.
4. Complete list of diagnostic and troubleshooting procedures for systems and major equipment.
5. Recommended preventative maintenance program for each piece of mechanical equipment, and each system, including items to be inspected and serviced, frequency of inspection and servicing, the type of servicing required, and types of lubricants to be used.
6. As-built material list including make and model numbers.
7. Catalog brochures for all components with specific parts used, marked clearly.
8. Supplier’s and manufacturer’s conformance of specifications and drawings certificates.
9. Copy of all test reports by manufacturer and contractor.
10. Performance data, curves, ratings.
11. Dimensional drawings.
12. Wiring and block diagrams, indicating factory wiring separate from field wiring.
13. Required settings.
14. Manufacturer's descriptive literature.
15. Manufacturer's maintenance and service manuals.
16. Multiple copies of Manufacturer’s **original** installation and maintenance manual that comes with the equipment itself.
17. Spare parts bill of material.
18. Owner’s sign off sheets for receipt of spare parts and training.

19. Name of service agency and installer complete with an emergency service phone number for nights, weekends and holidays.
20. Final approved shop drawings.
21. Warranties and guarantees.
22. Copies of all inspection reports and checkout forms by AHJs, inspectors, utilities, manufacturers, NFPA 72 Record of Compliance Form, etc.
23. Owner's training video tapes, if applicable.
24. Any other pertinent information that the Contractor or Manufacturer feels is important for the Owner to know about the electrical equipment or system.

1.19 RECORD DOCUMENTS AND AS-BUILT DRAWINGS

A. The Contractor shall maintain on site at all times a dedicated space for a current set of red-lined as-built specifications and drawings to record revisions to the original set of construction documents. These revisions shall include, but are not limited to: major interior conduit routings, all exterior underground raceways, manholes, and handholes, all Architect's Supplemental Instructions, all Bulletin drawings, all Addenda descriptions and drawings, all Change Orders, all Construction Change Directives, all Contractor field revisions such as circuiting changes, etc.

B. The Engineer or Owner may at any time ask to review the as-built drawings and specifications during construction.

C. These as-built plans and specifications shall be in addition to the sets used by the installing electricians in carrying out their day to day work on the project. The projected location of every outlet, raceway, or item of equipment to be installed under this contract shall be checked against the plans and specifications of all the other trades as well as by daily conference with workmen and supervisors of all other trades to the extent that any conflicts or uncertainties about locations are resolved before work is installed, particularly sprinkler head locations, etc. ceiling construction installation shall be made in accord with reflected ceiling plans and/or instructions by the Architect's representatives on the site. Moving of items from locations shown, rerouting, or changes to accomplish any work as shown on plans or specifications in order to accomplish this coordination shall not be a cause for claim for additional compensation for the work.

D. As part of the closeout procedures, the Contractor shall take a clean set of drawings and produce one set of as-built specifications and drawings in red ink with a signed Record Drawing stamp. These drawings are to be turned over to the Owner. These documents shall be called the Record Documents.

1.20 REQUESTS FOR INFORMATION

A. When a question, clarification, or discrepancy arises after the Bid has been awarded, the Contractor shall submit in writing to the Architect an RFI to document the issue. The RFI must indicate the

drawings and/or specification sections being referenced and eluded to. Upon receipt, the Engineer will then respond back to the RFI in writing as soon as possible given the circumstances of the RFI. Contractor shall take proper measures to initiate RFI in a timely fashion in order for the Engineer to properly evaluate.

1.21 SHOP DRAWINGS

A. Within 30 calendar days following Contract approval or Notice To Proceed and prior to submitting shop drawings, this Contractor shall submit to the Engineer a list of proposed manufacturers and (sub)Contractors for each specification section and each major piece of equipment for approval. Along with the above information, Contractor to submit the Pay Application Schedule Of Values and a Shop Drawing Submittal Schedule to the Engineer for their review coordination.

B. All shop drawings shall be submitted to the Architect for review within 30 days of receiving a contract, so as not to delay the project.

C. This Contractor shall review, stamp and sign with his/her approval and submit in an orderly sequence so as to cause no delay in the work or in the work of any other Contractor, all submittal information and samples required by the contract documents. Submittal information not stamped with Contractor approval will be returned for reprocessing.

D. Contractor shall **not** begin fabrication or rough-in work or release of materials until return of submittals with Engineer's approval. This is especially important for rough-in items below slab (such as switchgear and floorboxes) and inside poured walls (such as recessed light fixture rough-in boxes).

E. In approving the submittals, the Contractor guarantees that the submittals accurately and completely represent the equipment and materials to be installed.

F. Shop drawings shall be submitted for ALL material items as outlined in these specifications. Any deviations from contract requirements must be clearly indicated on shop drawings, and justification for their consideration must be included

G. Acceptance of submittal items will not preclude rejection of those items upon later discovery that their suitability for the application or ability to meet the requirements of these specifications was misrepresented in the submittals.

H. Submittals for equipment shall include detailed dimensional drawings which completely and accurately represent the specific piece of equipment to be supplied and all required clearances. When more than one piece of similar equipment is to be supplied, provide accurate dimensional drawings for each unique size and/or configuration of the equipment.

I. In checking shop drawings, the Engineer will make every effort to detect and correct errors, omissions and inaccuracies in such drawings, but his/her failure to detect errors, omissions and inaccuracies shall not relieve the Contractor of responsibility for the proper and complete installation in accordance with the intent of the Contract Documents.

J. The shop drawings will be reviewed by the Engineer per specification section. The Contractor shall bind together multiple specification section shop drawings if they so desire, however a separate shop drawing review sheet shall be issued for each section. This will help identify the issues involved with each item, rather than accepting or rejecting the entire submittal as a whole. However, a single specification section shop drawing shall not be broken out and submitted as partial shop drawings as the entire shop drawing for that specification section must be submitted together. If the Contractor submits multiple copies of partial shop drawings, they will not be reviewed by the Engineer and will be sent back as rejected.

K. In the event of multiple shop drawing (re)submissions for the same equipment or specification section, the Engineer reserves the right to require additional fee for a third review of the same shop drawing if the Contractor continues to not adhere to the shop drawing requirements listed in the specifications and the Engineer’s prior review comments.

L. Contractor shall maintain at the site a complete set of all shop drawings, fixture and equipment cut sheets, manufacturer’s wiring diagrams, and installation data. Installing personnel shall study this data before and during installation and rough-in so as to prepare for the proper fit and function upon completion.

M. Coordinate the quantity of shop drawings to be submitted with Architect at the outset of the project, ensuring that the Engineer can retain at least one copy for his/her records.

N. The shop drawings shall indicate factory wiring separate from field wiring.

O. The shop drawings need to illustrate all required rough-in box sizes.

P. The Engineer will perform due diligence in reviewing shop drawings as quickly as they are received. However, if the majority of the shop drawings are received at the same time, the Contractor shall provide the Engineer with a priority list for their use in reviewing the shop drawings in that order to best expedite the project.

Q. Contractors options:

1. For products specified only by reference standard, Contractor shall select any product meeting that standard.

2. For products specified by naming several manufacturers or manufacturer's make and model numbers, select any one of the products or manufacturers named. Be aware that just because a manufacturer is listed does not guarantee that they comply with all of the specifications. The manufacturer still has to illustrate through shop drawings that they meet all the required criteria in the specifications prior to approval.
3. For products specified by naming one or more products or manufacturers and "or equal", Contractor must submit a request for substitutions for any product or manufacturer not specifically named during the Bidding process for formal pre-approval.

1.22 SPARE PARTS

A. Refer to individual specification sections for quantity and description of required spare parts.

B. Label each box of spare parts clearly identifying the contents and turn over to Owner. Prepare a bill of material for all spare parts and have Owner sign off receiving the inventory. Include the spare parts sign off sheet as part of the closeout documents.

1.23 SUBSTITUTIONS

A. Bids concerning the use of substitute products must be accompanied by complete specifications and performance characteristics covering these products, together with such available test data and experience records as may be helpful to the Engineer in evaluating the quality and/or suitability of the proposed products, including:

1. Comparison of the qualities of the proposed substitution with that specified.
2. Changes required in other elements of the work because of the substitution.
3. Effect on the construction schedule.
4. Cost data comparing the proposed substitution with the product specified.
5. Availability of maintenance service, and source of replacement materials.

B. A request for a substitution constitutes a representation that the Contractor:

1. Has investigated the proposed product and determined that it is equal to or superior in all respects to that specified.
2. Will provide the same warranties or bonds for the substitution as for the product specified.
3. Will coordinate the installation of an accepted substitution into the work, and to make the work complete in all respects.
4. Waives all claims for additional costs, under his responsibility, which may subsequently become apparent.

5. Absorb all costs incurred by the substitution when affecting other trades, including but not limited to electrical, structural and architectural, etc.
6. Absorb any cost incurred by the Architect/Engineer in review of the substituted product if the acceptance of the substituted item creates the need for system modification and/or redesign, or if the substituting contractor exhibits negligence in his substituting procedure thus submitting inferior, misapplied or missized equipment. In the event of additional engineering costs, the billing structure shall be agreed upon prior to review by all involved parties.

C. Where more than one make or name is mentioned as being acceptable, it shall be understood that only the name or make referring to the manufacturer's model numbers or sizes shall be considered the "Specified Standard". It shall be further understood that other makes and names, even though mentioned, have not been checked for detail and that their size and arrangement are the Contractor's responsibility the same as a proposed substitute item.

D. The intent of this section is to make the specifications open to all available makes of material and apparatus during the bidding period. Substitutions will only be allowed to be submitted for pre-approval to the Engineer up to ten days prior to bid opening. The substitutions will be reviewed at that time by the Engineer with reasonable promptness. Substitution materials and equipment will only be incorporated into the project if the Engineer pre-approves the intent of the shop drawing(s) and lists the manufacturer’s make and model on an official written and distributed Addendum. No substitutions will be reviewed by the Engineer during construction.

1.24 TRAINING

A. Refer to individual specification sections for quantity and description of required Owner’s Training.

B. Contact and schedule with the Owner two weeks ahead of time for all training. Stress to the Owner to have any and all relevant personnel, teaching staff, and maintenance staff available for the training.

C. Personnel conducting training shall be: trained and experienced in maintenance and operation of equipment, familiar with specification requirements, skilled as a technical writer to the extent required to communicate essential data, and skilled as a draftsperson competent to prepare required drawings.

D. Distribute and review operations and maintenance manuals, shop drawings, record drawings, warranties, spare parts, keys, etc. at that time. Provide hands on demonstration of equipment operation, maintenance, troubleshooting, and features. Review spare parts inventory and contact information for future maintenance. Prepare a written sign off sheet for all attendees to sign having witnessed the training. Include the training sign off sheet as part of the

closeout documents. Video all training and provide videotape to Owner as part of the closeout procedure.

1.25 UNIT PRICING

A. Refer to Section 012200 "Unit Prices" for a complete listing and description of each item requiring unit pricing pertaining to work of this Contractor.

1.26 WARRANTIES

A. Refer to individual specification sections for quantity and description of required Warranties.

B. Prepare and deliver to the Owner all formal written certificates of warranty clearly stating the scope of the warranty and time period.

C. All warranties to commence at the time of Final Completion regardless of startup time or turnover to the Owner. Provide monies in the bid as required to accommodate the start of this warranty period.

D. All equipment under this Division of work shall be warranted for a minimum of one year or manufacturer's minimum warranty whichever is greater, unless otherwise noted. During this warranty period, the Contractor shall replace any and all defective equipment and parts at no additional cost to the Owner.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 260100

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

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. Related Sections include the following:

1. Section 083113 "Access Doors and Frames" for work relating to access doors.
2. Section 260533 "Raceways and Boxes for Electrical Systems" for work relating to sleeves.
3. Section 260536 "Cable Trays for Electrical Systems" for work relating to sleeves.

1.2 SUMMARY

A. This Section includes the following:

1. Access doors.
2. Cleanup.
3. Concrete.
4. Cutting and patching.
5. Damages.
6. Delivery, storage, and handling.
7. Electrical equipment coordination and installation.
8. Equipment wiring and equipment diagrams, details, and risers.
9. Excavation, backfill, and compaction.
10. Fire stopping.
11. Grading and planting.
12. Intent of drawings and specifications.
13. Lug ratings.
14. Painting and caulking.
15. Rough-in.
16. Site visits.
17. Sleeves for above grade raceways and cables.
18. Sleeve seals for below grade raceways and cables.
19. Temporary protection of electrical equipment.
20. Temporary power and lighting.
21. Temporary power useage fees.

1.3 SUBMITTALS

A. Product Data: Access panels of each type, sleeves of each type, and fire stopping as indicated below:

1. Shop drawings shall indicate proposed UL systems materials, anchorage, methods of installation, and actual adjacent construction.
2. Provide a copy of each UL illustration of each proposed system indicating manufacturer approved modifications.
3. Provide manufacturer’s specifications, recommendations, installation instructions and maintenance instructions.

1.4 QUALITY ASSURANCE

A. Test Equipment Suitability and Calibration: Comply with NETA ATS, "Suitability of Test Equipment" and "Test Instrument Calibration."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 ACCESS PANELS

A. Manufacturers:

1. Bar-Co, Inc.
2. J.L. Industries.
3. Karp Associates, Inc.
4. Larsens Manufacturing Company.
5. Mifab Manufacturing Company.
6. Milcor Div., Inryco. Inc.
7. Nystrom Building Products.

B. Coordinate keying, color, and type with Architect to match all other trades.

C. Unless specified differently by Architect, provide cold rolled steel door and frame, continuous piano hinged access panels, common mortise keyed cylinder.

D. Provide non-fire rated or fire-rated access doors according to the specific installation requirements.

E. The size of the access panels shall be kept to a bare minimum for required accessibility.

2.3 CONCRETE

A. Concrete Materials:

1. Portland Cement: ASTM C 150, Type I, except as otherwise indicated.
2. Aggregates: ASTM C 33, except as otherwise indicated.

   a. Local aggregates not complying with ASTM C 33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used.
   b. For rough grouting, provide aggregate which is well graded and 100 percent passing through 3/8" sieve.

3. Water: Clean and free of substances harmful to concrete.
4. Design Mix: Design electrical work concrete as follows, for each 28-day compressive strength class.

   a. 4000 psi Class: 565 lbs. of cement per cu. yd. (6.0 sacks), and 0.35 water/cement ratio.
   b. 3000 psi Class: 500 lbs of cement per cu. yd. (5.25 sacks), and 0.46 water/cement ratio.
   c. 2500 psi Class: 450 lbs. of cement per cu. yd. (4.75 sacks), and 0.54 water/cement ratio.
   d. Mix for Patching: Where electrical work requires patching of exposed concrete work which has been cut to accommodate electrical work, provide concrete patching mix which is identical with mix of work being patched (same cement, aggregates, admixtures and proportioning).

2.4 FIRE STOPPING

A. Fire stopping materials shall be safety barriers designed to block the spread of fire and smoke through penetrations created by electrical installations to fill holes, spaces, and voids in fire rated walls and floors. Products may be in the form of mortar, sealant, caulk, putty, wrap, strip, sheet, or devices. Materials shall be flame, toxic fume and water resistant and shall have a UL fire rating to match that of the wall or floor being penetrated. Fire rating shall be defined by tests conducted by ASTM, UL or other testing and inspection agencies acceptable to Authorities Having Jurisdiction. Fire stopping materials shall also provide adhesion to substrates and maintain fire and smoke seal under normal expected movements of substrates, conduits, and cables.

B. Acceptable Manufacturers:

1. Specified Technologies, Inc. (STI)
2. Tremco, Inc.
3. 3M Inc.
4. Hilti, Inc.
5. Nelson Firestop Products.
6. Wiremold.

C. Materials:

1. Firestop Mortar:

    a. STI SpecSeal Mortar
    b. Tremco TREMstop-M
    c. 3M Fire Barrier Mortar
    d. Hilti CP 637 Firestop Mortar

2. Intumescent Fire Stop Sealants and Caulks

    a. STI SpecSeal Mortar
    b. Tremco TREMstop-WBM
    c. 3M Fire Barrier CP-25 WB
    d. Hilti FS-ONE Intumescent Firestop Sealant

3. Silicone Fire Stop Sealants Caulks

    a. STI SpecSeal Pensil 100 & 300
    b. Tremco Fyre Sil Sealant
    c. 3M Fire Barrier 2000 & 2003
    d. Hilti CP 601s Elastomeric Firestop Sealant

4. Fire stop Putty:

    a. STI SpecSeal Firestop Putty Bars & Pads
    b. Tremco TREMstop FP Flowable Putty
    c. 3M Fire Barrier Firestop Putty
    d. Hilti CP 618 Firestop Putty

5. Fire stop Collars:

    a. STI SpecSeal Firestop Collars
    b. Tremco TREMstop D Combustible Pipe Device
    c. 3M Fire Barrier Pipe Device
    d. Hilti CP 642,643(N), or CP644 Firestop Collar

6. Wrap Strip:

    a. STI Spec Seal Wrap Strip
    b. Tremco TREMstop-WS
    c. 3M Fire Barrier WS-195 Wrap Strip
    d. Hilti CP 645 or CP 648 Wrap Strip

7. Pre-Manufactured 2” and 4” Sleeves:

    a. STI EZ Stop.
    b. Wiremold Flamestopper

2.5 SLEEVES FOR RACEWAYS AND CABLES

A. Horizontal Through Wall Steel Pipe Sleeves: EMT conduit.

B. Vertical Through Floor Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application. Provide steel lintels where required by Architect to preserve structural integrity of wall.

2.6 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. OZ/Gedney.
e. Pipeline Seal and Insulator, Inc.
f. Link-Seal.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure Plates: Glass reinforced nylon. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant zinc coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 ACCESS PANELS

A. Electrical Contractor shall be responsible for providing all access panels required for his/her work.

B. Coordinate location of access panels and doors for electrical items needing access for service and maintenance, such as junction boxes, pull boxes, duct smoke detectors, etc. that are behind finished surfaces or otherwise concealed.

C. In general, access panels are not normally shown on the electrical drawings as the location of these access panels is a means and methods issue for the Contractor to determine.

D. Notify and coordinate with Architect of each planned access panel prior to installation for their review via coordination drawings. Ordering, fabrication, and installation of all access panels shall not proceed until the coordination drawings have been reviewed by the Architect and Engineer.

E. Coordinate with other Contractors to combine adjacent equipment access from a common access panel to reduce the amount of panels in a given space.

3.2 CLEANUP

A. This Contractor shall be responsible for daily cleanup of all their electrical product debris. This includes but is not limited to: empty cardboard boxes, scrap wire and insulation, scrap conduit, etc.

B. This Contractor shall be responsible for final cleanup and wipe down of electrical items in their scope. These items include but are not limited to: switchboard/panelboard interior tubs, floor boxes, surface switchboard/panelboard covers and tubs, surface mounted raceway, wiring devices, low voltage outlets, low voltage system cabinets and racks, light fixture lenses and louvers, etc.

3.3 CONCRETE

A. This Contractor shall furnish and install concrete foundations or bases under all electrical equipment that rests on floors, concrete encased ductbanks and exterior lighting fixture pole bases. Contractor shall follow drawings and/or manufacturer's literature and/or utility company requirements with regard to design and construction of same.

B. Formwork:

1. General: Design, construct and maintain formwork to support vertical and lateral loads including pressure of cast-in-place concrete. Construct formwork so that formed concrete will be of required size and shape and in required location. Construct with joints which will not leak cement paste. Form sides and bottoms of concrete work, except where clearly indicated to be cast directly in excavation or against other construction, or on grade or prepared subgrade. Design and construct forms for easy removal without damage to concrete and other work.

   a. Install chamfer strips at external corners of exposed concrete work.
   b. Construct forms to retain equipment anchor bolts in accurate locations during placement of reinforcing steel and concrete. Use templates furnished by equipment manufacturers to locate anchor bolts or, where not furnished, locate by accurate measure from certified setting diagrams.

C. Placing Reinforcement:

1. General: Comply with requirements and recommendations of specified standards, including "Placing Reinforcing Bars" by CRSI. Place bars where indicated and support to prevent displacement during concrete placement, using appropriate reinforcement supports, properly spaced and wire tied to reinforcing bars.

   a. Place reinforcement to obtain at least minimum recommended coverages for concrete protection. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

2. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which would reduce bond with concrete.

D. Placing Concrete:

1. Wet wooden forms which have been coated with compound, immediately before concrete, and remove excess water from forms.
2. Strength-Class Application: Comply with the following general application requirements.

   a. Plain Concrete Encased Ductbanks: Provide 2500 PSI class.
   b. Reinforced Concrete Encased Ductbanks: Provide 3000 PSI class.
   c. Underground Structural Concrete: Provide 3000 PSI class.
   d. Concrete Pole Bases: Provide 4000 PSI class.
   e. Miscellaneous Supported Work: Provide 3000 PSI class for electrical equipment pads and similar supported work.
   f. Concrete Fill: Provide 2500 PSI class for filling structural steel foundation frames and for filling similar large-volume units.
   g. Concrete Grout: Provide rough grouting class for filling voids to be grouted which are too small to be filled effectively with 2500 PSI class concrete.
   h. Patching General Concrete Work: Match concrete being patched.

3. Deposit concrete continuously or in layers of thickness which will result in no concrete being placed on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within section. If section cannot be placed continuously, provide construction joints. Deposit concrete as nearly as practicable in its final location, so as to avoid segregation due to rehandling or flowing.
4. Place concrete in ductbanks slowly such that the force of the concrete does not force up the conduits.
5. Red dye shall be applied to the top of freshly placed concrete in all underground duct banks as a warning of electrical hazard in the event of future excavation. This is in addition to the required warning tape.
6. Use only minimal water additive to concrete mixture to allow time to smooth off exposed surfaces.
7. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures complying with recommended practices of ACI 309; eliminate voids in work.
8. Bring horizontal surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps and hollows.
9. Cold Weather Placement: Comply with ACI 306. Do not use frozen materials or materials containing ice and snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. When air temperature has fallen or is expected to fall below 40 deg F (4.4 deg C), heat water and aggregates uniformly before mixing, as required to obtain concrete mixture temperature of not less than 50 deg F (10 deg C), and not more than 80 deg F (26.7 deg C), at time of placement. Protect

concrete work from physical damage and reduced strength resulting from frost, freezing actions, or low temperatures.

10. Finishing Horizontal Surfaces: Float and trowel horizontal (top) surfaces to level, smooth, uniform textured, dense finish, where surface is to remain exposed or receive coating, membrane or other thin-set finish. Otherwise, leave struck-off surface undisturbed; except scratch surfaces which are to receive concrete or mortar topping.
11. Finishing Concrete Pole Bases: Remove all exposed formwork. "Sonotube" forms for round bases shall be removed to below depth of adjacent paving or grade whichever is applicable. Rub out entire surface of concrete pole base to smooth, uniform texture.
12. Surface Repairs:

    a. Unexposed Surfaces: Repair significantly damaged and honeycombed areas, and remove major projections and fins where forms have been removed.
    b. Exposed Surfaces: On formed surfaces which are to be exposed, including those to be coated or covered with membrane or other thin-set applied finish, repair and patch form-tie holes and damaged and honeycombed areas, filling voids with grout and completely removing fins and other projections.

E. Concrete Curing and Protection:

1. General: Protect freshly placed concrete from drying and excessively cold and hot temperatures, and maintain in moist condition at relatively constant temperature for period of time necessary for hydration of cement, proper hardening, and achievement of strength requirements as specified.

F. Miscellaneous Concrete Work:

1. Concrete Grouting: Space approximately 1" thick between bottom of equipment and top of concrete foundation or base which remains after shimming, shall be filled completely with grouting. Grout shall be made up with sand and cement designed for the purpose which does not shrink on setting up. Exposed surface of grouting shall be finished to make a neat appearance. Grout openings and recesses as indicated, in and around mechanical work and other work which penetrates or adjoins mechanical concrete work, using rough grouting class of concrete mix. Provide formwork where required, and tamp, screed and trowel surfaces. Cure grout as specified for concrete work.
2. Concrete Equipment Pads: In the absence of more specific information, either on drawings, or manufacturer's or utility’s literature, the bases shall be level, shall have a minimum height above finished floor/grade of 3-1/2" and extend beyond the base dimensions of the item of equipment (3” for interior pads and 6” for exterior pads). Where the terrain is sloped for an outdoor installation, provide additional concrete as required to ensure that each corner of the pad is a minimum of 3-1/2” above finished grade to prevent water sloping onto the pad from a low corner.
3. Concrete pads placed in existing structures shall be mounted securely to the original substrate with anchor bolts.

3.4 CUTTING AND PATCHING

A. Perform cutting, fitting, and patching of electrical equipment and materials required to:

1. Demolition of electrical items required to be removed from structure to remain.
2. Uncover work to provide for installation of ill-timed work.
3. Remove and replace defective work.
4. Remove and replace work not conforming to requirements of the Contract Documents.
5. Install equipment and materials in existing structures.
6. Upon written instructions from the Architect or Engineer, uncover and restore work to provide for Architect or Engineer observation of concealed work.

B. Cut, remove, and legally dispose of electrical equipment, components, and materials, including but not limited to electrical items to be removed and items made obsolete by the new work.

C. Protect the structure, furnishings, finishes, and adjacent materials not to be removed.

D. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

E. Where existing construction such as floors, walls, ceilings, etc., must be cut to relocate, remove or add raceways and/or equipment, such construction to be restored to original condition to satisfaction of Architect, by this Contractor using workmen skilled in respective trade.

F. General penetrations through walls, floors, slab, etc. will be patched with materials to match the surrounding surface (i.e. vinyl concrete patch for concrete surfaces, joint and patching compound for dry wall surfaces, etc.). If the penetrated surface is a fire or smoke barrier, refer to "Installation of Fire Stopping Materials" in this section.

3.5 DAMAGES

A. The Contractor will be held responsible for any and all damages to portions of the building caused by it, its employees and subcontractors, including, but not limited to:

1. Damage to any portion of the building caused by the movement of tools, materials, or equipment.
2. Damage to any component of the construction of spaces “turned over” to the Contractor.
3. Damage to the electrical distribution system and/or other space “turned over” to the Contractor.
4. Damage to the electrical, mechanical and/or life safety, or other systems caused by inappropriate operation or connections made by the Contractor or other actions of the Contractor.

5. Other damage to the materials, tools, and/or equipment of the Owner, its consultants, General Contractor, subcontractors, Architect, and other contractors, agents, and leases.

3.6 DELIVERY, STORAGE, AND HANDLING

A. Protect equipment during transit, storage, and handling to prevent damage, theft, soiling, and misalignment. Coordinate with the Owner for secure storage or equipment and materials or provide secured remote storage.

B. Do not store equipment where conditions fall outside manufacturer's recommendations for environmental conditions. Secure all sensitive electronic equipment in temperature and humidity controlled areas.

C. Wherever possible, store indoors. Where necessary to store outdoors, store sufficiently above grade and enclose with watertight wrapping.

D. Handle equipment carefully to prevent physical damage to equipment and components. Remove packaging, including the opening of crates and containers, avoiding the use of excessive hammering and jarring which would damage the electrical equipment contained therein. Do not install damaged equipment; remove from site and replace damaged equipment with new equipment.

E. Have conduit and all items in cardboard boxes shipped and stored on wooden pallets. Have boxes labeled from the factory to easily indicate materials inside and what electrical designation they are for. Utilize factory-fabricated type containers or wrappings for equipment and components which protect them from damage.

F. Coordinate shipping of large equipment with the construction timing of the building to ensure building is "dried in" or equipment can be moved in or out of building easily. If equipment needs to be assembled and/or reassembled to get it out or into the building, then do so without voiding any manufacturer's warranty. Field verify all existing passageways, door ways, elevator sizes and capacities, window openings, etc. prior to bid to determine how to move equipment in and out. Modify openings as required to move equipment in and out.

G. Coordinate receiving of large items with unloading equipment on site or obtain rental equipment as required. Coordinate location, size, and weight of all large equipment items located inside the building with the Structural Engineer.

3.7 ELECTRICAL EQUIPMENT COORDINATION AND INSTALLATION

A. When noted in the specifications or on the drawings that a certain manufacturer was the "basis of design," the engineer has designed the project around the manufacturer (while allowing equals manufacturers where noted). The contractor and equal named manufacturers are responsible for coordinating equipment/programming/dimensions/weights/capacity, etc. differences

for providing equipment from an equal named manufacturer as opposed to the manufacturer used as the "basis of design."

B. When utilizing existing low voltage head-end equipment to serve new devices or equipment, Contractor/Manufacturer to verify existing equipment is capable of being reused and extended from prior to bid. Contractor/Manufacturer to provide any and all additional equipment, programming, power supplies, servers, monitors, racks, capacity, amplifiers, annunciation points, etc. to make new devices shown operate from the existing head-end equipment. No additional compensation will be made for equipment found out to be insufficient during construction.

C. When two or more items of the same equipment are required (i.e. switchgear, wiring devices and plates, low voltage systems, light fixtures of the same type, etc.), they shall be of the same manufacturer.

D. Comply with NECA 1.

E. Coordinate arrangement, mounting, and support of electrical equipment so connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

F. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

G. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

H. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

I. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements. Install additional conduit, cable tray, busway, pullboxes, spliceboxes, etc. where required to obtain maximum headroom or to avoid conflict with other work without additional cost to the Owner.

J. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

K. Right of Way: Give to raceways and piping systems installed at a required slope. Provide addition trenching, conduit, sleeves, fittings, etc. as required to accommodate adjacent systems.

L. Before installing any work, this Contractor shall see that it does not interfere with clearance required for finish on beams, columns, pilasters, walls or other structural or architectural members, as

shown on Architectural Drawings. If any work is so installed and it later develops that Architectural design cannot be followed, Contractor shall, at his own expense, make such changes in his work as the Architect may direct to permit completion of Architectural work in accordance with plans and specifications.

M. Report any interferences between work under this division and that of any other Contractors to the Architect as soon as they are discovered. The Architect will determine which equipment shall be relocated, regardless of which was first installed, and his decision shall be final.

N. Contractor shall coordinate with the Owner for the Owner to make required applications for electrical, telephone, cable television, etc. services in a timely fashion so as to not impede the flow of work.

O. Verify all dimensions by field measurements.

P. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.

Q. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.

R. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

S. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.

T. Install systems, materials, and equipment level and plumb, parallel, and perpendicular to other building systems and components.

U. Secure all ceiling mounted devices tightly to ceiling (i.e. smoke detectors, occupancy sensors, exit signs, etc.)

V. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

W. Raceways, cable trays, conductors, etc., installed above ceilings or on exposed ceilings shall be supported from the building structure and shall be installed symmetrical with the axis of the space (do not cross room at an angle).

3.8 EQUIPMENT WIRING AND EQUIPMENT DIAGRAMS, DETAILS, AND RISERS

A. Wiring and elementary diagrams for equipment as shown on the drawings are based on the product of the specified equipment manufacturer and are shown for convenience to aid in estimating the extent of the work involved. The equipment actually installed shall be wired and connected in accordance with the equipment manufacturer's recommendations and shall conform to details in approved wiring diagrams to be furnished by the equipment manufacturer. All equipment so connected shall be made to operate in a safe, proper and efficient manner. Note that control circuitry is not necessarily shown on the drawings but shall be installed in conduit between the points and devices indicated on the diagrams.

B. Unless otherwise shown on the drawings or specified herein, it is the intent of this Division to provide all electrical equipment and connections required to protect, properly operate, and control all motors, appliances, electrical devices, and equipment furnished and installed under this and other Divisions of the specifications or shown on the drawings.

C. Wiring of Motors and/or Equipment:

1. Provide necessary power wiring to motors and/or equipment where shown on Drawings.

   a. Make final "line" side connections to respective items of equipment as shown on Drawings.
   b. Provide "Control" wiring, regardless of voltage, only when shown on Electrical Drawings.
   c. In general, all 120, 208, 240, 277, or 480 volt wiring to be construed as power wiring; however, line voltage control wiring shall not be construed as power wiring unless shown on Electrical Drawings.

D. Wiring of Heating, Ventilating, and Air Conditioning Equipment:

1. Provide power wiring as shown on Electrical Drawings. In general, this shall consist of power conductors and raceway up to and including connections to line terminals of respective items of equipment.

   a. Where this Contractor furnishes motor starter and/or disconnect switch, this also shall include the power wiring between the load side of starter and/or disconnect switch and line terminals of respective item of equipment.
   b. Where electric heating equipment is involved, wiring responsibilities to be as shown on Electrical Drawings.
   c. Control wiring, regardless of voltage characteristics, is not to be construed as power wiring and is not the responsibility of this Contractor unless indicated as such on Electrical Drawings. In certain cases, such as between a line voltage thermostat and a cabinet heater or a unit heater, or between a switch and a small exhaust fan, wiring may be required by this Contractor only if shown on Electrical Drawings.

d. It shall be the responsibility of this Contractor, prior to rough-in of conduits serving mechanical equipment, to verify with respective equipment supplier the required minimum circuit ampacity, maximum over current protection, rough-in, and quantity of conductors serving the equipment. In the event changes are required from those shown on the Drawings, this information shall be brought to the attention of the Architect and authorization obtained from the Engineer in writing prior to proceeding with the necessary changes. It is understood that the cost difference to wire the equipment from that shown on the Contract Documents shall by born by Division 23 directly to Division 26.

e. It shall be the responsibility of this Contractor to coordinate power requirements and locations for all temperature controls panels that are vendor specific and not necessarily shown on the drawings.

E. Wiring of Plumbing or Pool Equipment:

1. Provide necessary power wiring to plumbing equipment requiring same, where shown on Electrical Drawings.
2. Control equipment such as thermostats, pressure switches, etc., to be furnished, set in place, and wired by other Divisions, unless shown otherwise on Electrical Drawings.
3. Provide necessary disconnect switches, starters, or contactors where shown on Electrical Drawings. Refer to the motor controller section of these Specifications.
4. It shall be the responsibility of this Contractor, prior to rough-in of conduits serving plumbing equipment, to verify with respective equipment supplier the required minimum circuit ampacity, maximum over current protection, rough-in, and quantity of conductors serving the equipment. In the event changes are required from those shown on the Drawings, this information shall be brought to the attention of the Architect and authorization obtained from the Engineer in writing prior to proceeding with the necessary changes. It is understood that the cost difference to wire the equipment from that shown on the Contract Documents shall by born by Division 22 directly to Division 26.
5. Coordinate rough-in heights of all water coolers and electronic sensor operated devices.

F. Wiring of Fire Protection Equipment:

1. Provide necessary power wiring to fire protection equipment requiring same, where shown on Electrical Drawings.
2. Control equipment to be furnished, set in place, and wired by other Divisions, unless shown otherwise on Electrical Drawings.
3. Control wiring from integral automatic transfer switches provided by others to generator to be performed by this Contractor.
4. Control/Annunciator wiring from Fire Pump controller provided by others to fire alarm panel to be performed by this Contractor.
5. Provide necessary disconnect switches, starters, or contactors where shown on Electrical Drawings. Refer to the motor controller section of these Specifications.
6. It shall be the responsibility of this Contractor, prior to rough-in of conduits serving fire protection equipment, to verify with respective equipment supplier the required minimum circuit

ampacity, maximum over current protection, rough-in, and quantity of conductors serving the equipment. In the event changes are required from those shown on the Drawings, this information shall be brought to the attention of the Architect and authorization obtained from the Engineer in writing prior to proceeding with the necessary changes. It is understood that the cost difference to wire the equipment from that shown on the Contract Documents shall by born by Division 21 directly to Division 26.

G. Wiring of Kitchen Equipment:

1. Provide necessary conduit, wire, disconnect switches, and connections to all kitchen equipment shown on Drawings.
2. Provide power wiring from panel to demark point such as a disconnect switch; however, control wiring to be responsibility of others unless shown otherwise on Drawings.
3. It shall be the responsibility of this Contractor to obtain the exact location and mounting heights of all junction boxes, outlets, conduit stubs, etc., from kitchen equipment supplier before installation of same. (NOTE: Locations shown on Drawings are only approximate and may vary with different equipment.)
4. Use "Sealtite" conduit and fittings for final connections to dishwashers, booster heaters, disposals, and other motor driven equipment.
5. Disconnect switches under sinks and counters to have NEMA 3R enclosures.
6. Coordinate all Nema plug, wire quantity/size, and receptacle configurations with Kitchen Contractor. Wiring of Temperature Control Equipment.
7. It shall be the responsibility of this Contractor, prior to rough-in of conduits serving kitchen equipment, to verify with respective equipment supplier the required minimum circuit ampacity, maximum over current protection, rough-in, and quantity of conductors serving the equipment. In the event changes are required from those shown on the Drawings, this information shall be brought to the attention of the Architect and authorization obtained from the Engineer in writing prior to proceeding with the necessary changes. It is understood that the cost difference to wire the equipment from that shown on the Contract Documents shall by born the General Contractor providing this kitchen equipment directly to Division 26.

H. Wiring of Temperature Controls: Temperature control wiring, regardless of voltage characteristics, is not the responsibility of this Contractor unless indicated as such on Electrical Drawings or herein described.

1. In general, the furnishing and installing of all temperature control devices and respective wiring shall be the responsibility of other Divisions.

I. Wiring of Motor Operated, Power Assisted, Automatic Doors/Partitions/Blinds/Projection Screens, or Security Type Doors (with card readers, proximity sensors, pushpads, 3-position momentary pushbuttons, magnetic locks, electric latches, electric hinges, power supplies, etc. specified in other sections):

1. All control devices, such as pushbuttons, limit switches, pushpads, power supplies, security devices, etc., shall be furnished in other Sections, and installed and wired by this Contractor, unless shown otherwise on the Electrical Drawings or Specifications.
2. Power wiring up to and including termination to the overhead door motor system main control panel, power supply, or junction box, and to the motor from same, if not factory prewired shall be the responsibility of this Contractor.
3. Refer to the Door Hardware Schedule in the drawings and Door Hardware Specification for a complete list of materials.
4. The flexible conduit required to serve as a raceway for the door contacts, magnetic locks, electric hinges, etc. must be concealed for all new construction. This includes close coordination between the G.C. and E.C. regarding installation of door frames and/or aluminum storefront.
5. It shall be the responsibility of this Contractor, prior to rough-in of conduits serving the above equipment, to verify with respective equipment supplier the required ampacity and quantity of conductors serving the equipment. In the event changes are required from those shown on the Drawings, this information shall be brought to the attention of the Architect and authorization obtained from the Engineer in writing prior to proceeding with the necessary changes. It is understood that the cost difference to wire the equipment from that shown on the Contract Documents shall by born the General Contractor providing this equipment directly to Division 26.
6. Electrical Contractor to coordinate with General Contractor or Owner supplying door hardware for all wiring and rough-in requirements.
7. Handicap push pad operators shall be furnished by the G.C. and installed and roughed-in by the E.C.
8. Vending, POS readers, Copy, and Laundry Readers shall be wired by the E.C.

J. Wiring of Elevators and Escalators:

1. Installation shall be in accordance with NEC Article 620.
2. Provide 4-pole shunt trip operated circuit breaker with 120 volt coil in panelboard serving elevator for elevator power. Provide final power terminations from panelboard to local fused disconnect device. Disconnect device to be equipped with external operating handle lockable in the "off" position. Verify exact size of circuit breaker, fused disconnect and fuses from "approved" elevator equipment submittals prior to ordering material. In no case shall circuit breaker size exceed values given in NEC 430.
3. Install local fused disconnect switch for 120 volt power to elevator cab lights, ventilation fans and GFCI receptacle on top of each cab. A separate branch circuit shall supply the cab-lights for each elevator.
4. Provide weatherproof switch, light, and receptacle in elevator pit for each elevator. Locate light fixture, switch and GFCI type receptacle in locations as directed by elevator installer. Switches and receptacles shall be provided with weatherproof “while-in-use” covers and plates. Light fixture shall be enclosed type with diffuser rated for high abuse. Provide

separate receptacle (GFCI type) and circuit for elevator shaft sump pump as required.

5. Provide elevator recall as indicated in Section 28 "Fire Alarm System."
6. Coordinate entire installation with elevator system installer prior to placing order for equipment.
7. Coordinate location of equipment installed in elevator pits and machine rooms with elevator system installer on-site prior to installation.
8. Coordinate connections and requirements between fire alarm system and elevator equipment.
9. Coordinate connections and requirements between preaction sprinkler system control panel and elevator equipment and fire alarm control panel.
10. It shall be the responsibility of this Contractor, prior to rough-in of conduits serving the elevator equipment, to verify with respective equipment supplier the required minimum circuit ampacity, maximum over current protection, rough-in, and quantity of conductors serving the equipment. In the event changes are required from those shown on the Drawings, this information shall be brought to the attention of the Architect and authorization obtained from the Engineer in writing prior to proceeding with the necessary changes. It is understood that the cost difference to wire the equipment from that shown on the Contract Documents shall by born the General Contractor providing this equipment directly to Division 26.

3.9 EXCAVATION, BACKFILL, AND COMPACTION

A. This Contractor shall provide all excavation, backfill, and compaction required for the work covered under this Division.

B. Excavation:

1. Verify the location of all underground piping, foundations and any other underground utilities before commencing work. Perform survey work and acquire existing drawings as required to determine existing conditions. All existing underground utilities shall be supported and protected from damage. Contact proper authorities and/or the local "Call Before You Dig" utility service prior to excavation. If there are any major discoveries, bring them immediately to the attention of the Architect and Owner prior to excavation. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
2. Acquire and/or review survey of site and testing boring data to assist in determining soil content.
3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation operations.
4. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut-off of services if lines are active.

5. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights. Where trenches cross roads, walks, or public thoroughfares, provide suitable barricades and bridges adequately protected by signs or red flags during day and lights at night.
6. Excavation shall be made to the proper depths. If excavation is carried below that required, the bottom shall be brought to the required elevation with sand fill, thoroughly compacted.
7. Slope sides of excavations to comply with local codes and ordinances.
8. Shoring and Bracing: Establish requirements for trench shoring and bracing to comply with local codes and authorities. Shore and brace as required for stability of excavation. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Remove shoring and bracing when no longer required. Where sheeting is allowed to remain, cut top of sheeting at an elevation of 30 inches below finished grade elevation.
9. Install sediment and erosion control measures, such as silt fences, in accordance with local codes and ordinances.
10. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area. Do not allow water to accumulate in excavations. Remove water to prevent softening of bearing materials. Provide and maintain dewatering system components necessary to convey water away from excavations. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey surface water to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.
11. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage. Locate and retain soil materials away from edge of excavations. Do not store within drip-line of trees indicated to remain.
12. Remove off of Owner’s property and legally dispose of excess excavated materials and trash, debris and waste materials not acceptable for use as backfill or fill.
13. Excavation for Underground Vaults and Electrical Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot; plus a sufficient distance to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.
14. Excavation for Equipment Pads: Provide excavation for concrete pad and required aggregate backfill according to contour lines provided by Civil Engineer.
15. Excavate, by hand, areas within drip-line of large trees. Protect the root system from damage and dry-out. Maintain moist conditions for root system and cover exposed roots with burlap. Paint root cuts of 1 inch in diameter and larger with emulsified asphalt tree paint.
16. Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of 6 inches clearance on both sides of raceways and equipment.
17. Limit the length of open trench to that in which installations can be made and the trench backfilled within the same day.

18. Where rock is encountered, first attempt to break up rock with rocker trencher, jackhammer, or other heavy machinery as required. Consult with Owner prior to using any explosive materials. Carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of raceways and equipment. Provide a minimum of 6 inches of stone or gravel cushion between rock bearing surface and electrical installations.
19. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 deg F (1 deg C).
20. When excavation is required underneath an existing roadway, coordinate with Owner/Utility whether or not boring is required in lieu of excavation.
21. Where conduits pass below footings, install steel pipe sleeves (unless the conduits are required to turn up on the adjacent exterior wall) with at least 2" clearance all around conduit and fill excavation to the bottom of the footing with concrete. Where conduits pass through subgrade walls, install steel pipe sleeves with at least 2" clearance all around conduit. Fill annular space around conduit with inorganic compressible filler to provide a watertight seal.
22. Where holes are to be drilled for direct buried poles or the like, use hand or machine powered auger to proper depth required by manufacturer.
23. Ducts shall be pitched to drain toward manholes and handholes and away from buildings and equipment. Minimum slope shall be 4 inches per 100 linear feet. Where necessary to achieve this between manholes, ducts shall be sloped from a high point in the run to drain in both directions.

C. Backfill:

1. Backfilling and Filling: Place soil materials in layers to required subgrade elevations for each area classification listed below, using materials specified below:

    a. Backfill around conduits in bottom of trench shall be clean sand, unless otherwise indicated to be concrete. Provide a 3” separation between each conduit and between the conduits and the trench. Utilize PVC base and intermediate spacers to accomplish separation. Secure spacers to trench and to conduits with tie wire to ensure conduits do not shift during backfill installation.
    b. Backfill above conduits to subgrade shall consist of existing suitable dirt backfill, unless otherwise noted. Existing backfill shall be free of trash, rock, or other debris. Existing excavated materials may be used in the sentence above, provided it can be readily compacted.
    c. Concrete backfill shall be required around conduits when feeder conduits (not for branch circuits, unless otherwise noted) pass under a roadway or parking lot or are otherwise indicated herein or on the drawings. Concrete reinforcing steel cages (of #4 rebar) are also required around concrete encased conduits when indicated herein or on the drawings. Where concrete encasing is required around the conduits passing underneath a roadway or parking lot, provide a course

interlocking aggregate stone backfill above the concrete encasement to subgrade.

2. Backfill excavations as promptly as work permits, but not until completion of the following:

   a. Inspection, testing, approval, and locations of underground utilities have been recorded.
   b. Removal of concrete formwork.
   c. Removal of shoring and bracing, and backfilling of voids.
   d. Removal of trash and debris.

3. Place backfill and fill materials evenly adjacent to structures, conduit, and equipment to required elevations. Prevent displacement of raceways and equipment by carrying material uniformly around them to approximately same elevation in each lift.
4. Underground Line Warning Tape: Refer to Section 260553 "Identification for Electrical Systems" for specific types of warning tape. Install warning tape during backfill at 6-8" below sub-grade.
5. Inspection: Backfilling shall not be made until wiring or conduit has been inspected by Architect/Engineer.

D. Compaction:

1. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification specified below. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
2. Placement and Compaction: Place backfill and fill materials in layers of not more than 8 inches in loose depth for material compacted by heavy equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
3. Compaction: Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below.

   a. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture-density relationship (cohesive soils), determined in accordance with ASTM D 1557 and not less than the following percentages of relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).

      1. Areas Other Than Under Building or Pavement: Compact top 6 inches of subgrade and each layer of backfill or fill material to 85 percent maximum density for cohesive soils, and 90 percent relative density for cohesionless soils.

   b. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly

apply water. Apply water in minimum quantity necessary to achieve required moisture content and to prevent water appearing on surface during, or subsequent to, compaction operations.

4. Subsidence: Where subsidence occurs at electrical installation excavations during the period 12 months after Substantial Completion, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.

3.10 FIRE STOPPING

A. All fire and smoke rated walls/floors/partitions penetrated by electrical raceways, exposed conductors, etc. shall be properly sleeved and fire sealed. Perform fire stopping to re-establish the original fire resistance rating of the assembly at the penetration. Refer to architectural drawings for all fire rated floors and walls for location, hour rating, and construction type. Verify with Architect the ratings of existing walls and floors to determine the proper U.L. assembly required.

B. All fire stopping will be installed in accordance to the U.L. rated system and State requirements designed for the application.

C. Insulation types specified in other sections shall not be installed in lieu of fire stopping material specified herein. Fire stopping can be accomplished by using a combination of UL approved materials and devices, including penetrating raceway, cable tray, or cables, required to make up a complete approved fire stop installation. Rock wool may be partially utilized for larger opening voids, when it does not void the U.L. listed assembly.

D. Unapproved grout, mortar, or gypsum products shall not be installed in lieu of fire stopping material specified herein.

E. Sleeves: Install sleeves during the erection of concrete or masonry walls. Sleeve shall be grouted in using material to match surrounding surface. Install electrical raceway, exposed conductors, etc. through sleeve and install fire stopping, intumescent material.

F. Contractor to verify that cabling and other penetrating elements and supporting devices have been completely installed and temporary lines and cables have been removed prior to fire stopping installation.

G. Contractor to perform all necessary coordination with other trades constructing floors, walls, or other partitions of building construction with respect to size and shape of each opening to be constructed, wall/floor construction type, and device or system approved for use in each instance.

H. Coordinate each firestop selection with adjacent work for dimensional or other interference and for feasibility. In areas accessible to

public and other "finished" areas, firestop systems work shall be selected, installed, and finished to the quality of adjacent surfaces of building construction being penetrated.

I. Provide damming materials, plates, wires, restricting collars, and devices necessary for proper installation of fire stopping. Remove combustible installation aids after fire stopping material has cured.

J. Assemblies consisting of individual steel hat type restricting collars filled with intumescent type materials that completely surround communications penetration shall be used for nonmetallic raceways and cabling.

K. Provide daily sign off in a formalized log on site of each penetration created and firestopped.

L. Provide fire stopping in the following areas at a minimum:

1. Where penetrations including conduit, cable, wire, or other elements which pass through one or both outer surfaces of a fire rated floor or wall.
2. Except for floor on grade, where a penetration occurs through a structural floor or roof and a space would otherwise remain open between the surfaces of the penetration and the edge of the adjoining structural floor or roof.
3. Where a penetration occurs through fire-rated walls, or partitions of hollow-type construction, provide fire stopping to completely fill spaces around the penetration, on each side of the wall or partition.
4. These requirements for penetrations shall apply whether or not sleeves have been provided, and whether or not penetrations are to be equipped with escutcheons or other trim. If penetrations are sleeved, fire stop annular space, if any, between sleeve and wall opening.
5. Apply fire stopping to all electrical penetration voids in wall or floor or between sleeve and penetrating material left over from the demolition phase, whether the voids were existing or created by this Contractor.
6. If required by inspecting authorities:

    a. Expose and remove fire stopping to the extent directed by inspecting authority to permit his or her inspection.
    b. Reinstall new fire stopping and restore Work where removed for inspection.

7. Apply watertight fire stopping sealant between cables and associated conduit penetrations into a manhole. Wrap exposed cables in manhole with approved fire-wrapping tape.
8. Apply fire stop putty around 4″ square outlet boxes serving opposite rooms but sharing a common fire rated wall, where the boxes are less than 24″ apart (edge to edge), regardless of whether they are separated by metal studs or not.

3.11 GRADING AND PLANTING

A. Restore surface features, including vegetation, at areas disturbed by Work of this Division 26. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by excavation, trenching, storing of dirt, cable laying, cutting of roadway or sidewalk, and other activities to their original condition to the satisfaction of the Architect. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Section 02 "Landscaping." Maintain restored surfaces.

3.12 INTENT OF DRAWINGS AND SPECIFICATIONS

A. The implied and stated intent of the drawings and specifications is to establish minimum acceptable quality standards for materials, equipment and workmanship, and to provide operable electrical and mechanical systems in every respect.

B. The drawings are diagrammatic only, intending to show general arrangement and location of system components. Due to the small scale of the drawings, and to unforeseen job conditions, all required offsets and fittings may not be shown, but shall be provided at no change in contract price.

C. All work shall be accurately laid out and coordinated with other trades to avoid conflicts and to provide maximum accessibility for operation and maintenance.

3.13 LUG RATINGS

A. All wiring lugs used throughout the project, including but not limited to: overcurrent protection devices, switchgear lugs, wiring device terminals, motor terminals, equipment terminals, etc. shall be rated for use with 75 degree minimum conductors.

3.14 PAINTING AND CAULKING

A. Coordinate and schedule painting of exposed raceways, boxes, and fittings with G.C. to avoid unnecessary trips by the G.C. and/or their subcontractor. All field painting shall be performed by the G.C. according to Division 09 “Finishes” unless otherwise noted herein or on the drawings.

B. Suitable finish coatings shall be provided under this section of the Specifications on all items of electrical equipment and wiring which are exposed. This shall consist of either an approved factory applied finish or an acceptable finish applied during or after installation. Equipment which is furnished in finishes such as stainless steel or satin aluminum is not to be painted. Exposed equipment and/or wiring in finished areas such as panel covers or surface raceway shall be supplied with factory applied prime coat and shall be professionally painted or enameled as directed to result in a completely coated and

attractively finished manner. All such finishing shall be as directed and shall be satisfactory to the Architect/Engineer.

C. All factory-finished steel surfaces; boxes, enclosures, etc., shall be cleaned and retouched or repainted as necessary to provide a rust-resistant coating. Where painting or galvanizing is not specifically specified, ferrous devices, bolts, nuts, inserts, etc., shall be galvanized.

D. All nameplates and specially colored electrical equipment (such as fire alarm devices) shall be left unpainted and in a clean condition.

E. Coordinate installation of wiring devices and covers with G.C. to avoid overspray onto devices and/or covers. Provide temporary protection over the wiring devices, if installed ahead of painting, as required to prevent such overspray.

F. All caulking shall be performed by the G.C. unless otherwise noted herein or on the drawings. G.C. shall be responsible for caulking, and then painting, around all openings in walls that the G.C. cut larger then the device cover plate will cover up.

G. Where new electrical metallic equipment (i.e. surface raceway, conduit, boxes, panelboard tubs, etc. and not non-metallic surface raceway) is exposed on walls or ceilings to be painted, E.C. shall coordinate the timeliness of this work with the G.C. to ensure all is painted.

3.15 ROUGH-IN

A. In general, individual mounting heights of outlets, switches, etc. are not noted on the drawings. Details and notes specify “standard” mounting heights for these items. Contractor shall carefully study elevations of all walls and cabinet work as shown on architectural plans and locate outlets to given space and avoid all conflicts. Outlets shall always be located above, and not in, backsplashes. Coordinate location of outlets with other trades to avoid conflicts. Any conflict that cannot be resolved in the field shall be brought to the attention of the Architect prior to rough-in.

B. In general, the electrical drawing symbols and locations are not shown to an exact scale for legibility reasons. Field verify with Architect prior to rough-in, exact location and mounting heights of all electrical items such as switches, receptacles, clocks, speakers, call-in stations, fire alarm devices, nurse call stations, television outlets and associated receptacles, voice/data outlets, cctv monitors and cameras, floor boxes, poke-through assemblies, surface mounted raceways, wall mounted light fixtures, light poles, overhead projectors, etc., in all finished areas.

C. In general, where voice/data outlets and cable tv outlets and associated power receptacles are shown near each other but on separate plans, they shall be located adjacent to each other no more than 12” apart.

D. Verify with respective equipment supplier or Contractor prior to rough-in, exact location, electrical characteristics, and method of connection to respective equipment for such items as mechanical/plumbing/fire protection/kitchen/laundry/pool equipment, etc.

E. Where coursing of masonry block precludes the specified mounting height of an outlet such that the rough-in box would be located in the center of a cell, Contractor shall have the ability to adjust mounting heights slightly to work out with the coursing so that the rough-in box sits on the bottom or top of a course.

F. Refer to lintel schedule on Structural Drawings for requirements when penetrating wall with raceways.

3.16 SITE VISITS

A. All persons proposing to submit quotations for work in accordance with these plans and specifications are expected to visit the site of the work covered by the plans and specifications and are to familiarize themselves with existing conditions as they affect the work of this section of the specifications. Claims resulting from a failure to visit the site or inspect the existing conditions will not be considered. Existing wall/floor thicknesses and types shall be verified for required penetrations. Existing head-end equipment for low voltage systems being reused shall be verified by the prospective (sub) Contractors to ensure that they include any and all necessary equipment and programming costs in their Bid. Where existing switchgear is being modified or added onto, Contactor shall verify existing equipment and requirements for modifications/additions.

3.17 SLEEVES FOR ABOVE GRADE RACEWAYS AND CABLES

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies. Refer to architectural drawings for fire rated wall/floor area locations and ratings.

B. Coordinate sleeve selection and application with selection and application of fire stopping specified in this section.

C. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

D. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

E. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).

2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

F. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

G. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

H. Extend sleeves installed in walls 2 inches (50 mm) past each side of the wall.

I. Size pipe sleeves at two trade sizes bigger than the penetrating conduit unless seismic criteria require a different clearance.

J. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

K. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 "Joint Sealants" for materials and installation.

L. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials.

M. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible “Pate” boot-type flashing units applied in coordination with roofing work.

N. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

O. Sleeves shall not share openings with any other penetration (i.e. ductwork).

3.18 SLEEVE SEALS FOR BELOW GRADE RACEWAYS AND CABLES

A. Install cast-iron “wall pipes” to seal underground, exterior wall penetrations.

B. Use 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 1-inch (25-mm) annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.19 TEMPORARY PROTECTION OF ELECTRICAL EQUIPMENT

A. This contractor shall temporarily protect all electrical equipment from construction dust, dirt, debris, overspray, mud, etc. This equipment includes but it not limited to: sensitive electronic devices such as fire alarm and voice/data equipment, indirect/direct suspended light fixtures, indirect/direct recessed light fixtures, parabolic louvered light fixtures, wiring devices, etc. Contractor shall remove temporary covering for testing purposes and once the final building cleanup has been performed.

3.20 TEMPORARY POWER AND LIGHTING

A. The E.C. shall provide temporary 120/208/240 volt, single phase power and lighting for useage by all trades during construction until the permanent power is activated.

B. Temporary electrical panels shall be provided on each floor at a minimum or otherwise required to be reached from a 100’ extension cord.

C. Special three phase temporary power or circuits larger than 60 amps required by other trades shall be acquired through a portable generator from that specific trade and not from the E.C. unless they agree to do so at their expense.

D. Interior temporary lighting shall be provided in every working space and area of egress consisting of at least one 100 watt lamp per 100 square feet.

E. Exterior temporary lighting shall be provided where permanent site lighting is not yet available. Light towers powered from the temporary service or portable generators shall be provided for exterior site illumination as required for general vehicular and pedestrian traffic.

F. Temporary power distribution shall be provided in the form of multiple 20 amp, GFCI receptacles at the temporary panels or 20 amp, GFCI circuit breakers.

G. Install and maintain temporary utilities according to OSHA requirements.

H. Permanent light fixtures may be used for temporary lighting as long as they are relamped and cleaned upon Substantial Completion and there is no discernable damage to the fixture.

I. Remove all temporary wiring, lighting, and receptacles upon activation to permanent power. Patch all temporary penetrations with approved compound.

J. Temporary services ran underground must be installed in conduit and the temporary conductors shall be removed when the permanent service is on line.

K. Contractor shall provide temporary normal and life safety lighting fixtures, raceways, circuits, etc. as required for any temporary protective construction canopies installed over existing exterior egress paths.

3.21 TEMPORARY POWER USEAGE FEES

A. The Contractor, at his/her own expense, shall make arrangements for the purchase of power or portable power and provide (or coordinate with the Utility) for the extension of Utility power to the point of usage. The usage costs of temporary electrical power shall be included in the Bid by the G.C., unless otherwise noted in Division 01.

END OF SECTION 260500

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

B. Related Sections include the following:

1. Section 260500 "Common Work Results for Electrical" for related firestopping work.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Qualification Data: For testing agency.

C. Field Quality-Control Test Reports: From Contractor.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

C. Wiring and Cabling: Listed by an “approved” third-party testing agency.

D. Comply with NEMA WC 3 for rubber insulated wire and cable, WC 5 for thermoplastic insulated wire and cable, and WC 7 for crosslinked polyethylene insulated wire and cable.

E. All wire and cable shall be listed by an “approved” third-party testing agency.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 CONDUCTORS AND CABLES

A. Manufacturers:

1. American Insulated Wire Corp.; a Leviton Company.
2. Essex Electric.
3. General Cable Corporation.
4. Senator Wire & Cable Company.
5. Southwire Company.

B. Conductor Material: Solid copper conductor for power and lighting circuits No. 10 AWG and smaller, copper stranded for power and lighting circuits No. 8 AWG and larger. Copper stranded conductors shall be allowed for all low voltage systems wiring.

C. Conductor Insulation Types: Type THHN-THWN, XHHW, and SO.

D. Multiconductor Cable: Metal-clad cable, Type MC and Type SO with ground wire. Refer to Part 3 for acceptable installation methods.

E. Maximum Conductor Size: 500 KCMIL. Coordinate wire size with lug manufacturers.

F. Minimum Power and Lighting Conductor Size: #12 AWG.

G. Temperature Rating: All conductors shall be rated at 90 degrees C, unless otherwise noted.

H. Voltage Rating: Power wiring (120-480 Volts operating) must be 600 Volts. Low voltage systems wiring operating at 24 Volts or less can be 300 Volts, unless located in the same compartment as the power wiring.

2.3 CONNECTORS AND SPLICES

A. Manufacturers:

1. AFC Cable Systems, Inc.
2. AMP Incorporated/Tyco International.
3. Hubbell/Anderson.
4. Ideal.
5. Ilsco.
6. O-Z/Gedney; EGS Electrical Group LLC.

7. Thomas & Betts.
8. 3M Company; Electrical Products Division.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR AND INSULATION APPLICATIONS

A. Service Entrance: Type THHN-THWN, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and in Crawlspaces: Type THHN-THWN, single conductors in raceway.

E. Exposed Branch Circuits, including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions, up to Junction Box: Type THHN-THWN, single conductors in raceway or MC Cable.

G. Branch Circuits Concealed in Ceilings, Walls, and Partitions, Home run from Junction Box to Panel: Type THHN-THWN, single conductors in raceway.

H. Branch Circuits Concealed in Concrete and below Slabs-on-Grade: Type THHN-THWN, single conductors in raceway.

I. Underground Feeders and Branch Circuits: Type THHN-THWN, single conductors in raceway.

J. Cord Drops and Portable Appliance Connections: Type SO, hard service cord.

K. Fire Alarm Circuits: Type THHN-THWN and power-limited, fire-protective, signaling circuit cable, in raceway.

L. Class 1 Control Circuits: Type THHN-THWN, in raceway.

M. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.2 INSTALLATION

A. Conceal cables within raceways, unless otherwise indicated.

B. 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.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Unless otherwise noted, all cables at exposed ceilings or walls shall be concealed in conduit. If allowed by Engineer, install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Where exposed cables are not installed in cable trays and allowed in other sections of the project documents, they shall be supported by j-hooks. J-hooks shall be sized according to the cable fill capacities published by the manufacturer and allowed by NEC and/or BISCI. J-hooks shall be supported by rigid all thread to the structure and not tie wire or ceiling wire. Cables shall not be supported by the following methods: strapped to outside of a cable tray, strapped to a conduit or pipe, lay on the ceiling surface, lay on structural supports, lay on light fixtures, etc.

F. Seal around cables penetrating fire-rated elements according to 260500 "Common Work Results for Electrical."

G. Seal around cables penetrating from roofs or from the exterior through a wall or floor with duct seal.

H. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

I. **Voltage Drop:** Conductors for branch circuits shall be sized to prevent a voltage drop exceeding three percent at the farthest outlet, fixture, motor, or equipment load. Conductors for panel feeder circuits shall be sized to prevent a voltage drop exceeding two percent at the panelboard. Total maximum voltage drop on both feeders and branch circuits to the farthest outlet shall not exceed five percent. **Voltage drop criteria specified in this paragraph and the table below shall override standard wire sizes for associated circuit breakers that may be shown on the panelboard schedules on the drawings.**

J. **Voltage Drop Table:** Using a 20 amp branch circuit as an example, all wiring shall be in accordance with the following minimal values listed in this table:

Voltage:	Distance:	Home Run:	Remainder of Circuit:
120/208 V	0′ – 50′	#12	#12
	50′ – 100′	#10	#12
	100′ – 150′	#8	#10
	150′ – 250′	#6	#10
277/480 V	0′ – 125′	#12	#12
	125′ – 220′	#10	#12

220'- 330'	#8	#10

K. Provide no more than three current carrying conductors (hot circuits), three dedicated neutral conductors, and one equipment grounding conductor in any conduit homerun, unless directed by this Engineer.

L. The number of conductors in each run of conduit is indicated on the drawings and where there is a conflict between the number of wires indicated and the actual number required as determined by the functional design requirements, the number of wires determined by the functional design requirements shall govern.

M. The branch circuit wiring has been designed to utilize the advantages of multi-wire (3H + 3N + 1G) distribution and shall be installed substantially as indicated on the drawings. No major changes in the grouping or general routing of the branch circuits shall be made without the approval of the Engineer in writing. Branch circuit changes, once made, shall be updated on the as-built drawings and panelboard directories.

N. Install a dedicated neutral conductor for each phase (hot) conductor for each dimmed lighting circuits.

O. Install a dedicated neutral conductor for each GFI branch circuit.

3.3 CONNECTIONS

A. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

B. Install electrical connections in accordance with equipment manufacturer's written instructions and with recognized industry practices, and complying with applicable requirements of UL, NEC and NECA's "Standard of Installation" to ensure that products fulfill requirements.

C. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.

D. Cover splices with electrical insulating material equivalent to, or of greater insulation resistivity rating and mechanical strength, than electrical insulation rating of those conductors being spliced.

E. Prepare wires/cables, by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where wires/cables are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid "ringing" copper conductors while skinning wire.

F. Trim wires/cables as short as practicable and arrange routing to facilitate inspection, testing and maintenance.

G. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturers published torque tightening values for equipment connectors. Accomplish tightening by utilizing proper torquing tools, including torque screwdriver, beam-type torque wrench, and ratchet wrench with adjustable torque settings. Where manufacturer's torquing requirements are not available, tighten connectors and terminals to comply with torquing values contained in UL's 486A.

H. Joints in solid conductors shall be spliced using Ideal “wirenuts”, 3M Company “Scotchlok”, or T&B “Piggy” connectors in indoor and dry location junction boxes, outlet boxes, and lighting fixtures.

I. Joints in stranded conductors shall be spliced by approved mechanical connectors (such as split bolts) and gum rubber tape or friction tape. Solderless mechanical connectors for splices and taps, provided with UL approved insulating covers, may be used instead of mechanical connectors plus tape.

J. Joints in outdoor locations such as handholes, pole light bases, ground mounted light fixtures, wireways, junction boxes, etc. shall be spliced by approved mechanical connectors, such as split bolts and gum rubber tape or friction tape or “Ilsco” type connectors.

K. “Sta-kon” style permanent crimp ring or fork connectors shall not be used for stranded conductor branch circuit connections.

L. Conductors, in all cases, shall be continuous from outlet to outlet, device to device, box to box, etc. and no splicing shall be made except within outlet or junction boxes, troughs, and gutters.

M. For electric motors 5 HP and above, provide connection at junction point prior to flexible connection with either copper split bolts or ring terminal bolts and nuts as wire nuts are not acceptable.

N. Train and route cables terminating in a loadcenter, panelboard, switchboard, switchgear, etc. directly from the raceway to the respective termination point (OCPD or bar) with as few bends as possible. Bend the cable prior to termination neatly and consisting with bend radius according to manufacturer’s recommendations.

O. Provide a minimum 12” slack loop on all low voltage devices prior to termination at the device. This includes recessed ceiling speakers, recessed occupancy sensors and power packs, voice/data outlet, security devices, nurse call devices, fire alarm devices, etc.

3.4 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.

2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.

B. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
4. Provide copy of test reports in the O&M closeout information.

END OF SECTION 260519

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

B. Related Sections include the following:

1. Section 260519 “Low-Voltage Electrical Power Conductors and Cables” for grounding cable work.
2. Section 262726 “Wiring Devices” for grounding work relating to these devices.
3. Division 26 Sections relating to “Switchgear” for grounding work relating to these pieces of equipment.

1.3 DEFINITIONS

A. Test Well: A below-the-surface enclosure used in connection with accessing ground rod connections in non-grassy surface areas into which an individual can reach, but not enter, for the purpose of installing, maintaining or operating equipment or wiring.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

C. Field Test Reports: Submit written test reports to include the following:

1. Test procedures used.
2. Testing equipment make, model, and serial number along with date last calibrated.
3. Test results that comply with requirements.

4. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1. Comply with UL 467.

B. Comply with NFPA 70; for overhead-line construction and medium-voltage underground construction, comply with IEEE C2.

C. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

D. Comply with NEC Article 517; for Healthcare projects.

E. Comply with NEC Article 680: for Swimming Pool, Water Fountain, or Therapeutic Tub projects.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Grounding Conductors, Cables, Connectors, and Rods:

a. Apache Grounding/Erico Inc.
b. Chance/Hubbell.
c. Erico Inc.; Electrical Products Group.
d. Harger Lightning Protection, Inc.
e. Heary Brothers Lightning Protection Co.
f. Ideal Industries, Inc.
g. ILSCO.
h. Kearney/Cooper Power Systems.
i. O-Z/Gedney Co.; a business of the EGS Electrical Group.
j. Raco, Inc.; Division of Hubbell.
k. Thomas & Betts, Electrical.

2.2 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Material: Copper.

C. Equipment Grounding Conductors #6 AWG and smaller: Insulated with green-colored insulation the entire distance.

D. Equipment Grounding Conductors #4 AWG and larger: Insulated with black-colored insulation the entire distance and taped with green tape at all exposed or accessible locations.

E. Grounding Electrode Conductors: Stranded cable.

F. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

G. Bare Copper Conductors: Comply with the following:

1. Solid Conductors: ASTM B 3.
2. Assembly of Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.

H. Copper Bonding Conductors: As follows:

1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch (6.4 mm) in diameter.
2. Bonding Conductor: No. 4 AWG minimum, stranded copper conductor.
3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.
4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.

I. Ground Conductor and Conductor Protector for Wood Poles: As follows:

1. No. 4 AWG minimum, soft-drawn copper conductor.
2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir, or cypress or cedar.

J. Grounding Buss:

1. Bare, electrolytic tough pitch 10 alloy copper bars of rectangular cross section.
2. 2-3/4” deep stand-off insulators constructed of glass reinforced thermoset polyester.
3. Wall mounted with 3/8” hardware.
4. Minimum size of 12” x 4” x 2-3/4” using ¼” buss bar.
5. 7/16” diameter lug holes.
6. Spacing of lugs to be three (3) rows of five (5) columns. Center to center spacing to be ¾”, 1”, and 1-3/4” for two hole grounding lugs.
7. Meets UL467.

2.3 CONNECTOR PRODUCTS

A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

B. Bolted Connectors: Two hole, irreversible compression type.

C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

2.4 GROUNDING ELECTRODES

A. Ground Rod Material: Copper-clad steel.

B. Ground Rods: Sectional type, when required to achieve proper grounding measurement.

1. Size: 3/4 by 120 inches (19 by 3000 mm) in diameter.

C. Ground Plate Material: Copper bronze with tabs for ground wire connection.

D. Ground Plate Size: 24” x 24” x 1/4” thick.

E. Chemical Electrodes: Copper tube, straight or L-shaped, filled with nonhazardous chemical salts, terminated with a 4/0 bare conductor. Provide backfill material recommended by manufacturer.

2.5 TEST WELLS

A. Test Well Description:

1. Heavy duty high traffic area test well constructed from 12-3/4" OD concrete.
2. Each test well comes with a cast iron lid marked "Ground" and has a cast iron ring to support the lid. Lids shall be provided with security bolts.
3. Test well base length to extend past the frost line depth.

PART 3 - EXECUTION

3.1 APPLICATION

A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.

B. In raceways, use insulated equipment grounding conductors.

C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells.

D. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

E. Ground Rod Clamps at Test Wells: Use bolted pressure clamps with at least two bolts.

F. Grounding Bus: Install in all electrical and telecommunications equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Use insulated spacer; space 1 inch (25.4 mm) from wall and support from wall 6 inches (150 mm) above finished floor, unless otherwise indicated.

3.2 EQUIPMENT GROUNDING CONDUCTORS

A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

B. Install equipment grounding conductors in all conduits for circuits over 100 volts, except service entrances, telecommunications, and audio/video conductor raceways.

C. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for low voltage system cables or designated as service entrance raceways.

D. Air-Duct Equipment Circuits: Install an equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners and heaters. Bond conductor to each unit and to air duct.

E. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install an equipment grounding conductor to each electric water heater, heat-tracing, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.

F. Signal and Communication Systems: For voice and data equipment rooms, and other communication systems head end equipment, provide No. 6 AWG minimum insulated grounding conductor in raceway from main building service grounding electrode system to each service location, terminal cabinet, wiring closet, central equipment location, and/or supplemental telecommunications room grounding bus bar.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-10-inch (6.4-by-101.6-by-254-mm) copper grounding bus bar.
2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

G. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.

H. Common Ground Bonding with Lightning Protection System: Bond main building service grounding system 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.

I. Service Entrance Panels: Provide bonding bushings and bonding conductors between bushings and equipment ground bar for any rigid steel conduits that are stubbed up into the bottom of the panel.

3.3 INSTALLATION

A. Ground Rods: Install at least one rod at the service entrance (or three if shown on a drawing detail). Provide additional rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, as required to meet maximum ground rod resistance criteria of 25 ohms.

1. Drive ground rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.
2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.
3. Where soil conditions preclude the installation of ground rods, ground plates may be installed. The ground plates shall be a minimum of 30” deep BFG.

B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance. Provide bonding jumpers at all steel expansion joints for continuity. Bonding jumpers shall be used around concentric or eccentric knockouts that are punched or otherwise formed so as to impair the electrical connection to ground.

D. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to within 5’ from where the main metal water service entrance is to the building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

E. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.

F. Structural Steel: Provide exothermic connection to a structural steel member and connect to the main electrical service grounding bar. Provide bonding jumpers at each and any structural steel expansion joint and point where steel is not entirely connected together.

G. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.

H. Where a ground rod connection is buried below a finished concrete or asphalt area, install a test well for each ground rod. Set top of well flush with finished grade or floor.

I. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within the base of the foundation. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to a grounding electrode external to concrete.

J. Provide a grounding jumper and secure to each junction and outlet box with wiring over 100 Volts and splice to the integral equipment grounding conductor.

K. Provide a #10 AWG grounding jumper between each and every vertical section of modular furniture and screw to the metal framing.

3.4 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
6. Scrape off painted finish to expose steel surface on structure and water piping when making bonding connections.

B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to

housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

E. Connections at Test Wells: Use compression-type connectors on conductors and make bolted- and clamped-type connections between conductors and ground rods.

F. Tighten screws and bolts for grounding and bonding 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 and UL 486B.

G. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

H. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.5 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING

A. Manholes and Handholes: Install a driven ground rod close to wall and set rod depth so 4 inches (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide a 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 tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.

B. Connections to Manhole Components: Connect 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 conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

C. Pad-Mounted Transformers and Switches: For primary power services, install two ground rods and counterpoise circling pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with primary switches and substations by connecting them to underground cable and grounding electrodes.

D. Pad-Mounted Transformers and Switches: For secondary power services, install a vertical 1” PVC conduit below grade during pad construction for utility company’s use in grounding.

3.6 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
2. Test grounding system at each location where a maximum ground-resistance level is specified: at each ground rod, at service disconnect enclosure grounding terminal, and at ground test wells. Disconnect the ground conductor from the ground rods to the main service ground reference point, prior to testing. Measure ground resistance not less than two full days after the last trace of precipitation, and without the 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. Perform tests in all new buildings or additions, by the three point fall-of-potential method according to IEEE 81. Perform tests in all existing buildings, by the two point method.
3. Provide drawings locating each 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. Include nameplate information from testing equipment and last date calibrated. Describe measures taken to improve test results.

   a. Maximum Reading: 25 ohms.

4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and provide additional ground rods to achieve specified rating.

END OF SECTION 260526

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01 and all Division 26 Specification Sections, apply to this Section.

B. Related Sections include the following:

1. Section 260500 "Common Work Results for Electrical" for concrete foundation work.

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Vibration isolation requirements for electrical equipment and systems.
3. Seismic restraints for electrical equipment and systems.
4. Construction requirements for concrete bases.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. Seismic Restraint: A structural support element such as a metal framing member, a cable, an anchor bolt or stud, a fastening device, or an assembly of these items used to transmit seismic forces from an item of equipment or system to building structure and to limit movement of item during a seismic event.

1.4 SUBMITTALS

A. Product Data: Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of electrical support and seismic-restraint component used.

1. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
2. Annotate to indicate application of each product submitted and compliance with requirements.

B. Shop Drawings: Indicate materials and dimensions and identify hardware, including attachment and anchorage devices, signed and sealed by a qualified professional engineer. Include the following:

1. Fabricated Supports: Representations of field-fabricated supports not detailed on Drawings.

2. Seismic Restraints: Detail anchorage and bracing not defined by details or charts on Drawings. Include the following:

a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
b. Details: Detail fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events.
c. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

C. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

D. Welding certificates.

E. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC and SMACNA, as dictated by the Architectural/Structural Engineering drawings, unless requirements in this Section are more stringent.

B. Testing of Seismic Anchorage Devices: Comply with testing requirements in Part 3.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 PROJECT CONDITIONS

A. Seismic Design Category as Defined in the IBC: See Structural Drawings.

B. Seismic Use Group as Defined in the IBC: See Structural Drawings.

C. Seismic Importance Factor: 1.0 for all non-life safety equipment and 1.5 for all life safety equipment.

D. Verify all seismic criteria with Architect prior to installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified below.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed under this Project. Verify with Structural Engineer the minimum structural safety factor times the applied force.

B. Steel Slotted Support Systems: Comply with MFMA-3, factory-fabricated components for field assembly.

1. Manufacturers:

a. Cooper B-Line; a division of Cooper Industries.
b. ERICO International Corporation.
c. Allied Support Systems; Power-Strut Unit.
d. GS Metals Corp.
e. Michigan Hanger Co., Inc.; O-Strut Div.
f. Thomas & Betts Corporation.
g. Unistrut; Tyco International, Ltd.

2. Finishes:

a. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-3.
b. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-3.
c. Painted Coatings: Manufacturer's standard green painted coating applied according to MFMA-3.

3. Size: 1-5/8” x 1-5/8”, 12 gauge, minimum.

C. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- (14-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c., in at least 1 surface.

1. Manufacturers:

a. Allied Support Systems; Aickinstrut Unit.
b. Cooper B-Line; a division of Cooper Industries.
c. Fabco Plastics Wholesale Limited.
d. Seasafe, Inc.

2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
3. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
4. Rated Strength: Selected to suit structural loading and applicable seismic forces.
5. Size: 1-5/8” x 1-5/8”, 12 gauge, minimum.

D. Raceway and Cable Supports: As described in NECA 1.

E. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

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: Not allowed for Seismic Design Category D, E, or F. If permitted by Structural Engineer, Architect, and Owner, provide 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. Manufacturers:

1) Hilti, Inc.
2) ITW Construction Products.
3) MKT Fastening, LLC.
4) Simpson Strong-Tie Co. Inc.
5) Ramset/Redhead.

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. Provide anchors that are seismically approved and properly selected, based on design calculations through the center or gravity. Anchor bolts must be embedded and spaced in accordance with ICBO standards.

a. Manufacturers:

1) Cooper B-Line; a division of Cooper Industries.
2) Hilti, Inc.
3) ITW Construction Products.
4) MKT Fastening, LLC.
5) Powers Fasteners.

3. Concrete Inserts: Steel or malleable-iron slotted-support-system units similar to MSS Type 18; complying with MFMA-3 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, high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type for hollow masonry walls.
7. Hanger Rods: Threaded steel.
8. Drop-In Anchors: Carbon steel with bolt insert for solid concrete walls and floors.
9. Nail-In Anchors: Zamac alloy with carbon steel drive pin.
10. Machine Screws or Self-Tapping/Self-Drilling Screws: For metal surfaces.
11. Wood Screws: For wood construction.

2.3 SEISMIC-RESTRAINT COMPONENTS

A. Rated Strength, Features, and Application Requirements for Restraint Components: As defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed under this Project. Verify with Structural Engineer the minimum structural safety factor times the applied force.

B. Angle and Channel-Type Brace Assemblies: Steel angles or steel slotted-support-system components; with accessories for attachment to braced component at one end and to building structure at the other end.

C. Cable Tray Restraints: Provide separate 45 degree angled bracing to the structure every 30 linear feet and at each change in direction.

D. Cable Restraints: ASTM A 603, zinc-coated, steel wire rope attached to steel or stainless-steel thimbles, brackets, swivels, and bolts designed for restraining cable service.

1. Manufacturers:

a. Amber/Booth Company, Inc.
b. Loos & Co., Inc.
c. Mason Industries, Inc.

2. Seismic Mountings, Anchors, and Attachments: Devices as specified in Part 2 "Support, Anchorage, and Attachment Components" Article, selected to resist seismic forces.

3. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or reinforcing steel angle clamped to hanger rod, of design recognized by an agency acceptable to authorities having jurisdiction.

4. Bushings for Floor-Mounted Equipment Anchors: Separate double acting seismic snubbers with Neoprene cushioned interfaces designed for seismically rated rigid equipment mountings, and matched to type and size of anchor bolts and studs used.

5. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to type and size of attachment devices used.

2.4 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. It is not the intent of these documents to clearly indicate every individual hanger and support required. Contractor shall provide hangers and supports as required for manufacturer’s recommendations and code requirements.

B. Comply with NECA 1 for application of hangers and supports for electrical equipment and systems, except if requirements in this Section are stricter.

C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for conduit as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support 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 trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction

2. Secure raceways and cables to these supports with two-bolt conduit clamps single-bolt conduit clamps single-bolt conduit clamps using spring friction action for retention in support channel.

E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

F. Use steel slotted U-channel in most all applications, except corrosive, wet, and outdoor locations where nonmetallic shall be used.

3.2 SUPPORT AND SEISMIC-RESTRAINT INSTALLATION

A. Comply with NECA 1 and Civil Engineering drawings and specifications for installation requirements, except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, conduit may be supported by openings through structure members, as permitted in NFPA 70. Conduits sized 2-1/2" and larger to have special seismic support design including angle iron type bracing.

C. Install seismic-restraint components using methods approved by the evaluation service providing required submittals for component.

D. 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. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

E. 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, or pneumatic-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick. Verify with Structural Engineer prior to installation.
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. Install additional blocking in metal stud walls to support heavy wall mounted equipment such as transformers, distribution panelboards, transfer switches, etc.

F. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

G. Junction and outlet boxes: Provide two studs to secure box to wall or ceiling in lieu of one.

H. Support all ceiling mounted equipment independently to the building structure (i.e. recessed light fixtures, recessed ceiling speakers, etc.). Provide at least four twists on the ceiling wire when tying up a piece of equipment.

I. Supports for floor mounted transformers, switchgear, transfer switches, etc: Provide neoprene rubber type isolators under each corner of the unit between the unit and the concrete base.

J. Supports for generators: Provide pneumatic air type isolators under each corner of the unit between the unit and the concrete base.

K. In seismic areas, conduit 2-1/2” and larger must be braced, when supported more than 12” below structure.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and seismic criteria at Project.

B. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so expansion anchors will be a minimum of 10 bolt diameters from edge of the base.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of the base.
2. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
6. Use 2500-psi (17.2-MPa), 28-day compressive-strength concrete for all concrete ductbanks. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete for all transformer pads. Use 4000-psi (27.6-MPa), 28-day compressive-strength concrete for all

light pole bases. Concrete materials, reinforcement, and placement requirements are specified in Section 260500 "Common Work Results for Electrical."

C. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

D. 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.

E. Restraint Cables: Provide slack within maximums recommended by manufacturer.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

3.5 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Make flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross expansion and seismic-control joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to electrical equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.6 FIELD QUALITY CONTROL

A. Testing: Test pullout resistance of seismic anchorage devices.

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 post connection 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. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

B. Record test results.

END OF SECTION 260529

SECTION 26 05 33

RACEWAYS, BOXES, AND FITTINGS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, cabinets, floor service outlets, poke-through assemblies, service poles, and multi-outlet assemblies for electrical wiring.

B. Related Sections include the following:

1. Section 260500 "Common Work Results for Electrical" for supports, anchors, identification products, access panels, and firestopping.
2. Section 260529 "Hangers and Supports for Electrical Systems" for seismic restraints and bracing of raceways, boxes, enclosures, and cabinets.
3. Section 262726 "Wiring Devices" for devices installed in boxes and for floor-box service fittings.

1.3 ABBREVIATIONS/DEFINITIONS

A. AC: Armored cable.

B. Duct Bank: A group of two or more ducts in a continuous run between two points.

C. EMT: Electrical metallic tubing.

D. ENT: Electrical nonmetallic tubing.

E. FMC: Flexible metal conduit.

F. GRC: Galvanized rigid steel conduit.

G. IMC: Intermediate metal conduit.

H. LFMC: Liquidtight flexible metal conduit.

I. MC: Metal clad cable.

J. PVC: Polyvinylchloride conduit.

K. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Product Data: For conduit fittings, surface raceways and components, wireways and fittings, floor boxes, poke-through assemblies, hinged-cover enclosures, and cabinets.

B. Shop Drawings: Signed and sealed by a qualified professional engineer.

1. Design Calculations: Calculate requirements for selecting seismic restraints.
2. Detail assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

C. Coordination Drawings: Coordinate with all trades to provide elevation drawings and reflected ceiling plans drawn to scale for coordinating congested areas and ceiling-mounted items, when requested by the Architect. Show the following:

1. Cable trays, lighting fixtures, feeder conduits, HVAC ductwork, HVAC piping, fire sprinkler piping, etc.
2. Ceiling suspension assembly members.
3. Method of attaching hangers to building structure.
4. Size and location of initial access modules for acoustical tile.
5. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, detectors, and special moldings.

D. Manufacturer Seismic Qualification Certification: Submit certification that enclosures, cabinets, accessories, and components will withstand seismic forces defined in Section 260529 "Hangers and Supports 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.

   a. 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."

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.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, cable tray, and partition assemblies.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below 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 20, but no fewer than one.
2. Floor Service Outlet Assemblies: One for every 20, but no fewer than one.
3. Poke-Through, Fire-Rated Outlet Assemblies: One for every twenty floor service outlets installed, but no fewer than one.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 METAL CONDUIT, TUBING, AND FITTINGS

A. Manufacturers:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Anamet Electrical, Inc.; Anaconda Metal Hose.
4. Electri-Flex Co.
5. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
6. LTV Steel Tubular Products Company.
7. Manhattan/CDT/Cole-Flex.
8. O-Z Gedney; Unit of General Signal.
9. Shamrock.

10. Wheatland Tube Co.

B. Galvanized Rigid Steel Conduit: ANSI C80.1.

1. Fittings: Use heavy duty threaded double locknut rigid steel conduit fittings along with thermoplastic bushings in a non-threaded hub installation, unless otherwise indicated. Set screw fittings are not permitted.

C. IMC Conduit: ANSI C80.6.

1. Fittings: Use heavy duty threaded double locknut rigid steel conduit fittings along with thermoplastic bushings in a non-threaded hub installation, unless otherwise indicated. Set screw fittings are not permitted.

D. EMT and Fittings: ANSI C80.3.

1. Fittings: Steel hexagonal compression type with insulated throat bushings. Set screw, die cast, and indented type fittings are not permitted. Utilize thermoplastic bushings and heavy duty steel locknuts as well.

E. FMC: Zinc-coated steel.

1. Fittings: Stamped steel, zinc plated, squeeze type with insulated throat bushings. Set screw and die cast are not permitted.

F. MC: Interlocking steel metallic tape flexible armor with factory installed cables.

1. Fittings: Stamped steel construction, zinc electroplated, squeeze or snap-in type with insulated throat bushings. Set screw and die cast are not permitted.

G. LFMC: Liquidtight flexible steel conduit with PVC jacket.

1. Fittings: Malleable iron, zinc plated, compression type with insulated throat. Die cast are not permitted.

2.3 NONMETALLIC CONDUIT AND TUBING

A. Manufacturers:

1. American International.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arnco Corp.
4. Cantex Inc.
5. Certainteed Corp.; Pipe & Plastics Group.
6. Condux International.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.

11. RACO; Division of Hubbell, Inc.
12. Southern Pipe Company.
13. Spiralduct, Inc./AFC Cable Systems, Inc.
14. Thomas & Betts Corporation.

B. ENT: NEMA TC 13.

C. Rigid Non-Metallic Ducts and Fittings, Schedule 40 and 80: NEMA TC-2, Federal Specifications WC 1094A and UL 651 and to be UL listed.

D. Rigid Non-Metallic Ducts and Fittings, Type EB-20 (For Concrete Encasement): Tested to UL-651-A, ETL listed, NEMA TC-6 and ASTM F-512.

E. Rigid Non-Metallic Ducts and Fittings, Type EB-35 (For Concrete Encasement): NEMA TC-8 and ASTM F-512.

F. Rigid Non-Metallic Ducts and Fittings, Type DB-60 (For Direct Burial or Concrete Encasement): NEMA TC-6, ASTM F-512.

G. Rigid Non-Metallic Ducts and Fittings, Type DB-120 (For Direct Burial or Concrete Encasement): NEMA TC-8, ASTM F-512.

H. ENT and RNC Fittings: NEMA TC 3; match to conduit or tubing type and material as recommended by respective manufacturer.

I. Non-metallic conduit solvents and sealants to be as recommended by manufacturer of respective conduit manufacturer.

2.4 METAL WIREWAYS

A. Manufacturers:

1. Cutler Hammer.
2. Hoffman.
3. Square D.

B. Material and Construction: Sheet metal sized, shaped, and NEMA rating as indicated.

C. Fittings and Accessories: Include 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. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

E. Wireway Covers: Hinged type for indoor. Flanged-and-gasketed type for outdoor.

F. Finish: Manufacturer's standard enamel finish.

2.5 NONMETALLIC WIREWAYS

A. Manufacturers:

1. Hoffman.
2. Lamson & Sessions; Carlon Electrical Products.
3. Stahlin.

B. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.

C. Fittings and Accessories: Include 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. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

2.6 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating.

1. Manufacturers:

a. Hubbell Incorporated; Wiring Device-Kellems.
b. Walker/Wiremold Company (The).
c. Thomas & Betts/Steel City Corporation.

B. Types, sizes, and channels as indicated and required for each application.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, dividers, covers, wire supports, external 90s, internal 90s, entrance end fittings, and other fittings to match and mate with wireways as required for complete system.

2.7 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. Emerson/General Signal; Appleton Electric Company.
3. Erickson Electrical Equipment Co.
4. Hoffman.
5. Hubbell, Inc.; Killark Electric Manufacturing Co.
6. O-Z/Gedney; Unit of General Signal.
7. RACO; Division of Hubbell, Inc.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet-PLM Division.
10. Spring City Electrical Manufacturing Co.
11. Thomas & Betts Corporation.

12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1. Minimum outlet box size 4” square by 1-1/2” deep. Gangable masonry boxes are to be minimum 3” deep.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinged cover and flush latch.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.

H. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

I. Where concentric, eccentric or over-sized knockouts are encountered, a bonding bushing shall be provided.

2.8 FLOOR BOXES

A. Manufacturers:

1. Floor Boxes:

a. FSR, Inc.
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Walker/Wiremold Company (The).
d. Thomas & Betts/Steel City Corporation.

B. Floor Boxes: Cast iron metal or stamped steel, fully adjustable, rectangular for ground floor locations.

C. Floor Boxes: Nonmetallic, nonadjustable, round for ground floor locations.

D. Type: Modular, flush-type with recessed activation cover, dual-service units suitable for wiring method used.

E. Compartments: Barrier separates power from voice, data, catv, or sound cabling.

F. Service Plate: Rectangular, solid brass or polycarbonate.

G. Power Receptacle: NEMA WD 6, Configuration 5-20R, unless otherwise indicated.

H. Floor Boxes: Entire housing shall be removable for unrestricted access to all connector locknuts inside base. The unit shall provide for a minimum of 1 7/8" pre-pour adjustment and 3/4" post-pour adjustment for leveling. Provide quantity of power receptacles, voice/data outlets, microphone outlets, cable television outlets, etc. as indicated on the drawings. Where low voltage outlets are used, provide standard Decora (GFI) or 106 Frame (Duplex) type device brackets for use with standard floor box covers as coordinated with telecom installer. Provide all required dividers/compartments, device brackets, coverplate inserts, coverplates, etc. for a complete installation.

2.9 POKE-THROUGH OUTLET ASSEMBLIES

A. Manufacturers:

1. Poke-Through Outlet Assemblies:

   a. Hubbell Incorporated; Wiring Device-Kellems.
   b. Thomas & Betts/Steel City Corporation.
   c. Walker/Wiremold Company (The).

B. Standards: All poke through assemblies must meet the "Scrub Water Exclusion" requirements of UL 514 A & C.

C. Description: Factory fabricated and wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service outlet assembly.

1. Service Outlet Assembly: Flush type with either one duplex receptacle and space for four (4) RJ-45 jacks or with threaded opening for flexible conduit whip connection. Refer to drawings for requirements.

2. Size: Selected to fit nominal 3-inch (75-mm) cored holes in floor and matched to floor thickness.
3. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
4. Closure Plug: Arranged to close unused 3-inch (75-mm) cored openings and reestablish fire rating of floor.
5. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors; and a minimum of two, 4-pair, Category 6 voice and data communication cables.
6. Compartments: Barrier separates power from voice, data, catv, or sound cabling.
7. Service Cover and Flange Plate: Round, polycarbonate or solid brass.

8. Provide quantity of power receptacles, voice/data outlets, microphone outlets, cable television outlets, etc. as indicated on the drawings. Where low voltage outlets are used, provide standard Decora (GFI) or 106 Frame (Duplex) type device brackets for use with standard floor box covers as coordinated with the telecom installer. Provide all required dividers/compartments, device brackets, coverplate inserts, coverplates, etc. for a complete installation.

2.10 MULTIOUTLET ASSEMBLIES

A. Manufacturers:

1. Multioutlet Assemblies:

a. Hubbell Incorporated; Wiring Device-Kellems.
b. Walker/Wiremold Company (The).
c. Thomas & Betts/Steel City Corporation.

A. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

B. Raceway Material: Steel or aluminum with color as coordinated with Architect.

C. Wire: No. 12 AWG.

D. Devices: 15 amp, 125 volt simplex receptacles on 6” centers the entire length of the raceway.

E. Verify mounting height with architect.

2.11 TELEPHONE/POWER POLE ASSEMBLIES

A. Manufacturers:

1. Telephone/power pole assemblies:

a. Hubbell Incorporated; Wiring Device-Kellems.
b. Walker/Wiremold Company (The).
c. Thomas & Betts/Steel City Corporation.

B. Description: 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.

1. Poles: Nominal 2.25-inch- (57-mm-) square cross section, with height adequate to extend from floor to at least 6 inches (150 mm) above ceiling, and with separate channels for power wiring and voice and data communication cabling.
2. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment. Verify ceiling height with Architect.

3. Finishes: Steel or aluminum with color as coordinated with Architect.
4. Wiring: Sized for minimum of fifteen No. 12 AWG power and ground conductors; and a minimum of fifteen, 4-pair, Category 6 voice and data communication cables.
5. Power Receptacles: Multiple, as indicated duplex, 20-A, heavy-duty, NEMA WD 6, Configuration 5-20R units.

6. Voice and Data Communication Outlets: Multiple RJ-45 voice/data jacks, as indicated.

2.12 FACTORY FINISHES

A. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard prime-coat finish ready for field painting.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors:

1. Exposed: GRC or IMC.
2. Concealed: GRC or IMC.
3. Underground, Single Run: RNC.
4. Underground, Grouped: RNC.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

6. Boxes and Enclosures: NEMA 250, Type 3R or 4X.

B. Indoors:

1. Exposed in unfinished areas: GRC or IMC where subject to physical damage (such as conduit installed on floors or up to a surface mounted device or panel from underground) or EMT.
2. Exposed in finished areas (where existing wall prohibits fishing conduit down the walls): Metallic surface raceway with surface raceway style boxes. EMT conduit with standard 4” square boxes is not allowed, unless otherwise directed in the field.
3. Elevator pits: GRC or IMC with FS type boxes.
4. Concealed in metal stud partition: EMT.
5. Concealed in masonry partition: RNC.
6. Concealed in wood partition: EMT.
7. Concealed above finished ceiling: EMT.
8. Underground or in Bedding Material: RNC.
9. Concealed within Concrete Slab: RNC or EMT with compression fittings where subject to space limitations only. Verify with Structural Engineer when attempting to locate within slab above grade.
10. Connection to Vibrating Equipment such as Transformers and Fan Equipment): FMC; except use LFMC in damp or wet locations.

11. Connection to Vibrating Equipment such as Pump Equipment): LFMC.
12. Connection to from one individual junction box to one individual lighting fixture: FMC or MC.
13. Damp or Wet Locations: GRC or IMC.
14. Tight to Bottom of Roof Deck: GRC or IMC.
15. Fire Pump Raceways on the Line Side of the Controller and Fire Pump Control Raceways: GRC or IMC. In addition if the raceways do not originate in the same room they must be: encased in concrete if underground or be wrapped in 1-hour rated fire-tape if overhead.
16. Fire Pump Raceways on the Load Side of the Controllers and Jockey Pump Raceways: GRC or IMC or MI and LFMC.
17. Boxes and Enclosures: NEMA 250, Type 1, except as follows:

    a. Damp or Wet Locations: NEMA 250, Type 3R or 4X.

C. Minimum Indoor Non-Flexible Raceway Size: 3/4-inch trade size (DN 20). Minimum Outdoor Raceway Size: 3/4-inch trade size (DN 20). Obey these dimensions despite what might be indicated on the panelboard schedules on the drawings.

3.2 INSTALLATION

A. The use of MC cable (for other than light fixture whips) shall have written authorization by the Engineer prior to installation. If allowed, it shall be limited to in wall or above ceiling application up to a junction box within the same room.

B. Electrical raceways shall be supported independently from any other trade’s supports or existing supports to the structure. E.C. shall provide strut as required between beams or bar joists that span between a required support location. E.C. shall provide strut as required underneath elements such as ductwork to independently support their electrical equipment, such as light fixtures.

C. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

D. Complete raceway installation before starting conductor installation.

E. Support raceways as specified in Section 260529 "Hangers and Supports for Electrical Systems".

F. Install temporary closures to prevent foreign matter from entering raceways, boxes, panels, light fixtures, smoke detectors, etc. during construction. Provide duct tape over masonry rough-in boxes during construction to prevent mortar and other debris from entering box. Remove all temporary protection for final device trim out and when the job conditions are conducive.

G. Protect stub-ups from damage where conduits rise through floor slabs. Coordinate depth of conduits penetrating above/below footings with the structural drawings to ensure proper bend radius when conduit turns up through floor. Arrange so that no part of the bend in the conduit shall be visible from above the floor.

H. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.

I. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated. Notify Architect and Engineer prior to installation if conduit or boxes are to be exposed, other than that shown on the drawings.

J. Raceways Embedded in Slabs: Install in middle 1/3 of slab thickness where practical and leave at least 2 inches (50 mm) of concrete cover, when available.

1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
2. Space raceways laterally to prevent voids in concrete.
3. Run conduit larger than 1-inch trade size (DN 27) parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
4. Change from nonmetallic tubing to GRC or IMC before rising through the floor (such as an underground conduit homerun to a panelboard).
5. Utilize ½" EMT with compression fittings only where dictated by concrete pour space limitations, upon pre-approval of the Engineer.

K. Change from nonmetallic tubing to GRC or IMC before rising above grade to a utility pole.

L. Install exposed and concealed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.

1. Run parallel or banked raceways together on common supports.
2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

M. Join raceways with fittings designed and approved for that purpose and make joints tight.

1. Use insulating bushings to protect conductors.

N. Tighten set screws of threadless fittings with suitable tools.

O. Terminations:

1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two heavy-duty locknuts, one inside and one outside box.
2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

P. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Label pull wire at origination end (i.e. cable tray or panelboard).

Q. Pull or Junction Boxes: Install raceways in maximum lengths of 150 feet (45 m). Install telecommunication conduits with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes, along with access panels if required, where necessary to comply with these requirements.

R. Non-Hazardous Locations: Install raceway seal-off fittings at suitable, approved, and accessible locations and fill them with UL-listed ductseal 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 at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces and penetrations outside of building including roof.
2. Where otherwise required by NFPA 70.

S. Hazardous Locations: Install raceway seal-off fittings at suitable, approved, and accessible locations and fill them with UL-listed "Chico" 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 at the following points:

1. Where conduits pass from one Class and Division location to another.
2. Where otherwise required by NFPA 70.

P. Stub-up Connections: Extend conduits through concrete floor for connection to surface mounted or freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conduits to the equipment (such as surface mounted panelboards) with rigid steel conduit; LFMC may be used 6 inches (150 mm) above the floor to vibrating equipment. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections. When transitioning up from underground slab on grade below to above grade (whether exposed or concealed), provide rigid steel conduit ells.

Q. Flexible Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations and connections to pumps. Install separate ground conductor across flexible connections. Tie up flexible conduit light fixture whips above ceiling with metal clips such as made by Caddy or tie wire to the structure so that it does not rest on the ceiling.

R. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals. Verify mounting height with architect on all surface raceways prior to rough-in. All surface raceways are to be supported a minimum of every eight (8) linear inches with one anchor for single compartment raceway and two separate anchors for dual compartment raceway. Where surface raceways butt up against each other at an intersecting wall or around a column, Contractor shall use factory internal and external radius fittings and not stop the raceways and butt them up against each other.

S. Floor Boxes and Poke-Through Assemblies: Set units level and flush with finished floor surface. Verify exact locations with Architect/Owner prior to rough-in. Do not scale locations from the drawings. Adjust locations of floor service outlets, poke-through assemblies, service poles, and associated service pole junction boxes to suit arrangement of partitions and furnishings. Provide either cast iron or PVC floor boxes for devices on a grade floor. Provide poke-through assemblies for boxes on floors above grade. Where a poke-through assembly(ies) cannot be provided to accomplish the task, a stamped steel floor box may be provided in this instance. E.C. shall provide rough opening sizes to G.C. for them to box out for floor boxes installed above grade. Provide all required firestopping, additional gypsum board, rockwool, etc. for boxes/poke-throughs above finished floor to retain the fire rating of the floor. Provide core-drilled opening in concrete floor for poke-through assemblies at the diameter recommended by the poke-through manufacturer. Coordinate with the Architect and Structural Engineer prior to installation of any floor boxes or poke-throughs installed in existing concrete floors for structural integrity or coordination of any existing post stress rebar concealed within floors. Install floor boxes and poke-throughs on 24” minimum centers per UL requirements. Coordinate any further spacing requirements with Structural Engineer. E.C. shall coordinate audio/visual and voice/data/video jacks/connectors supplied by others with floor box and/or poke-through assembly manufacturer for compliance.

T. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

U. Separate raceways: Provide separate raceways for conductors of different voltage systems (i.e. 480/277 volt versus 208/120 volt versus sub 100 volt systems). Provide separate raceways, including fixture whip drops, for the normal power and emergency power systems.

V. Burial Depth: Exterior branch circuit conduits in grassy areas shall have a minimum cover of 18 inches (457 mm). Exterior feeder and service entrance conduits in grassy areas shall have a minimum cover of 36 inches (914 mm). Exterior conduit ductbanks encased in concrete shall have a minimum cover of 30 inches (762 mm). Coordinate burial depths with contour lines and new elevations indicated on the drawings.

W. In general, all conduits passing under concrete or asphalt roads, parking lots, driveways, etc. and service entrance conduits shall be

encased in concrete. Refer to the drawings for other exact locations of concreted encased ductbanks.

X. Conduit Fittings: The use of condulets shall minimized. Provide cast iron body and gasketing for all exterior uses and aluminum and gasketing for all interior uses. Where necessary to use condulets sized above 2”, mogul units shall be installed. Notify Engineer prior to installation. The use of conduit pulling fittings is not permitted. A short 180 degree “u-shaped” bend between two adjacent rough-in boxes is not an acceptable solution.

Y. Service entrance conduit penetrations and entrances into buildings to be in galvanized steel, heavy wall conduit. Transform from non-metallic ducts to steel at a minimum of 10 feet from building. Use fittings manufactured for the purpose.

Z. Concrete-encased conduits to have reinforcing steel when passing through excavations and disturbed earth. Coordinate duct bank with structural design at wall so duct bank is supported at wall without reducing structural or watertight integrity.

AA. Non-encased, direct buried exterior conduits entering non-waterproofed walls to have a galvanized, heavy wall steel pipe sleeve for each duct installed by the Electrical Contractor. Caulk sleeve between sleeve and conduit with duct sealing compound on both sides for moisture-tight seal, to satisfaction of Architect.

BB. Where exterior conduits enter a building or structure through a waterproofed floor or wall or below grade, provide a watertight entrance-sealing device, with sealing gland assembly on the inside. Refer to Section 260500 "Common Work Results for Electrical" for information regarding these sleeves. Device to be securely anchored into the masonry construction with one or more integral flanges and membrane waterproofing secured to the device in a permanently watertight manner.

CC. Where conduits are indicated to be non-metallic, stub-ups to be galvanized heavy wall steel and to extend 5 feet away from pad or equipment. Encase with 3-inch concrete envelope. Provide insulating bushings on stubs.

DD. Provide temporary closure at all ends of exterior conduits which are to be active. Spare exterior conduits to have permanent seals at all openings, to allow for future use. Sealing compound and plugs to withstand 15 psi minimum hydrostatic pressure.

EE. Deliver conduits to site with ends capped, and store with supports to prevent bending, warping and deformings.

FF. Wireways: Provide metallic wireways for all indoor dry applications.

GG. Where a conduit penetrates a wall and must be terminate at a surface mounted junction box, the junction box shall not be located off of the wall the depth of the conduit connector or more. The vertical conduit shall be terminated in a flush junction box and the box shall be brought out to the surface with (an) extension ring(s) for

continuation of the conduit. Junction boxes that are spaced off a wall more than the length of a conduit connector are not acceptable, unless structural conditions do not permit this installation.

HH. Maintain 3” minimum spacing between conduits in a ductbank and between conduits and the edge of the ductbank with PVC intermediate spacers. Maintain 3” minimum spacing between the lowest row of conduits in a ductbank and the earth with PVC base spacers. Conduits and PVC spacers shall be securely anchored during concrete placement in a ductbank to prevent movement through the use of rebar and non-metallic fasteners such as nylon zip ties. Provide spacers to prevent sags in conduit at least every 10 feet.

II. Secure vertical conduits along wall entering or exiting distribution equipment through the use of strut and strut straps.

JJ. Coordinate any floor and wall penetrations through new walls with Architect and Structural Engineer prior to installation. Provide steel lintels for wall openings 24 inches wide or greater.

KK. Where conduits of any type pass over a building expansion joint, a standard “expansion joint fitting,” compatible with the type raceway being used, shall be provided.

LL. Waterproof marking cord with 130 lb tensile strength and marked every ten feet shall be installed in all exterior underground ducts, including spares, after thoroughly rodding, clearing, and swabbing all lines free of any and all obstructions.

MM. Exterior underground ducts shall be sealed at terminations, using sealing compound and plugs, as required to withstand 15 psi minimum hydrostatic pressure.

NN. All electrical devices shall be mounted to an approved electrical rough-in box, unless otherwise noted.

OO. Junction boxes suspended more than 36” from a wall or ceiling, require a dedicated minimum ¼” all thread support to the structure.

PP. Obey the NEC for all minimum conduit support distances.

QQ. Flexible conduit installed above ceilings for light fixture whips shall not touch the ceiling grid and shall be supported by the use of a caddy clip or tie wire.

RR. For all exterior conduits mounted on flat rubber roofs or ran along ground in aggregate base (such as a mechanical courtyard), provide 4” x 4” wood blocking with rubber bases or Styrofoam blocking with insert for strut support at a maximum of every 7 feet for each conduit support and secure conduit to blocking with two hole conduit strap on wood block or strut strap on Styrofoam blocking.

SS. Provide Caddy type metallic box supports between metal studs for supporting of electrical boxes rigidly on both sides, in lieu of securing box only on one side with right angle Caddy type box support.

TT. Provide Caddy type "through the stud conduit support" with two screw fasteners for all conduits routed through metal stud openings, both horizontal and vertical, to eliminate conduit rattle.

UU. All conduit shall be rigidly supported with either one hole straps, two hole straps, minerallac straps, strut straps, etc. Conduit shall not be supported with tie wire, ceiling wire, or tape.

VV. The electrical drawings do not specifically indicate gypsum board thickness or wall thickness. The Contractor shall coordinate and provide all required plaster rings, masonry rings, extensions, etc. for a flush outlet box rough-in with the wall thickness.

WW. Provide flanged coverplate for all recessed screw cover or hinged cover junction boxes in wall that is at least 1" larger than the junction box itself in all four directions to conceal the gap around the junction box opening (i.e. A/V junction boxes). Caulk and paint around coverplate and wall with materials to match adjacent wall finish.

3.3 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.4 CLEANING

A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

B. Wipe down all exposed surface raceways.

C. Clean out all floor boxes for dust and debris.

D. Rod all underground conduits with a mandrel 1/4-inch smaller in diameter than the internal diameter of respective duct, prior to backfill. Remove any indicated obstructions.

END OF SECTION 260533

SECTION 26 09 23

LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 26 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes occupancy sensors and programmable time clocks:

1. Indoor occupancy sensors.

B. Related Sections include the following:

1. Section 26 "Interior Lighting" for lighting control coordination.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. PIR: Passive infrared.

C. US: Ultrasonic.

D. DT: Dual technology.

E. BACnet: A networking communication protocol that complies with ASHRAE 135.

F. BAS: Building automation system.

G. DALI: Digital addressable lighting interface.

H. LonWorks: A control network technology platform for designing and implementing interoperable control devices and networks.

I. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling and power-limited circuits.

J. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.

K. PC: Personal computer; sometimes plural as "PCs."

L. Power Line Carrier: Use of radio-frequency energy to transmit information over transmission lines whose primary purpose is the transmission of power.

M. RS-485: A serial network protocol, similar to RS-232, complying with TIA/EIA-485-A.

1.4 REFERENCES

A. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE)

1. C62.41-1991 – Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.

B. ASTM International (ASTM) ()

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) ().

1. CSA C22.2 # 14 Industrial Control Equipment
2. CSA C22.2 # 184 Solid-State Lighting Controls

D. International Electrotechnical Commission ().

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) ():

1. 20 (2002) - Standard for Safety for General-Use Snap Switches.
2. 508 (1999) - Standard for Industrial Control Equipment.
3. 924 (2003) - Emergency Lighting and Power Equipment

1.5 SUBMITTALS

A. Product Data: For each type of product indicated herein including: occupancy sensors and time clocks, wiring diagrams, conductors and cables, provide catalog cut sheets with performance specifications demonstrating compliance with specified requirements.

B. Specification Conformance Document: Indicate whether the submitted equipment either:

1. Meets specification exactly as stated.
2. Meets specification via an alternate means and indicate the specific methodology used.

C. Shop Drawings: Show wiring and installation details for all components specific to this project.

1. Lighting plan showing location, orientation, and coverage area of each sensor.
2. Power, signal, and control wiring diagrams of each device and how it interconnects with the panels and fixtures.
3. Interconnection diagrams showing field-installed wiring vs. factory wiring.
4. Outline Drawings: Indicate dimensions, weights, arrangement of components, and clearance and access requirements.
5. Block Diagram: Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.
6. Load schedule of connected load, load type, voltage, circuit numbers, devices, wiring, zoning, and fixtures per area.

D. Coordination Drawings: Submit evidence that lighting controls in this Section are compatible with connected monitoring and control devices and systems specified in other Sections.

1. Show interconnecting signal and control wiring and interfacing devices that prove compatibility of inputs and outputs.
2. For networked controls, list network protocols and provide statements from manufacturers that input and output devices meet interoperability requirements of the network protocol.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

G. Software licenses and upgrades required by and installed for operation and programming of digital and analog devices.

H. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain lighting control module and power distribution components through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with 47 CFR, Subparts A and B, for Class A digital devices.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.7 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

B. Coordinate lighting control components to form an integrated interconnection of compatible components.

1. Match components and interconnections for optimum performance of lighting control functions.
2. Coordinate lighting controls with BAS. Design display graphics showing building areas controlled; include the status of lighting controls in each area.

1.8 WARRANTY

A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of lighting controls that fail in materials or workmanship or from transient voltage surges within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Failure of software input/output to execute switching or dimming commands.
   b. Failure of modular relays to operate under manual or software commands.
   c. Damage of electronic components due to transient voltage surges.

2. Warranty Period: One year from date of Substantial Completion.
3. Extended Warranty Period Failure Due to Transient Voltage Surges: Eight years.
4. Extended Warranty Period for Electrically Held Relays: 10 years from date of Substantial Completion.
5. Make ordering of new equipment for expansions, replacements, and spare parts available to end user.
6. Make new replacement parts available for minimum of ten years from date of manufacture.
7. Provide factory direct technical support hotline 24 hours per day, 7 days per week.
8. Provide on-site service support within 24 hours anywhere in continental United States and within 72 hours worldwide except where special visas are required.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Centralized Lighting Control Panel Basis-of-Design Product: Subject to compliance with requirements, provide Lutron Softswitch 128 or equal.

B. Localized Lighting Control Peripheral Products: Refer to the individual paragraphs for manufacturers.

2.2 GENERAL LIGHTING CONTROL DEVICE REQUIREMENTS

A. Line-Voltage Surge Protection: An integral part of the devices for 120- and 277-V solid-state equipment. For devices without integral line-voltage surge protection, field-mounting surge protection shall comply with IEEE C62.41 and with UL 1449 4th Edition, where indicated.

2.3 LOCALIZED INDOOR OCCUPANCY SENSORS (OPERATING INDEPENDENTLY OF THE CENTRALIZED LIGHTING CONTROL SYSTEM)

A. Manufacturers: Lutron or approved equal.

B. General Description: Wall- or ceiling-mounting, solid-state units as indicated on drawings, that work independently of the centralized lighting control system. All ceiling mounted occupancy sensors require a separate power/switch pack.

1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 60 minutes.
2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit. Provide spare set of contacts as a control point for Building Automation System.
3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
4. Mounting:

   a. Sensor: Suitable for mounting in any position on a standard outlet box.
   b. Relay: Externally mounted though a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
   c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
6. Bypass Switch: Override the ON function in case of sensor failure.

7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (215 to 2150 lx); keeps lighting off when selected lighting level is present.
8. Include ground wire.

C. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.

1. Detector Sensitivity: Detect occurrences of 6-inch (150-mm) minimum movement of any portion of a human body that presents a target of at least 36 sq. in. (232 sq. cm).
2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
3. Detection Coverage (Corridor): Detect occupancy within 90 feet (27 m) when mounted on a 10-foot- (3-m-) high ceiling.

D. Ultrasonic (US) Type: Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.

1. Detector Sensitivity: Detect a person of average size and weight moving at least 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. (56 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on an 8-foot- (2.4-m-) high ceiling.
4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. (186 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet (27 m) when mounted on a 10-foot- (3-m-) high ceiling in a corridor not wider than 14 feet (4.3 m).

E. Dual-Technology (DT) Type: Ceiling mounting; detect occupancy by using a combination of PIR and US detection methods in area of coverage. Particular technology or combination of technologies that controls ON and OFF functions shall be selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch (150-mm) minimum movement of any portion of a human body that presents a target of at least 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving at least 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.

2.4 TIME CLOCK - GENERAL

A. Provide hardware that is designed, tested, manufactured, and warranted by a single manufacturer.

B. Lighting Controls: Ten-year operational life while operating continually at any temperature in an ambient temperature range of 0° C (32°F) to 40° C (104°F) and 90 percent non-condensing relative humidity.

C. Designed and tested to withstand electrostatic discharges up to 15,000 V without impairmentper IEC 801-2.

2.5 TIME CLOCK - PERFORMANCE REQUIREMENTS

A. Electrolytic capacitors to operate at least 20° C below the component manufacturer's maximum temperature rating when device is under fully-loaded conditions in 40° C (104° F) ambient temperature.

B. Capable of withstanding repetitive inrush current of 50 times operating current without impacting lifetime of dimmer/relay.

C. Design and test relays to withstand line-side surges without impairment to performance.

1. Panels: Withstand surges without impairment of performance when subjected to surges of 6,000 volts, 3,000 amps per ANSI/IEEE C62.41B.

D. Utilize air gap off, activated when user selects “off” at any control to disconnect the load from line supply.

E. Possess power failure memory such that if power is interrupted and subsequently returned, lights will automatically return to same levels (on or off) prior to power interruption within 3 seconds.

F. Non-dim circuits to meet the following requirements:

1. Rated life of relay: Minimum 1,000,000 cycles.
2. Load switched in manner that prevents arcing at mechanical contacts when power is applied to load circuits.
3. Fully rated output continuous duty for inductive, capacitive, and resistive loads.

2.6 TIME CLOCK- DIAGNOSTICS AND SERVICE:

A. Replacing relay does not require re-programming of system or processor.

B. Relays: Include diagnostic LED’s to verify proper operation and assist in system troubleshooting.

C. Include tiered control scheme for dealing with component failure that minimizes loss of control for occupant.

1. If lighting control system fails, lights to remain at current level. Panel processor provides local control of lights until system is repaired.
2. If panel processor fails, lights to remain at current level. Circuit breakers can be used to turn lights off or to full light output, allowing non-dim control of lights until panel processor is repaired.
3. If relay fails, factory-installed mechanical bypass jumpers to allow each relay to be mechanically bypassed. Mechanical bypass device to allow for switching operation of connected load with relay removed by means of circuit breaker.

2.7 TIME CLOCK - LOW VOLTAGE CONTROL INTERFACES

A. Contact Closure Interfaces:

1. Where contact closures are used to integrate between lighting controls and other systems:

a. Input open circuit voltage not to exceed 36V.
b. Input short circuit current not to exceed 0.5 mA.
c. Mechanical contact closures to be dry contact rated.
d. Solid state contact closures:

1. Output off-state leakage current not to exceed 50mA.
2. Output on-state saturation voltage not to be less than 2V.

e. The contact closure input device will accept both momentary and maintained contact closures.

2.14 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG, complying with Section 26 "Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multi-conductor cable with stranded copper conductors not smaller than No. 18 AWG, complying with Section 26 "Conductors and Cables."

C. Class 1 Control Cable: Multi-conductor cable with stranded copper conductors not smaller than No. 14 AWG, complying with Section 26 "Conductors and Cables."

PART 3 - EXECUTION

3.1 OCCUPANCY SENSOR INSTALLATION

A. Install and aim sensors in locations to achieve at least 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

B. Do not install occupancy sensors within line of site of adjacent space visible through a doorway.

C. Do not install ceiling mounted occupancy sensors within six (6) feet of an air diffuser or grill.

D. All occupancy sensors and power packs shall be mounted to a junction box with plaster/mud ring. Provide t-bar support for rough-in box in lay-in ceilings. Grid ceiling mounted sensors shall be centered in the ceiling tile.

3.3 WIRING INSTALLATION

A. Wiring Method: Comply with Section 26 "Conductors and Cables."

B. Comply with NECA 1.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

D. Wiring Method: Install wiring in raceways. Comply with Section 26 "Conductors and Cables". Minimum conduit size shall be 3/4 inch.

E. Install field-mounting transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.

F. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

G. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

H. Identify components and power and control wiring according to Section 26 "Identification for Electrical Systems."

I. 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 and UL 486B.

J. If a toggle switch is being provided on the wall along with a ceiling mounted occupancy sensor, then wire the toggle switch downstream of the ceiling power/switch pack and upstream of the lighting switchleg

circuit. The power/switch pack shall constantly remain energized, but the lights will not be energized until the toggle switch is in the ON position and there is movement in the space.

K. Provide 120 Volt control power to all contactor coils, time clocks, photocells, and OS power packs, whether or not indicated on the drawings. For emergency egress lighting circuits driven by a lighting control system, provide emergency control power.

L. All low voltage wiring shall be installed in conduit.

M. Install unshared dedicated neutral conductors on line and load side of dimmer controls.

N. Install wall dimmers to achieve indicated rating after derating for ganging according to manufacturer's written instructions.

O. Group common dimmers under a single, multi-gang wall plates, whether or not indicated on drawings.

3.4 IDENTIFICATION

A. Identify components and power and control wiring according to Section 26 "Electrical Identification."

B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Test for circuit continuity.
2. Verify that the control module features are operational.
3. Check operation of local override controls and programmed zones.
4. Test system diagnostics by simulating improper operation of several components selected by the Commissioning Agent.

C. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.

D. Operational Test: Verify actuation of each sensor and adjust time delays.

E. Remove and replace lighting control devices where test results indicate that they do not comply with specified requirements.

F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose.

B. Initial Setting: Set the time delay on all occupancy sensors to 30 minutes minimum, unless otherwise directed. Confirm actual settings with Owner in the field.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, program, and maintain lighting controls. Refer to Section 26 "Basic Electrical Requirements."

END OF SECTION 260923

SECTION 26 24 16

PANELBOARDS

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. This Section includes the following:

1. Lighting and appliance branch-circuit panelboards.

B. Related Sections include the following:

1. Section 260526 "Grounding and Bonding for Electrical Systems" for additional grounding specification items.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. LIM: Line Isolation Monitor.

D. RFI: Radio-frequency interference.

E. RMS: Root mean square.

F. SPDT: Single pole, double throw.

1.4 SUBMITTALS

A. Product Data: For each type of panelboard indicate the accessories and components as noted on drawings or these specifications and place in alphabetical order of the designation name. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. The layout of overcurrent protection devices shall be in accordance with the schedules shown on the drawings, in lieu of manufacturer's standard layouts.

2. Provide ¼" scale plan view drawings of each electrical room indicating all switchgear, busways, feeders, and electrical equipment to verify NEC and manufacturer specific required clearances. Lack of submission of these coordination drawings at the time of shop drawing submittals relieves Engineer from future coordination issues.

3. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:

   a. Enclosure and cover types, mounting types, and details.
   b. Grounding bars.
   c. Nametags (not standard manufacturer's type).
   d. Panelboard layout diagrams.
   e. Bus configurations, bus material, current, voltage, phase, wire ratings.
   f. Short-circuit current full rating of panelboards and overcurrent protective devices.

   g. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

4. Wiring Diagrams: Power, signal, and control wiring.

C. Manufacturer Seismic Qualification Certification: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Section 260529 "Hangers and Supports for Electrical Systems". Include the following:

1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

   a. 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."

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.

D. Field quality-control test reports including the following:

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.

E. Panelboard Schedules: For installation in panelboards.

F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 260500 "Common Work Results for Electrical," 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.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated. Refer to Section 016000 "Product Requirements."

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NEMA PB 1.

E. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:

1. Ambient Temperature: Not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2000 m).

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet (2000 m).

1.7 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, and encumbrances to workspace clearance requirements.

B. Coordinate erection of recessed panelboards with wall erection. Coordinate erection of wall mounted panelboards with priming and painting of walls.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Six spares for each type of panelboard cabinet lock.

1.9 ELECTRICAL IDENTIFICATION

A. Refer to Section 260553 “Identification for Electrical Systems” and the drawing details for non-standardized nametag information.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:

a. Eaton
b. Siemens
c. Square D

2.2 MANUFACTURED UNITS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260529 “Hangers and Supports for Electrical Systems”.

B. Enclosures: Flush- and surface-mounted cabinets. NEMA PB 1, Type 1.

1. Rated for environmental conditions at installed location.

a. Outdoor Locations: NEMA 250, Type 3R.

2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.

3. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
4. Directory Card: Typewritten or computer generated card with transparent protective cover, mounted in metal frame or plastic frame, inside panelboard door.

C. Phase and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.

2. Equipment Ground Bus: Adequate capacity and size to accommodate all feeder and branch-circuit equipment ground conductors; bonded to box.

D. Conductor Connectors: Suitable for use with conductor material.

1. Main and Neutral Lugs: Mechanical type.
2. Ground Lugs and Bus Configured Terminators: Mechanical type.

3. Feed-Through Lugs: Mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
4. Sub-Feed Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

E. Service Equipment Label: UL labeled for use as service equipment for panelboards, when utilized as such.

F. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

2.3 PANELBOARD SHORT-CIRCUIT RATING

A. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Branch Overcurrent Protective Devices: Thermal-magnetic, molded-case, bolt-on circuit breakers, replaceable without disturbing adjacent units. Branch circuit breakers shall be rated at 80%, unless otherwise noted.

B. Doors: Hinged door within hinged door; secured with screw fasteners and with flush latch and tumbler lock; keyed alike.

2.5 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: 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. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity. Provide GFCI circuit breakers for all of the following whether or not indicated on the drawings: electric water coolers, heat trace, ice machines, and receptacles near water sources such as sinks.

B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment loads. Confirm breaker listings with circuiting.
3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator. Provide as indicated on the drawings.
4. Multipole units enclosed in a single housing or factory-assembled to operate as a single unit.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Comply with mounting and anchoring requirements specified in Section 260529 “Hangers and Supports for Electrical Systems”.

C. Mount top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.

D. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

E. Install overcurrent protective devices and controllers.

1. Set field-adjustable switches and circuit-breaker trip ranges under direction of Engineer.

F. Install filler plates in unused spaces.

G. For flush panelboards, stub 3/4-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub ¾-inch empty conduits into raised floor spaces. Provide spare conduit quantities equal to the number of single pole spares and spaces divided by three.

H. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

I. Provide a copy of the as-built electrical one line diagram in a clear glass frame next to the main service entrance panel.

J. Provide a 1” conduit from the panelboard meter (if applicable) to the BAS system.

K. Surface mounted panelboards can be installed on stand off strut as long as all clearances are maintained.

L. All spare circuit breakers shall be left in the OFF position.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads. Schedule a meeting with the Owner and obtain Owner’s final room naming and numbering scheme prior to creating directory, which may or may not match the contract drawings. Provide brief description of each circuit load and room number(s) being served and indicate on the directory. Use a computer or typewriter to create directory; handwritten directories are not acceptable. Revise existing panelboard schedules, as required, for a renovation project.

C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each panelboard supplying and exiting feeder.
2. Test continuity of each circuit.

B. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. 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.

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 as best as possible.

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 15 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.
5. Revise panelboard directories according to any shifting of circuits.

3.5 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 262416

SECTION 26 27 26

WIRING DEVICES

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. This Section includes the following:

1. Simplex and duplex receptacles.
2. Ground-fault circuit interrupter receptacles.
3. Single- and double-pole snap switches and dimmer switches (not dimming controls).
4. Device wall plates.

B. Related Sections include the following:

1. Section 260553 "Identification for Electrical Systems" for special device colors and nametag identification on device plates.
2. Section 260526 "Grounding and Bonding for Electrical Systems" for grounding connections to wiring devices.
3. Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for termination of cables to wiring devices.
4. Section 260923 "Lighting Control Devices" for coordination of equipment in that section with those in this section.

1.3 DEFINITIONS

A. AFCI: Arc-fault circuit-interrupter.

B. EMI: Electromagnetic interference.

C. GFCI or GFI: Ground-fault circuit interrupter.

D. IG: Isolated Ground.

E. LED: Light-emitting diode.

F. PVC: Polyvinyl chloride.

G. RFI: Radio-frequency interference.

H. TVSS: Transient voltage surge suppressor.

I. UTP: Unshielded twisted pair.

J. Wall-Box Dimmer: A self-contained dimmer that fits into a switch box.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

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, if requested.

D. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an "approved" third-party testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment or Equipment Supplied By Others: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Wiring Devices:

a. Hubbell Incorporated; Wiring Device-Kellems.

b. Leviton Mfg. Company Inc.
c. Pass & Seymour/Legrand; Wiring Devices Div.

2.2 RECEPTACLES

A. All receptacles shall be listed by an "approved" third-party agency, approved for the voltage and amperage indicated.

B. Straight-Blade-Type Receptacles, General: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596G, UL 498, and NEMA WDI 101968. Arrange for side wiring only.

C. Straight-Blade and Locking Receptacles, Specific: Heavy-Duty specification grade only (i.e. Hubbell #HBL5362). Receptacles marked as commercial grade, construction grade, commercial/specification grade, or specification grade (i.e. Hubbell #CR20) are not acceptable.

D. Straight-Blade Receptacles: Heavy-Duty hospital grade, tamper resistant safety type (i.e. Hubbell #HBL8300).

E. Grounding Type Receptacles: All receptacles shall be of the grounding type with a dedicated green grounding screw for terminating the equipment grounding conductor.

F. Rating: All receptacles are to be rated at 20 amps, unless otherwise noted.

G. GFCI Receptacles: Straight blade, non-feed-through type, Heavy-Duty duplex receptacle specification grade (i.e. Hubbell #GF20) with integral NEMA WD 6, Configuration 5-20R duplex receptacle; complying with UL 498 and UL 943. Design units for installation in a 2-1/8-inch deep outlet box without an adapter.

2.6 SWITCHES

A. All switches shall be listed by an "approved" third-party agency, approved for the voltage and amperage indicated.

B. Single- and Double-Pole Switches: Comply with DSCC W-C-896F and UL 20.

C. Toggle Switches: Heavy-Duty specification grade, quiet operating mechanisms (without the use of mercury switches), 20 A, 120/277-VAC, grounding type, with hex-head grounding screw (i.e. Hubbell #1221). Switches marked as commercial grade, commercial/specification grade, or specification grade (i.e. Hubbell #CSB20) are not acceptable.

D. Pilot Light Switches: Heavy-Duty grade, quiet type with red LED light illuminated when load is "on".

E. Lighted Toggle Switches: Heavy-Duty grade, quiet type with red LED light illuminated when load is "off".

F. Keyed Switches: Heavy-Duty grade, with keyed on and off operation. Provide uniform keying system.

G. Twist Timer Switches: Mechanically spring wound, requires no electricity to operate, centered shaft, provide Decora style plate, switch contacts shall break current carrying contacts at the end of the time cycles, 0-12 hour range, no “hold” feature.

H. Combination Switch and Receptacle: Both devices in a single gang unit with plaster ears and removable tab connector that permit separate or common feed connection.

2.7 WALL PLATES

A. Single and combination types of standard sizes to match corresponding wiring devices. The use of jumbo plates is strictly prohibited unless otherwise directed.

1. Plate-Securing Screws: Metal with slotted oval head; color to match plate finish.

2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
3. Material for Surface Mounted Devices in Unfinished Spaces: Galvanized steel raised surface.
4. Material for Wet Location Receptacles: Thermoplastic with spring-loaded lift cover, and listed and labeled by an “approved” third-party for “wet while in use".
5. Material for Wet Location Switches: Clear rubber silicon bubble elastomer plate, and listed and labeled by an “approved” third-party for “wet while in use".

2.8 FINISHES

A. Color:

1. Wiring Devices and Thermoplastic Cover Plates Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wiring devices and coverplates level, plumb, and square with building lines.

B. Flush mounted devices and coverplates shall be installed so that the device sticks out a minimum of 1/16” from the device plate.

C. Devices shall be mounted securely to outlet box and coverplate so that it does not move when being plugged into.

D. Install wall dimmers to achieve indicated rating after derating for ganging according to manufacturer's written instructions.

E. Install unshared dedicated neutral conductors on line and load side of dimmers and GFCI receptacles.

F. Arrangement of Devices: Unless otherwise indicated or physically impossible, mount flush, with long dimension vertical, and with grounding terminal of receptacles on top. If wall space does not permit a vertical installation, such as above a counter and/or backsplash, then mount flush, with long dimension horizontal, and with neutral terminal of receptacles on top.

G. Group common switches, receptacles, and dimmers under single, multigang wall plates, whether or not indicated on drawings.

H. Where a normal power and emergency power wiring device is located adjacent to each other, provide the same in a common backbox and with a common faceplate along with a box divider.

I. Remove wall plates and protect devices and assemblies during painting.

J. Provide GFCI receptacles at all electric water coolers, countertops with sinks, hydrotherapy tubs, ice machines, and within six feet of any water source. For non-20 amp devices, provide GFI type circuit breaker in panel instead.

K. Coordinate with respective equipment Contractor the exact NEMA configuration requirements and wire size/quantity requirements for special receptacles with cord and plugs furnished by others.

L. Where dual switching of light fixtures occurs in a common room, always install the closest switch to the door to control the inner lamps (or less quantity of lamps) and install the outer switch to control the outer lamps (or greater quantity of lamps).

M. Provide black electrical tape around wiring devices/terminals.

3.2 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems", labeling device plates with panel and circuit number.

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. 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 and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.

2. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION 262726

SECTION 26 51 00

INTERIOR LIGHTING

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. This Section includes the following:

1. Interior lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.

B. Related Sections include the following:

1. Section 262726 "Wiring Devices" for manual wall-box dimmers.
2. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
3. Section 260529 "Hangers and Supports for Electrical Systems" for seismic supporting criteria.

1.3 DEFINITIONS

A. BF: Ballast factor.

B. CRI: Color-rendering index.

C. CU: Coefficient of utilization.

D. HID: High-intensity discharge.

E. LER: Luminaire efficacy rating.

F. Luminaire: Complete lighting fixture, including ballast housing if provided.

G. RCR: Room cavity ratio.

1.4 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, material type for housing/ door frame/trim/lens/reflector/etc., mounting information, and efficacy and illuminance-efficiency data.
2. Emergency lighting units and battery packs including battery and charger information. Exit sign fixtures shall quantify the light uniformity across the face of the sign according to requirements in Part 2 below.
3. Ballast type, input voltage(s), sound transmission type, temperature operating limits, ballast factor, line current amperes, and power factor. Ballast cut sheet shall be separate from ballast manufacturer and not listed as an option or type on the fixture cut sheet.
4. Lamp type, life in hours, temperature in Kelvin, output in watts, Color Rendering Index, TLCP compliance, coated or clear, lamp pin/socket configuration, lamp orientation, and initial and mean lumen output for lamps. Lamp cut sheet shall be separate from lamp manufacturer and not listed as an option or type on the fixture cut sheet.

B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.

1. Wiring Diagrams: Power and control wiring.

C. Samples for Verification: Interior lighting fixtures designated for sample submission in Interior Lighting Fixture Schedule. Each sample shall include the following:

1. Lamps: Specified units installed.
2. Accessories: Cords and plugs.

D. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, signed by product manufacturer.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

G. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

C. Emergency fixtures shall comply with UL 924, NEC Article 700, NFPA 5000, NFPA 1, NFPA 101, and Energy Star.

D. All fixtures shall be UL listed and have UL labeling on the fixtures according to the type of usage.

E. FMG Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FMG.

1.6 COORDINATION

A. Coordinate layout and installation of lighting fixtures and required associated trims, plaster frames and suspension/mounting systems with the adjacent mounting surface that is supported by them.

B. Coordinate voltage of fixtures with floor plan circuiting, if not indicated on the light fixture schedule itself.

C. Coordinate the need for IC rated fixtures in IC rated ceilings with direct insulation contact.

D. Coordinate the need for tenting of fixtures or provision of fire rated enclosures (such as the product manufactured by E.Z. Barrier for recessed downlights) in fire rated ceilings.

1.7 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: Ten 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.

B. Special Warranty for All Lamps: Manufacturer's standard form, made out to Owner and signed by lamp manufacturer agreeing to replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping

point to Project site, within specified warranty period indicated below. Warranty shall be based on 3000 annual hours of operation.

1. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

B. In Interior Lighting Fixture Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified either in these specifications or on the lighting fixture schedule on the drawings.
2. Substitutions: Refer to Division 260100 "Basic Electrical Requirements" concerning substitutions.

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

A. Manufacturers: Refer to the lighting fixture schedule on the drawings.

B. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

C. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.

D. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

E. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.

F. LED Fixtures: Comply with UL 8750.

G. Pendant Mounted Fixtures in Finished Areas: Provide ¼ turn lamp sockets to eliminate lamps being ejected and clear acrylic or prismatic lens cover securely mounted to the top of the fixture to eliminate dust/debris collection on exposed lamps.

H. Metal Parts: Free of burrs and sharp corners and edges.

I. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

J. 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.

K. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.
4. Laminated Silver Metallized Film: 90 percent.

L. Open Exposed Lamps Over Food Prep Areas: Shall be shatterproof and labeled as such.

M. Plastic Diffusers, Covers, 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 (3.175 mm) minimum unless different thickness is indicated.
   b. UV stabilized.

2. Glass: Annealed crystal glass, unless otherwise indicated.

N. Ballast Disconnect Plugs: Provide factory wired disconnect plugs per fixture as required to meet the NEC.

O. Illuminating Engineering Society (IES):

1. LM-79-08 Electrical and Photometric Measurements of Solid-State Lighting Products

2. LM-80-08 Measuring Lumen Maintenance of LED Light Sources

3. LM-82-12 Characterization of LED Light Engines and LED Lamps for Electrical and Photometric Properties as a Function of Temperature

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. Manufacturers:

1. Advance.
2. General Electric.
3. Magnetek/Universal.
4. Osram/Sylvania.

B. Voltages: Provide dual voltage 120/277 volt for all linear fluorescent lamps.

C. Electronic Ballasts for T8 Lamps: Comply with ANSI C82.11; instant-start type, unless otherwise indicated, and designed for type and quantity of lamps served. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated.

1. Class P, Sound A rating.
2. Total Harmonic Distortion Rating: Less than 10 percent.
3. Transient Voltage Protection: IEEE C62.41, Category A or better.

4. Operating Frequency: 20 kHz or higher.
5. Lamp Current Crest Factor: 1.7 or less.
6. Minimum BF: 0.85.
7. Power Factor: 0.98 or higher.
8. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C 82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.
9. Flicker: Maximum of 15%.
10. Ballast case temperature shall not exceed 25 degrees C rise over 40 degrees C ambient.
11. Temperatures 0 Deg F (Minus 17 Deg C) and Higher: Electronic type rated for 0 deg F (minus 17 deg C) starting and operating temperature with indicated lamp types.

D. Electronic Programmed Rapid-Start Ballasts for T5 and T5HO Lamps: Comply with ANSI C82.11 and the following:

1. Lamp end-of-life detection and shutdown circuit.
2. Automatic lamp starting after lamp replacement.
3. Class P, Sound Rating A.
4. Total Harmonic Distortion Rating: Less than 10 percent.
5. Transient Voltage Protection: IEEE C62.41, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. BF: 0.95 or higher, unless otherwise indicated.
9. Power Factor: 0.98 or higher.
10. Flicker: Maximum of 15%.
11. Temperatures 0 Deg F (Minus 17 Deg C) and Higher: Electronic type rated for 0 deg F (minus 17 deg C) starting and operating temperature with indicated lamp types.

E. Electromagnetic Ballasts: Comply with ANSI C82.1; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.

1. Ballast Manufacturer Certification: Indicated by label.

F. Single Ballasts for Multiple Lighting Fixtures: Factory-wired with ballast arrangements and bundled extension wiring with quick disconnects to suit final installation conditions without modification or rewiring in the field. For example, where a four foot fixture is shown to be continuously row mounted, fewer multi-lamp ballasts can be provided as long as the switching arrangement is maintained (all on or inboard/outboard).

G. Ballasts for Low-Temperature Environments:

1. Temperatures Minus 20 Deg F (Minus 29 Deg C) and Higher: Electromagnetic type designed for use with indicated lamp types.

H. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.

1. Dimming Range: 100 to 1 percent of rated lamp lumens.
2. Ballast Input Watts: Can be reduced to 20 percent of normal.
3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

I. Ballasts for Bi-Level Controlled Lighting Fixtures: Electronic type.

1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.

   a. High-Level Operation: 100 percent of rated lamp lumens.
   b. Low-Level Operation: 50 percent of rated lamp lumens.

2. Ballast shall provide equal current to each lamp in each operating mode.
3. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

A. Manufacturers:

1. Advance.
2. General Electric.
3. Magnetek/Universal.
4. Osram/Sylvania.

B. Voltages: Provide dual voltage 120/277 volt for all CFL lamps.

C. Triple Tube Lamps: Provide the “delta” shaped type for vertically oriented socket fixtures and the “D” shaped for horizontally oriented socket fixtures.

D. Description: Electronic programmed rapid-start type, complying with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:

1. Lamp end-of-life detection and shutdown circuit.
2. Automatic lamp starting after lamp replacement.
3. Class P, Sound Rating A.
4. Total Harmonic Distortion Rating: Less than 10 percent.
5. Transient Voltage Protection: IEEE C62.41, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. Minimum BF: 0.85.
9. Power Factor: 0.98 or higher.

10. Minimum Starting Temperature: 0 deg F (Minus 18 deg C).

11. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
12. Ballast Case Temperature: 75 deg C, maximum.
13. Wattages: Where multi-wattage (i.e. 26/32/42) and/or multi-lamp (i.e. 1/2) ballasts are available, provide ballasts of this type.

E. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.

1. Dimming Range: 100 to 10 percent of rated lamp lumens.
2. Ballast Input Watts: Can be reduced to 10 percent of normal.
3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

2.5 FLUORESCENT LAMPS

A. Manufacturers:

1. General Electric.
2. Osram/Sylvania.
3. Philips.

B. Low-Mercury Lamps: Comply with EPA's Toxicity Characteristic Leaching Procedure (TCLP) test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.

C. T8 rapid-start, TCLP compliant lamps, rated 32 W maximum, nominal length of 48 inches (1220 mm), 2950 initial lumens (minimum), CRI 86 (minimum), color temperature 4100K unless otherwise indicated, and average rated life 20,000 hours at 3 hours operation per start, unless otherwise indicated.

D. Compact Fluorescent Lamps: 4-Pin, TCLP compliant when available, CRI 82 (minimum), color temperature 4100K, average rated life of 12,000 hours at 3 hours operation per start, and suitable for use with dimming ballasts, unless otherwise indicated.

1. 5 W: T4, short Twin Tube, rated 250 initial lumens (minimum).
2. 7 W: T4, short Twin Tube, rated 380 initial lumens (minimum).
3. 9 W: T4, short Twin Tube, rated 600 initial lumens (minimum).
4. 13 W: T4, short Twin Tube or Double Twin Tube, rated 800 initial lumens (minimum).
5. 18 W: T4, Double Twin Tube or Triple Twin Tube or long Twin Tube, rated 1200 lumens (minimum).
6. 26 W: T4, Double Twin Tube or Triple Twin Tube, rated 1800 lumens (minimum).
7. 32 W: T4, Triple Twin Tube, rated 2400 initial lumens (minimum).
8. 40 W: T4, long Twin Tube, rated 3300 initial lumens (minimum).
9. 42 W: T4, triple Twin Tube, rated 3200 initial lumens (minimum).
10. 50 W: T4, long Twin Tube, rated 4300 initial lumens (minimum).
11. 80 W: T4, long Twin Tube, rated 6000 initial lumens (minimum).

2.6 EXIT SIGNS

A. Manufacturers: Refer to the lighting fixture schedule on the drawings.

B. Description: Comply with UL 924 and NFPA 101 and NEMA; for sign colors, visibility, and luminance, comply with authorities having jurisdiction. Letters shall be 6" high with a ¾" brush stroke. Chevrons shall be viewable at 40 feet. Fixture shall maintain 30 candela/meter-squared for light uniformity across the face of the exit sign. Maximum wattage of either single or double face sign is to be 5 watts.

C. Internally Lighted Signs:

1. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life. Maximum LED failure rate shall be 25% within a seven (7) year period; otherwise, if exceeded, manufacturer shall replace the complete unit at no charge to the Owner.

2.7 EMERGENCY LIGHTING RELAY

A. Manufacturers:

1. 924, Inc.
2. Bodine.
3. Iota.

B. Description: Self-contained power supply and low voltage relay units complying with UL 924, NEC Article 700, NFPA 101 and NEMA.

C. Allows normal switching of designated emergency lighting fixture(s) via dimmers, relays, or local switches while overriding this input and automatically switching the fixture(s) on when the normal power fails.

D. Wall mounted single gang unit with stainless steel device cover, test switch, and LED indicator lights. Amber LED indicator light for normal utility power availability. Red LED indicator light for unswitched emergency power availability. Green LED indicator light for notification that test switch is activated and emergency power is switched over.

E. Ten amp load rating.

F. Coordinate voltage rating with associated fixture circuiting.

G. Warranty: Full five year material warranty.

2.8 LED FIXTURES

A. General:

1. LED light fixtures shall be in accordance with IES, NFPA, UL, as shown on the
drawings, and as specified.

2. LED light fixtures shall be Reduction of Hazardous Substances (RoHS)-compliant.

3. LED drivers shall include the following features unless otherwise indicated:

   a. Minimum efficiency: 85% at full load.

   b. Minimum Operating Ambient Temperature: -20˚ C. (-4˚ F.)

   c. Input Voltage: 120 - 277V (±10%) at 60 Hz.

   d. Integral short circuit, open circuit, and overload protection.

   e. Power Factor: ≥ 0.95.

   f. Total Harmonic Distortion: ≤ 20%.

   g. Comply with FCC 47 CFR Part 15.

4. LED modules shall include the following features unless otherwise indicated:

   a. Comply with IES LM-79 and LM-80 requirements.

   b. Minimum CRI 80 and color temperature 4000 K unless otherwise specified in LIGHTING FIXTURE SCHEDULE.

c. Minimum Rated Life: 50,000 hours per IES L70.

d. Light output lumens as indicated in the LIGHTING FIXTURE SCHEDULE.

B. LED Downlights:

1. Housing, LED driver, and LED module shall be products of the same manufacturer.

C. LED Troffers:

1. LED drivers, modules, and reflector shall be accessible, serviceable, and replaceable from below the ceiling.

2. Housing, LED driver, and LED module shall be products of the same manufacturer.

2.9 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Section 260529 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with ceiling canopy. Finish same as fixture. Provide swivel hanger when mounted on sloped ceilings.

C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) 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 gauge (2.68 mm).

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gauge (2.68 mm).

F. Rod Hangers: 3/16-inch (5-mm) 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.

H. Safety Chain: Provide safety chain, as suggested by manufacturer, from the fixture up to the structure as a secondary means of supporting all HID pendant mounted fixtures.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fixtures per manufacturer's recommendations and maintain clearance requirements.

B. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

C. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Use grid as a support element.

1. Install a minimum of four (4) dedicated ceiling support system rods or wires for each 2'x2', 1'x4', 2'x4', or 4'x4' fixture, one at each corner of the fixture independently to the structure. Grid ceiling mounted troffers shall be installed so that they are flush with the ceiling grid after the grid has been leveled. Provide minimal slack in structure supports to allow for final leveling and adjustments of the ceiling. Locate not more than 6 inches (150 mm) from lighting fixture corners. Install a minimum of one dedicated ceiling support system rod or wire for each downlight.
2. Hurricane Support Clips: Provide these as separate fasteners in addition to the factory installed clips on modern rectilinear troffer fixtures. Fasten to lay-in troffer lighting fixtures at or near each fixture corner. Provide 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 (20-mm) metal channels spanning and secured to ceiling tees.
4. E.C. shall provide strut as required underneath elements such as ductwork to independently support their electrical equipment, such as light fixtures. No light fixture support wires shall touch an interfering object (such as ductwork) prior to terminating to the ceiling structure.

5. Screw the recessed fixtures in an acoustical ceiling grid to the grid itself at each edge.

D. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), 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.

E. Adjust aimable lighting fixtures to provide required light intensities.

F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

G. Coordination: Coordinate lamp base, lamp orientation, and lamp pin/socket type between the lamp supplier and the fixture supplier.

H. In congested areas with exposed structure ceilings and pendant mounted lighting (i.e. mechanical rooms, elevator rooms, telecom rooms, electrical rooms, etc.), locate and suspend light fixtures as required in the field to avoid obstructions and to allow for the best possible light distribution. Span underneath ductwork and other obstructions as required with independent strut supported properly from the walls or the ceiling.

I. Emergency wall mounted fixtures shall be mounted at a minimum of 82” AFF, unless otherwise noted.

J. Maintain manufacturer required clearances around fixtures (such as 3” around recessed downlights) in ceilings with insulation.

K. Coordinate mounting height of all wall mounted fixtures (including wall sconces and fixtures in stairwells) with the Architect prior to rough-in.

L. Secure wiring harness to clips within exit signs so that this wiring is not exposed through the exit sign panel lettering.

M. Exit signs shall be no more than 100 feet from viewing area.

N. Grid ceiling mounted recessed downlights shall be centered in tile.

O. Remove all debris from lensed fixtures including instruction sheets, bugs, etc.

P. All ballast channel covers shall be installed as required.

Q. All troffers shall have the door hinges secured.

3.2 CLEANING

A. Clean all exposed aluminum reflector surfaces with warm soapy water and a clean towel to eliminate fingerprints immediately after accidental touching of surfaces.

B. Remove all cardboard, manufacturer’s stickers, plastic covers, etc. from final installed light fixtures.

3.3 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. 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.

END OF SECTION 265100

SECTION 31 20 11
EARTHWORK (SHORT FORM)

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies the requirements for furnishing all equipment, materials, labor and techniques for earthwork including excavation, fill, backfill and site restoration utilizing fertilizer, seed and/or sod.

1.2 DEFINITIONS:

A. Unsuitable Materials:

1. Fills: Topsoil, frozen materials; construction materials and materials subject to decomposition; clods of clay and stones larger than 75 mm (3 inches); organic materials, including silts, which are unstable; and inorganic materials, including silts, too wet to be stable.
2. Existing Subgrade (except footings): Same materials as above paragraph, that are not capable of direct support of slabs, pavement, and similar items, with the possible exception of improvement by compaction, proof-rolling, or similar methods of improvement.
3. Existing Subgrade (footings only): Same as Paragraph 1, but no fill or backfill. If materials differ from design requirements, excavate to acceptable strata subject to COR's approval.

B. Earthwork: Earthwork operations required within the new construction area. It also includes earthwork required for auxiliary structures and buildings and sewer and other trenchwork throughout the job site.

C. Degree of Compaction: Degree of compaction is expressed as a percentage of maximum density obtained by the test procedure presented in ASTM D1557

D. The term fill means fill or backfill as appropriate.

1.3 RELATED WORK:

A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

1.4 CLASSIFICATION OF EXCAVATION:

A. Unclassified Excavation: Removal and disposal of pavements and other man-made obstructions visible on the surface; utilities, and other items including underground structures indicated to be demolished and removed; together with any type of materials regardless of character of material and obstructions encountered.

1.5 MEASUREMENT AND PAYMENT FOR EXCAVATION:

Measurement: The unit of measurement for excavation and borrow will be the cubic yard, computed by the average end area method from cross sections taken before and after the excavation and borrow operations, including the excavation for ditches, gutters, and channel changes, when the material is acceptably utilized or disposed of as herein specified. Quantities should be computed by a Registered Professional Land Surveyor or Registered Civil Engineer, specified in Division 1, General Requirements specifications. The measurement will include authorized excavation for rock, authorized excavation of satisfactory subgrade soil, and the volume of loose, scattered rocks and boulders collected within the limits of the work; allowance will be made on the same basis for selected backfill ordered as replacement. The measurement will not include the volume of subgrade material or other material used for purposes other than directed. The volume of overburden stripped from borrow pits and the volume of excavation for ditches to drain borrow its, unless used as borrow material, will not be measured for payment. The measurement will not include the volume of any excavation performed prior to taking of elevations and measurements of the undisturbed grade.

1.6 MEASUREMENT AND PAYMENT FOR ROCK EXCAVATION:

A. Measurement: Cross section and measure the uncovered and separated materials, and compute quantities by the Registered Professional Land Surveyor or Registered Civil Engineer, specified in Division 1 General Requirements specifications. Do not measure quantities beyond the following limits:
   1. 300 mm (12 inches) outside of the perimeter of formed footings.
   2. 600 mm (24 inches) outside the face of concrete work for which forms are required, except for footings.

3. 150 mm (6 inches) below the bottom of pipe and not more than the pipe diameter plus 600 mm (24 inches) in width for pipe trenches.
4. The outside dimensions of concrete work for which no forms are required (trenches, conduits, and similar items not requiring forms).

B. Payment: No separate payment shall be made for rock excavation quantities shown. The contract price and time will be adjusted for overruns or underruns in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL CONDITIONS as applicable.

1.7 SUBMITTALS:

A. Submit in accordance with Division 1 General Requirements specifications.

C. Contractor shall submit procedure and location for disposal of unused satisfactory material. Proposed source of borrow material. Notification of encountering rock in the project. Advance notice on the opening of excavation or borrow areas. Advance notice on shoulder construction for rigid pavements.

D. Furnish to COR, soil samples, suitable for laboratory tests, of proposed off site or on site fill material.

E. Qualifications of the commercial testing laboratory or Contractor's Testing facility shall be submitted.

1.8 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. American Nursery and Landscape Association (ANLA):
2004.....American Standard for Nursery Stock

C. American Association of State Highway and Transportation Officials (AASHTO):
T99-10.....Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305 mm (12 inch) Drop
T180-10.....Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg [10 lb] Rammer and a 457 mm (18 inch) Drop

D. American Society for Testing and Materials (ASTM):

C33-03.....Concrete Aggregate

D698-e1.....Laboratory Compaction Characteristics of Soil Using Standard Effort

D1140-00.....Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve

D1556-00.....Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

D1557-09.....Laboratory Compaction Characteristics of Soil Using Modified Effort

D2167-94 (2001).....Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method

D2321-20.....Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

D2487-06.....Standard Classification of Soil for Engineering Purposes (Unified Soil Classification System)

D2774-25.....Standard Practice for Underground Installation of Thermoplastic Pressure Piping

D6938-10.....Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

E. Standard Specifications of Virginia State Department of Transportation, latest revision.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Fills: Materials approved from on site and off site sources having a minimum dry density of 1760 kg/m3 (110 pcf), a maximum Plasticity Index of 6, and a maximum Liquid Limit of 30.

B. Granular Fill:

1. Under concrete slab, granular fill shall consist of clean, poorly graded crushed rock, crushed gravel, or uncrushed gravel placed beneath a building slab with or without a vapor barrier to cut off the capillary flow of pore water to the area immediately below. Fine aggregate grading shall conform to ASTM C33 with a maximum of 3 percent by weight passing ASTM D1140, 75 micrometers (No. 200) sieve, or.5 mm (1-1/2 inches) and no more than 2 percent by weight

passing the 4.75 mm (No. 4) size sieveor coarse aggregate Size 57, 67, or 77.

2. Bedding for piping shall meet the requirements of ASTM D2321-20 Class I as modified by Section X1.9 with a maximum particle size of 3/8". Open-graded crushed stone from 3/8" to No. 50 sieve, such as Virginia Size #9 crushed stone or equivalent is acceptable.

Virginia Size #9 gradation
(% finer per Sieve, by
Weight): 3/8": Min
100%
No. 4: 85-100%
No. 8: 10-40%
No. 16: Max 10%
No. 50: Max 5%

a. General Requirements:
   i. Pipe bedding shall consist of clean, open-graded crushed stone that is free from organic material, clay, silt, and other deleterious substances.
   ii. The material shall provide adequate drainage, load-bearing support, and resistance to settlement."

Bedding for septic tanks and dosing tanks

b. General Requirements
   i. Granular fill for septic tank installations shall consist of clean, well-graded crushed stone or gravel that is free from organic material, clay, silt, and other deleterious substances.
   ii. The material shall provide adequate drainage, load-bearing support, and resistance to settlement under the septic tank.

c. Material Properties:
   i. Granular fill shall conform to ASTM C33, Size 57 or 67, with a maximum particle size of 25 mm (1 inch) and no more than 5 percent by weight passing the 4.75 mm (No. 4) sieve.
   ii. The material shall exhibit a permeability sufficient to facilitate drainage and prevent water accumulation under the septic tank.

d. Installation Requirements:
   i. Place granular fill in uniform lifts not exceeding 200 mm (8 inches) and compact to a firm, stable surface.
   ii. Ensure a minimum thickness of 150 mm (6 inches) beneath the septic tank or as required by the project specifications.
   iii. Granular fill shall extend laterally beyond the tank footprint by a minimum of 300 mm (12 inches) to provide adequate support and prevent differential settlement.
e. All granular fill materials shall be sourced from an approved supplier and meet applicable regulatory and environmental requirements for septic system installations.

C. Fertilizer: (5-10-5) delivered to site in unopened containers that clearly display the manufacturer's label, indicating the analysis of the contents.

D. Seed:
1. Seeding Guidelines:
   a. Apply 70 pounds of seed/Acre
   b. Seed Mix:
      i. Creeping Red Fescue - 40#,
      ii. Annual Rye - 20#,
      iii. Ladino Clover - 5# (inoculated),
      iv. Medium Red Clover - 5# (inoculated).
   c. Lime application rate = 2000#/Acre
   d. Fertilizer - "triple 19"

1. Add a statement about time of year, that between Sept 15 and December 15 to add Winter Wheat 20# to the seed mix and reduce the red fescue to 20#.
2. Certified weed-free straw is to be used for mulch, application rate of 4k #/Acre.

E. Requirements For Offsite Soils: Offsite soils brought in for use as backfill shall be tested for TPH, BTEX and full TCLP including ignitability, corrosivity and reactivity. Backfill shall contain less than 100 parts per million (ppm) of total hydrocarbons (TPH) and less than 10 ppm of the sum of Benzene, Toluene, Ethyl Benzene, and Xylene (BTEX)and shall not fail the TCLP test. TPH concentrations shall be determined by using EPA 600/4-79/020 Method 418.1. BTEX concentrations shall be determined by using EPA SW-846.3-3a Method5030/8020. TCLP

shall be performed in accordance with EPA SW-846.3-3a Method 1311. Provide Borrow Site Testing for TPH, BTEX and TCLP from a composite sample of material from the borrow site, with at least one test from each borrow site.

F. Buried Warning and Identification Tape: Polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inch minimum width, color coded as specific below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, Unaffected by moisture or soil. Warning tape color codes:

Red:	Electric
Blue:	Water Systems
Green:	Sewer Systems

G. Warning Tape for Metallic Piping: Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.076 mm (0.003 inch). Tape shall have a minimum strength of 10.3 MPa (1500 psi) lengthwise, and 8.6 MPa (1250 psi) crosswise, with a maximum 350 percent elongation.

H. Detectable Warning Tape for Non-Metallic Piping: Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.102 mm (0.004 inch). Tape shall have a minimum strength of 10.3 MPa (1500 psi) lengthwise and 8.6 MPa (1250 psi) crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 0.9 m(3 feet) deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

I. Detection Wire For Non-Metallic Piping: Detection wire shall be Insulated single strand, solid copper with a minimum of 12 AWG.

PART 3 - EXECUTION

3.1 SITE PREPARATION:

A. Clearing: Clearing within the limits of earthwork operations as described or designated by the COR. Work includes removal of trees, shrubs, fences, foundations, incidental structures, paving, debris, trash and any other obstructions. Remove materials from the property.
B. Grubbing: Remove stumps and roots 75 mm (3 inches) and larger diameter. Undisturbed sound stumps, roots up to 75 mm (3 inches) diameter, and nonperishable solid objects which will be a minimum of 900 mm (3 feet) below subgrade or finished embankment may be left.
C. Trees and Shrubs: Trees and shrubs, not shown for removal, may be removed from the areas within 4500 mm (15 feet) of new construction and 2250 mm (7’-6”) of utility lines if such removal is approved in advance by the COR. Remove materials from the Property
D. Stripping Topsoil: Unless otherwise indicated on the drawings, the limits of earthwork operations shall extend anywhere the existing grade is filled or cut or where construction operations have compacted or otherwise disturbed the existing grade or turf. Strip topsoil as defined herein, or as indicated in the geotechnical report, from within the limits of earthwork operations as specified above unless specifically indicated or specified elsewhere in the specifications or shown on the drawings. Topsoil shall be fertile, friable, natural topsoil of loamy character and characteristic of the locality. Topsoil shall be capable of growing healthy horticultural crops of grasses. Stockpile topsoil and protect as directed by the COR. Eliminate foreign material, such as weeds, roots, stones, subsoil, frozen clods, and similar foreign materials, larger than 0.014 m3 (1/2 cubic foot) in volume, from soil as it is stockpiled. Retain topsoil on the station. Remove foreign materials larger than 50 mm (2 inches) in any dimension from topsoil used in final grading. Topsoil work, such as stripping, stockpiling, and similar topsoil work, shall not, under any circumstances, be carried out when the soil is wet so that the tilth of the soil will be destroyed.
    2. Concrete Slabs and Paving: Score deeply or saw cut to insure a neat, straight cut, sections of existing concrete slabs and paving to be removed where excavation or trenching occurs. Extend pavement section to be removed a minimum of 300 mm (12 inches) on each side of widest part of trench excavation and insure final score lines are approximately parallel unless otherwise indicated. Remove material from the Property.

E. Disposal: All materials removed from the property shall be disposed of at a legally approved site, for the specific materials, and all removals shall be in accordance with all applicable Federal, State and local regulations. No burning of materials is permitted onsite.

3.2 EXCAVATION:

A. Shoring, Sheeting and Bracing: Shore, brace, or slope to it's angle of repose banks of excavations to protect workmen, banks, adjacent paving, structures, and utilities, in compliance with OSHA requirements.

1. Extend shoring and bracing to the bottom of the excavation. Shore excavations that are carried below the elevations of adjacent existing foundations.
2. If the bearing of any foundation is disturbed by excavating, improper shoring or removal of shoring, placing of backfill, and similar operations, provide a concrete fill support under disturbed foundations, as directed by COR, at no additional cost to the Government. Do not remove shoring until permanent work in excavation has been inspected and approved by the COR.

D. Building Earthwork:

1. Excavation shall be accomplished as required by drawings and specifications.
2. Excavate foundation excavations to solid undisturbed subgrade.
3. Remove loose or soft material to solid bottom.
4. Fill excess cut under footings or foundations with 25 MPa (3000 psi) concrete, poured separately from the footings.
3. Do not tamp earth for backfilling in footing bottoms, except as specified.

E. Trench Earthwork:

1. Utility trenches (except water, sanitary, and storm sewer):
   a. Excavate to a width as necessary for sheeting and bracing and proper performance of the work.
   b. Grade bottom of trenches with bell-holes, scooped-out to provide a uniform bearing.
   c. Support piping on clean coarse aggregate VDOT No. 9 or smaller bedding stone. Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 150 mm (6 inches) loose thickness.

d. The length of open trench in advance of pipe laying shall not be greater than is authorized by the COR.

e. Provide buried utility lines with utility identification tape. Bury tape 300 mm (12 inches) below finished grade; under pavements and slabs, bury tape 150 mm (6 inches) below top of subgrade

f. Bury detection wire directly above non-metallic piping at a distance not to exceed 300 mm (12 inches) above the top of pipe. The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum of 0.9 m (3 feet) of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over its entire length. The wire shall enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, the wire shall terminate in the valve pit at the pump station end of the pipe.

g. Bedding shall be of the type and thickness shown. Pipe bedding material shall be placed and compacted with approved tampers to a height of at least one foot above the utility pipe or conduit. The pipe bedding material shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the material under the haunches of the pipe. Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with ASTM D2321-20 Class I as modified by Section X1.9 with a maximum particle size of 3/8”, except as specified herein. Backfill to top of pipe shall be compacted to 95 percent of ASTM D 698 maximum density. Plastic piping shall have bedding to 6” above the top of the pipe.

2. Water, Sanitary, and storm sewer trenches:

a. Trench width below a point 150 mm (6 inches) above top of the pipe shall be 600 mm (24 inches) for up to and including 300 mm (12 inches) diameter and four-thirds diameter of pipe plus 200 mm (8 inches) for pipe larger than 300 mm (l2 inches). Width of trench above that level shall be as necessary for sheeting and bracing and proper performance of the work.

b. The bottom quadrant of the pipe shall be bedded on clean coarse aggregate VDOT No. 9 or smaller bedding stone. Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 150 mm (6 inches) loose thickness.
   2) Clean Coarse Aggrefate: Depth of fill shall be a minimum of 150 mm (6 inches) above top of pipe. Place and tamp fill material by hand.
c. Place and compact as specified the remainder of backfill using acceptable excavated materials. Do not use unsuitable materials.
d. Use extra bedding material where rock or rocky materials are excavated.
e. Provide buried utility lines with utility identification tape. Bury tape 300 mm (12 inches) below finished grade; under pavements and slabs, bury tape 150 mm (6 inches) below top of subgrade
f. Bury detection wire directly above non-metallic piping at a distance not to exceed 300 mm (12 inches) above the top of pipe. The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum of 0.9 m (3 feet) of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over its entire length. The wire shall enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, the wire shall terminate in the valve pit at the pump station end of the pipe.
g. Bedding shall be of the type and thickness shown. Bedding material shall be placed and compacted with approved tampers to a height of at least 6” above the utility pipe or conduit. The bedding shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the bedding under the haunches of the pipe. Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with ASTM D2321-20 Class I as modified by Section X1.9 with a maximum particle size of 3/8, except as specified herein. Backfill to top of pipe shall be compacted to 95 percent of ASTM D698 maximum

density. Plastic piping shall have bedding to 4” above the top of the pipe.

F. Site Earthwork: Excavation shall be accomplished as required by drawings and specifications. Remove subgrade materials that are unsuitable, and replace with acceptable material. When unsuitable material is encountered and removed, the contract price and time will be adjusted in accordance with Division 1 General requirements specifications as applicable. Adjustments to be based on cubic yards (yardage) in cut section only.

G. Finished elevation of subgrade shall be as follows:
   1. Pavement Areas - bottom of the pavement or base course as applicable.
   2. Planting and Lawn Areas - 100 mm (4 inches) below the finished grade, unless otherwise specified or indicated on the drawings.

3.3 FILLING AND BACKFILLING:

A. General: Do not fill or backfill until all debris, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from the excavation. Proof-roll exposed subgrades with a fully loaded dump truck. Use excavated materials or borrow for fill and backfill, as applicable. Do not use unsuitable excavated materials. Do not backfill until foundation walls have been completed above grade and adequately braced, waterproofing or dampproofing applied, and pipes coming in contact with backfill have been installed, and inspected and approved by COR.

B. (NOT USED)

C. Placing: Place material in horizontal layers not exceeding 200 mm (8 inches) in loose depth and then compacted. Do not place material on surfaces that are muddy, frozen, or contain frost.

D. Compaction: Use approved equipment (hand or mechanical) well suited to the type of material being compacted. Do not operate mechanized vibratory compaction equipment within 3000 mm (10 feet) of new or existing building walls without the prior approval of the COR. Moisten or aerate material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Compact each layer until there is no evidence of further compaction to not less than 95 percent of the maximum density

determined in accordance with the following test method ASTM D698 . Backfill adjacent to any and all types of structures shall be placed and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials to prevent wedging action or eccentric loading upon or against the structure.

E. Borrow Material: Borrow material shall be selected to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Borrow material shall be obtained from the borrow areas within the limits of the project site, selected by the Contractor or from approved private sources. Unless otherwise provided in the contract, the Contractor shall obtain from the owners the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling. Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties. Unless specifically provided, no borrow shall be obtained within the limits of the project site without prior written approval. Necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon shall be considered related operations to the borrow excavation.

F. Opening and Drainage of Excavation and Borrow Pits: The Contractor shall notify the COR sufficiently in advance of the opening of any excavation or borrow pit to permit elevations and measurements of the undisturbed ground surface to be taken. Except as otherwise permitted, borrow pits and other excavation areas shall be excavated providing adequate drainage. Overburden and other spoil material shall be transported to designated spoil areas or otherwise disposed of as directed. Borrow pits shall be neatly trimmed and drained after the excavation is completed. The Contractor shall ensure that excavation of any area, operation of borrow pits, or dumping of spoil material results in minimum detrimental effects on natural environmental conditions.

3.4 GRADING:

A. General: Uniformly grade the areas within the limits of this section, including adjacent transition areas. Smooth the finished surface within specified tolerance. Provide uniform levels or slopes between points where elevations are indicated, or between such points and existing

finished grades. Provide a smooth transition between abrupt changes in slope.

B. Cut rough or sloping rock to level beds for foundations. In unfinished areas fill low spots and level off with coarse sand or fine gravel.

C. Slope backfill outside the building away from the building walls for a minimum distance of 3048 mm (10 feet)at a minimum five percent (5%) slope.

D. The finished grade shall be 150 mm (6 inches) below bottom line of windows or other building wall openings unless greater depth is shown.

E. Place crushed stone or gravel fill under concrete slabs on grade tamped and leveled. The thickness of the fill shall be 150 mm (6 inches), unless otherwise indicated.

F. Finish subgrade in a condition acceptable to the COR at least one day in advance of the paving operations. Maintain finished subgrade in a smooth and compacted condition until the succeeding operation has been accomplished. Scarify, compact, and grade the subgrade prior to further construction when approved compacted subgrade is disturbed by contractor's subsequent operations or adverse weather.

G. Grading for Paved Areas: Provide final grades for both subgrade and base course to +/- 6 mm (0.25 inches) of indicated grades.

3.5 LAWN AREAS:

A. General: Harrow and till to a depth of 100 mm (4 inches), new or existing lawn areas to remain, which are disturbed during construction. Establish existing or design grades by dragging or similar operations. Do not carry out lawn areas earthwork out when the soil is wet so that the tilth of the soil will be destroyed. Plant bed must be approved by COR before seeding or sodding operation begins.

B. Finished Grading: Begin finish grading after rough grading has had sufficient time for settlement. Scarify subgrade surface in lawn areas to a depth of 100 mm (4 inches). Apply topsoil so that after normal compaction, dragging and raking operations (to bring surface to indicated finish grades) there will be a minimum of 100 mm (4 inches) of topsoil over all lawn areas; make smooth, even surface and true grades, which will not allow water to stand at any point. Shape top and bottom of banks to form reverse curves in section; make junctions with undisturbed areas to conform to existing topography. Solid lines within grading limits indicate finished contours. Existing contours, indicated

by broken lines are believed approximately correct but are not guaranteed.

C. Fertilizing: Incorporate fertilizer into the soil to a depth of 100 mm (4 inches) at a rate of 2000 pounds per acre.

D. Seeding: Seed at a rate of 70 pounds per acre and accomplished only during periods when uniform distribution may be assured. Lightly rake seed into bed immediately after seeding. Roll seeded area immediately with a roller.

E. Lime: Incorporate lime into the soil to a depth of 50 mm (2 inches) at a rate of 2000 pounds per acre.

F. Watering: The COR is responsible for having adequate water available at the site.

3.6 DISPOSAL OF UNSUITABLE AND EXCESS EXCAVATED MATERIAL:

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off property.

B. Place excess excavated materials suitable for fill and/or backfill on site where directed.

C. Remove from site and dispose of any excess excavated materials after all fill and backfill operations have been completed.

D. Segregate all excavated contaminated soil designated by the COR from all other excavated soils, and stockpile on site on two 0.15 mm (6 mil) polyethylene sheets with a polyethylene cover. A designated area shall be selected for this purpose. Dispose of excavated contaminated material in accordance with State and Local requirements.

3.7 CLEAN-UP:

Upon completion of earthwork operations, clean areas within contract limits, remove tools, and equipment. Provide site clear, clean, free of debris, and suitable for subsequent construction operations. Remove debris, rubbish, and excess material from the Property.

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SECTION 32 05 23
CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Subbase for concrete pavements.
   2. Curbs, gutters, wheel stops .
   3. Pedestrian Pavement: Walks, pedestrian crossings, wheelchair curb ramps, steps, and patios,
   4. Vehicular Pavement: driveways, .

1.2 RELATED REQUIREMENTS

A. Field Testing: Section 01 45 29, TESTING LABORATORY SERVICES.
B. Step Nosings and Railings: Section 05 50 00, METAL FABRICATIONS.
C. Subgrade Preparation and Subbase Compaction: Section 31 20 11, EARTH WORK (SHORT FORM).

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.
B. American Association of State Highway and Transportation Officials (AASHTO):
   1. M147-65-UL-04 - Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses.
   2. M233-86 - Boiled Linseed Oil Mixture for Treatment of Portland Cement Concrete.
C. American Concrete Institute (ACI):
   1. 305R-10 - Guide to Hot Weather Concreting.
   2. 306R-10 - Guide to Cold Weather Concreting.
D. American National Standards Institute (ANSI):
   1. B101.3 - Wet DOCF of Common Hard Surface Floor Materials (Including Action and Limit Thresholds for the Suitable Assessment of the Measured Values).
E. ASTM International (ASTM):
   1. A615/A615M-16 - Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.
   2. A996/A996M-15 - Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
   3. A1064/A1064M-16 - Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

4. C33/C33M-16 - Concrete Aggregates.
5. C94/C94M-16 - Ready Mixed Concrete.
6. C143/C143M-15a - Slump of Hydraulic Cement Concrete.
7. C150/C150M-16 - Portland Cement.
8. C171-16 - Sheet Materials for Curing Concrete.
9. C260/C260M-10a - Air Entraining Admixtures for Concrete.
10. C309-11 - Liquid Membrane Forming Compounds for Curing Concrete.
11. C494/C494M-15a - Chemical Admixtures for Concrete.
12. C618-15 - Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
13. C979/C979M-16 - Pigments for Integrally Colored Concrete.
14. C989/C989M-14 - Slag Cement for Use in Concrete and Mortars.
15. C1240-15 - Silica Fume Used in Cementitious Mixtures.
16. D1751-04(2013)e1 - Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
17. D5893/D5893M-10 - Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.
18. D6690-15 - Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

1.4 PREINSTALLATION MEETINGS

A. Conduct preinstallation meeting at project site minimum 30 days before beginning Work of this section.
   1. Required Participants:
      a. Contracting Officer's Representative.
      b. Contractor.
      c. Installer.
      d. Other installers responsible for adjacent and intersecting work, including excavation, plantings, traffic markings, etc.
   2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
      a. Installation schedule.
      b. Installation sequence.
      c. Preparatory work.
      d. Protection before, during, and after installation.
      e. Installation.
      f. Terminations.
      g. Transitions and connections to other work.

h. Inspecting and testing.

i. Other items affecting successful completion.

3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.5 SUBMITTALS

A. Submittal Drawings:

1. Show size, configuration, and fabrication and installation details.
2. Show reinforcing.
3. Include jointing plan for concrete pavements, curbs and gutters.

B. Manufacturer's Literature and Data:

1. Description of each product.
2. Installation instructions.

C. Samples:

1. Exposed Aggregate Concrete Panel: 0.4 sq. m by 50 mm (4 sq. ft. by 2 inches) thick, 2 required, each color and finish.
2. Colored Concrete Panel: As specified in with mix data.

D. Test reports: Certify products comply with specifications.

1. Concrete materials.
2. Select subbase materials.
3. Field test reports.

E. Certificates: Certify products comply with specifications.

1. Expansion joint filler.
2. Reinforcement.
3. Curing materials.
4. Concrete protective coating.

F. Qualifications: Substantiate qualifications comply with specifications.

1. Installer with project experience list.
2. Land surveyor.

G. Concrete mix design.

H. Select subbase job-mix design.

I. Proposed hot and cold weather concreting methods.

J. Land surveyor's construction staking notes, before placing concrete.

1. Identify discrepancies between field conditions and Drawings.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. Regularly installs specified products.

2. Installed specified products with satisfactory service on five similar installations.
   a. Project Experience List: Provide contact names and addresses for completed projects.

B. Land Surveyor: Professional land surveyor or engineer registered to provide land surveys in jurisdiction where project is located.

C. Preconstruction Testing:
   1. Engage independent testing laboratory to perform tests and submit reports.
      a. Deliver samples to laboratory in number and quantity required for testing.
   2. Concrete mix design.
   3. Select subbase job-mix design. Report the following:
      a. Material sources.
      b. Gradation.
      c. Plasticity index.
      d. Liquid limit.
      e. Laboratory compaction curves indicating maximum density at optimum moisture content.

1.7 DELIVERY

A. Deliver steel reinforcement to prevent damage.

B. Before installation, return or dispose of distorted or damaged steel reinforcement.

C. Bulk Products: Deliver bulk products away from buildings, utilities, pavement, and existing turf and planted areas. Maintain dry bulk product storage away from contaminants.

1.8 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight facility.

B. Protect products from damage during handling and construction operations.

1.9 FIELD CONDITIONS

A. Hot Weather Concreting Procedures: ACI 305R.

B. Cold Weather Concreting Procedures: ACI 306R.
   1. Use non-corrosive, non-chloride accelerator admixture.
   2. Do not use calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions.

1.10 WARRANTY

A. Construction Warranty: Provide 1 year warranty on all concrete work.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II.

B. Pozzolans:

1. Fly Ash: ASTM C618, Class C or F including supplementary optional physical requirements.
2. Slag: ASTM C989/C989M; Grade 80, Grade 100 or Grade 120.
3. Silica Fume: ASTM C1240.

C. Coarse Aggregate: ASTM C33/C33M; size 1” diameter max to suit application.

D. Fine Aggregate: ASTM C33/C33M.

E. Mixing Water: Fresh, clean, and potable.

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

G. Chemical Admixtures: ASTM C494/C494M.

H. Reinforcing Steel: ASTM A615/A615M or ASTM A996/A996M, Type, amount, and locations shown on the drawings as specified.

I. Welded Wire Fabric: ASTM A1064/A1064M, sized as indicated.

J. Expansion Joint Filler: ASTM D1751.

K. Sheet Materials for Curing Concrete: ASTM C171.

L. Color Pigment: ASTM C979/C979M, colored and white powder pigments.

2.2 SELECT SUBBASE

A. Subbase: AASHTO M147; Grade E or Grade F.

1. Select granular material composed of sand, sand-gravel, crushed stone, crushed or granulated slag, with or without soil binder, or combinations of these materials.

SUBBASE GRADING REQUIREMENTS							
Sieve Size		Percentage Passing by Mass					
		Grades					
(mm)	(in)	A	B	C	D	E	F
50	2	100	100				
25	1		75-95	100	100	100	100
9.5	3/8	30-65	40-75	50-85	60-100		
4.47	No. 4	25-55	30-60	35-65	50-85	55-100	70-100

SUBBASE GRADING REQUIREMENTS							
Sieve Size		Percentage Passing by Mass					
		Grades					
2.00	No. 10	15-40	20-45	25-50	40-70	40-100	55-100
0.425	No. 40	8-20	15-30	15-30	25-45	20-50	30-70
0.075	No. 200	2-8	5-20	5-15	5-20	6-20	8-25

B. Other Acceptable Gradations: Materials within three to five percent, plus or minus, of specified gradation, or as recommended by the geotechnical engineer and approved by the Contracting Officer's Representative.

2.3 FORMS

A. Forms: Wood, plywood, metal, or other materials, approved by Contracting Officer's Representative, of grade or type suitable to obtain type of finish specified.
   1. Plywood: Exterior grade, free of defects and patches on contact surface.
   2. Lumber: Sound, grade-marked, S4S stress graded softwood, minimum 50 mm (2 inches) thick, free from warp, twist, loose knots, splits, or other defects.
   3. Form Coating: As recommended by Architect/Engineer.

B. Provide forms suitable in cross-section, depth, and strength to resist springing during depositing and consolidating concrete.
   1. Do not use forms varying from straight line more than 3 mm in 3000 mm (1/8 inch in 10 feet), horizontally and vertically.

C. Provide flexible or curved forms for forming radii.

2.4 CONCRETE CURING MATERIALS

A. Concrete curing materials, conform to one of the following:
   1. Burlap: Minimum 233 g/sq. m (7 ounces/sq. yd.) dry.
   2. Sheet Materials for Curing Concrete: ASTM C171.
   3. Curing Compound: ASTM C309, Type 1 clear liquid membrane forming type, without paraffin or petroleum.

2.5 CONCRETE MIXES

A. Design concrete mixes according to ASTM C94/C94M, Option C.

B. Concrete Type: Air-entrained. See Table I.

TABLE I - CONCRETE TYPES

Concrete Type	Minimum 28 Day Compressive Strength f'c MPa (psi)	Non-Air-Entrained		Air-Entrained	
		Min. Cement kg/cu. m (lbs./cu. yd.)	Max. Water Cement Ratio	Min. Cement kg/cu. m (lbs./cu. yd.)	Max. Water Cement Ratio
A	35 (5000)1,3	375 (630)	0.45	385 (650)	0.40
B	30 (4000)1,3	325 (550)	0.55	340 (570)	0.50
C	25 (3000)1,3	280 (470)	0.65	290 (490)	0.55
D	25 (3000)1,2	300 (500)	*	310 (520)	*

Footnotes:
1. If trial mixes are used, achieve compressive strength 8.3 MPa (1,200 psi) in excess of f'c. For concrete strengths greater than 35 MPa (5,000 psi), achieve compressive strength 9.7 MPa (1,400 psi) in excess of f’c.
2. For Concrete Exposed to High Sulfate Content Soils: Maximum water cement ratio is 0.44.
3. Laboratory Determined according to ACI 211.1 for normal weight concrete.

C. Maximum Slump: ASTM C143/C143M. See Table II.

TABLE II - MAXIMUM SLUMP	
APPLICATION	MAXIMUM SLUMP
Curb & Gutter	75 mm (3 inches)
Pedestrian Pavement	75 mm (3 inches)
Vehicular Pavement	50 mm (2 inches) Machine Finished 100 mm (4 inches) Hand Finished
Equipment Pad	75 to 100 mm (3 to 4 inches)

2.6 ACCESSORIES

A. Equipment and Tools: Obtain Contracting Officer's Representative's, approval of equipment and tools needed for handling materials and performing work before work begins.

B. Maintain equipment and tools in satisfactory working condition.

C. Sealants:

1. Concrete Paving Expansion Joints: ASTM D5893/D5893M, Type SL, single component, self-leveling, silicone joint sealant.
2. Concrete Paving Joints: ASTM D6690, Type IV, hot-applied, single component joint sealant.

D. Concrete Protective Coating: AASHTO M233 linseed oil mixture.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

C. Prepare, construct, and finish subgrade. See Section 31 20 00, EARTHWORK.

D. Maintain subgrade in smooth, compacted condition, in conformance with the required section and established grade until the succeeding operation has been accomplished.

3.2 SELECT SUBBASE

A. Placing:

1. Place subbase material on prepared subgrade in uniform layer to required contour and grades, and to maximum 200 mm (8 inches) loose depth.
2. When required compacted thickness exceeds 150 mm (6 inches), place subbase material in equal thickness layers.
3. When subbase elevation is 13 mm (1/2 inch) or more below required grade, excavate subbase minimum 75 mm (3 inches) deep. Place and compact subbase to required grade.

B. Compaction:

1. Perform compaction with approved hand or mechanical equipment well suited to the material being compacted.
2. Maintain subbase at optimum moisture content for compaction.
3. Compact each subbase layer to minimum 95 percent or 100 percent of maximum density as specified in Section 31 20 00, EARTHWORK.

C. Subbase Tolerances:

1. Variation from Indicated Grade: Maximum 9 mm (3/8 inch).
2. Variation from Indicated Thickness: Maximum 13 mm (1/2 inch).

D. Protection:

1. Protect subbase from damage until concrete is placed.
2. Reconstruct damaged subbase before placing concrete.

3.3 SETTING FORMS

A. Form Substrate:

1. Compact form substrate to uniformly support forms along entire length.
2. Correct substrate imperfections and variations by cutting, filling, and compacting.

B. Form Setting:
   1. Set forms to indicated line and grade with tight joints. Rigidly brace forms preventing movement.
   2. Remove forms when removal will not damage concrete and when required for finishing.
   3. Clean and oil forms before each use.
   4. Correct forms, when required, immediately before placing concrete.
C. Land Surveyor: Establish control, alignment, and grade for forms.
   1. Notify Contracting Officer's Representative immediately when discrepancies exist between field conditions and drawings.
   2. Correct discrepancies greater than 25 mm (1 inch) before placing concrete.
D. Form Tolerances:
   1. Variation from Indicated Line: Maximum 6 mm (1/4 inch).
   2. Variation from Indicated Grade: Maximum 3 mm in 3000 mm (1/8 inch in 10 feet).

3.4 PLACING REINFORCEMENT

A. Keep reinforcement clean from contamination preventing concrete bond.
B. Install reinforcement shown on drawings.
C. Support and securely tie reinforcing steel to prevent displacement during concrete placement.
D. Obtain Contracting Officer's Representative's reinforcement placement approval before placing concrete.

3.5 JOINTS - GENERAL

A. Place joints, where shown on approved submittal Drawings.
   1. Conform to details shown.
   2. Install joints perpendicular to finished concrete surface.
B. Make joints straight and continuous from edge to edge of pavement.

3.6 CONSTRUCTION JOINTS

A. Locate longitudinal and transverse construction joints between slabs of vehicular pavement as shown on approved submittal Drawings.
B. Place transverse construction joints of type shown, where indicated, and whenever concrete placement is suspended for more than 30 minutes.
C. Provide butt-type joint with dowels in curb and gutter at planned joint locations.
D. Provide keyed joints with tie bars when joint occurs in middle third of planned curb and gutter joint interval.

3.7 CONTRACTION JOINTS

A. Tool or cut joints to width, depth, and radius edge shown on drawings using grooving tool, jointer, or saw.

B. Construct joints in curbs and gutters by inserting 3 mm (1/8 inch) steel plates conforming to curb and gutter cross sections.

1. Keep plates in place until concrete can hold its shape.

C. Finish joint edges with edging tool.

D. Score pedestrian pavement with grooving tool or jointer.

3.8 EXPANSION JOINTS

A. Form expansion joints with expansion joint filler of thickness shown on drawings.

1. Locate joints around perimeter of structures and features abutting site work concrete.
2. Create complete, uniform separation between structure and site work concrete.

B. Extend expansion joint material full depth of concrete with top edge of joint filler below finished concrete surface where sealant is indicated on Drawings.

C. Cut and shape material matching cross section.

D. Anchor with approved devices to prevent displacing during placing and finishing operations.

E. Round joint edges with edging tool.

3.9 PLACING CONCRETE - GENERAL

A. Preparation before Placing Concrete:

1. Obtain Contracting Officer's Representative approval.
2. Remove debris and other foreign material.
3. Uniformly moisten substrate, without standing water.

B. Convey concrete from mixer to final location without segregation or loss of ingredients. Deposit concrete to minimize handling.

C. During placement, consolidate concrete by spading or vibrating to minimize voids, honeycomb, and rock pockets.

1. Vibrate concrete against forms and along joints.
2. Avoid excess vibration and handling causing segregation.

D. Place concrete continuously between joints without bulkheads.

E. Install construction joint in concrete placement suspended for more than 30 minutes.

F. Replace concrete with cracks, chips, bird baths, and other defects to nearest joints, approved by Contracting Officer's Representative.

3.10 PLACING CONCRETE FOR CURB AND GUTTER, PEDESTRIAN PAVEMENT, AND EQUIPMENT PADS

A. Place concrete in one layer conforming to cross section shown on Drawings after consolidating and finishing.

B. Deposit concrete near joints without disturbing joints. Do not place concrete directly onto joint assemblies.

C. Strike concrete surface to proper section ready for consolidation.

D. Consolidate concrete by tamping and spading or with approved mechanical finishing equipment.

E. Finish concrete surface with wood or metal float.

F. Construct concrete pads and pavements with sufficient slope to drain, preventing standing water.

3.11 PLACING CONCRETE FOR VEHICULAR PAVEMENT

A. Deposit concrete as close as possible to its final position.

B. Place concrete continuously between construction joints without cold joints.

C. Strike and consolidate concrete with finishing machine, vibrating screed, or by hand-finishing.

D. Finish concrete surface to elevation and crown shown on drawings.

E. Deposit concrete near joints without disturbing joints. Do not place concrete directly onto joint assemblies.

F. Obtain Contracting Officer's Representative's approval before placing adjacent lanes.

3.12 FORM REMOVAL

A. Keep forms in place minimum 12 hours after concrete placement. Remove forms without damaging concrete.

B. Do not use bars or heavy tools against concrete to remove forms. Repair damage concrete found after form removal.

3.13 CONCRETE FINISHING - GENERAL

A. Follow operation sequence below, unless otherwise indicated on Drawings:

1. Consolidating, floating, striking, troweling, texturing, and joint edging.

B. Use edging tool with 6 mm (1/4 inch) radius, unless otherwise shown on Drawings.

C. Keep finishing equipment and tools clean and suitable for use.

3.14 CONCRETE FINISHING - PEDESTRIAN PAVEMENT

A. Walks, Wheelchair Curb Ramps, Patios:
   1. Finish concrete surfaces with metal float, troweled smooth, and finished with a broom moistened with clear water.
   2. Finish slab edges and formed transverse joints with edger.
   3. Broom surfaces transverse to traffic direction.
      a. Use brooming to eliminate flat surface produced by edger.
      b. Produce uniform corrugations, maximum 1.5 mm (1/16 inch) deep profile.
   4. Provide surface uniform in color and free of surface blemishes, form marks, and tool marks.
   5. Paving Tolerances:
      a. Variation from Indicated Plane: Maximum 5 mm in 3000 mm (3/16 inch in 10 feet).
      b. Variation from Indicated Thickness: Maximum 6 mm (1/4 inch).
   6. Replace paving within joint boundary when paving exceeds specified tolerances.

B. Step Treads, Risers and Sidewalls: Finish as specified for pedestrian pavement, except as follows:
   1. Remove riser forms sequentially, starting with top riser.
   2. Rub riser face with wood or concrete rubbing block and water. Remove blemishes, form marks, and tool marks. Use outside edger to round nosing; use inside edger to finish bottom of riser.
   3. Apply uniform brush finish to treads, risers, and sidewall.
      a. Apply stiff brush finish to treads to provide slip resistant surface complying with ANSI B101.3.
   4. Step Tolerance:
      a. Variation from Indicated Plane: Maximum 5 mm in 3000 mm (3/16 inch in 10 feet).

3.15 CONCRETE FINISHING - VEHICULAR PAVEMENT

A. Align finish surfaces where new and existing pavements abut.

B. Longitudinally float pavement surface to profile and grade indicated on drawings.

C. Straighten surface removing irregularities and maintaining specified tolerances while concrete is plastic.

D. Finish pavement edges and joints with edging tool.

E. Broom finish concrete surface after bleed water dissipates and before concrete hardens.
   1. Broom surface transverse to traffic direction.
      a. Use brooming to eliminate flat surface produced by edger.
      b. Produce uniform corrugations, maximum 3 mm (1/8 inch) deep profile.
F. Pavement Tolerances:
   1. Variation from Indicated Plane: Maximum 6 mm in 3000 mm (1/4 inch in 10 feet) tested parallel and perpendicular to traffic direction at maximum 1500 mm (5 feet) intervals.
   2. Variation from Indicated Thickness: Maximum 6 mm (1/4 inch).
G. Replace paving within joint boundary when paving exceeds specified tolerances.

3.16 CONCRETE FINISHING - CURBS AND GUTTERS

A. Round edges of gutter and top of curb with edging tool.
B. Gutter and Curb Top:
   1. Float surfaces and finish with smooth wood or metal float until true to grade and section and uniform color.
   2. Finish surfaces, while still plastic, longitudinally with bristle brush.
C. Curb Face:
   1. Remove curb form and immediately rub curb face with wood or concrete rubbing block removing blemishes, form marks, and tool marks and providing uniform color.
   2. Brush curb face, while still plastic, matching gutter and curb top.
D. Curb and Gutter Tolerances:
   1. Variation from Indicated Plane and Grade:
      a. Gutter: Maximum 3 mm in 3000 mm (1/8 inch in 10 feet).
      b. Curb Top and Face: Maximum 6 mm in 3000 mm (1/4 inch in 10 feet).
E. Replace curbs and gutters within joint boundary when curbs and gutters exceed specified tolerances.
F. Correct depressions causing standing water.

3.17 CONCRETE FINISHING - EQUIPMENT PADS

A. Strike pad surface to elevation shown on Drawings.
B. Provide smooth, dense float finish, free from depressions or irregularities.

C. Finish pad edges with edger.

D. After removing forms, rub pad edge faces with wood or concrete rubbing block, removing blemishes, form marks, and tool marks and providing uniform color.

E. Pad Tolerances:

1. Variation from Indicated Plane: Maximum 3 mm in 3000 mm (1/8 inch in 10 feet).
2. Variation from Indicated Elevation: Maximum 6 mm (1/4 inch).
3. Variation from Indicated Thickness: Maximum 6 mm (1/4 inch).

F. Replace pads when pads exceed specified tolerances.

3.18 SPECIAL FINISHES

A. Exposed Aggregate Finish:

1. Prepare concrete base 10 to 13 mm (3/8 to 1/2 inch) lower than the finish grade.
2. Scatter aggregate over concrete base surface and embed by use of hand float, straight edge, or darby.
3. Apply concrete mix and mark off surface as indicated on Drawings with surface joints at least 10 mm (3/8 inch) deep. Level off finish to a true surface and compact with wood float, working as little as possible so that coarse material will remain at the top. Before finish has set, treat top surface with cement retarding material. When body of concrete finish has set, remove retarded surface film by wire brushes and fine water spray to remove mortar from top of colored aggregate. Continue washing and brushing until flush water runs clear and no noticeable cement film left on the aggregate.

B. Colored Concrete: Add integral color pigment to the pedestrian concrete paving mix at batch plant. Introduce sufficient quantities of to produce color specified.

3.19 CONCRETE CURING

A. Concrete Protection:

1. Protect unhardened concrete from rain and flowing water.
2. Provide sufficient curing and protection materials available and ready for use before concrete placement begins.
3. Protect concrete to prevent pavement cracking from ambient temperature changes during curing period.
   a. Replace pavement damaged by curing method allowing concrete cracking.

b. Employ another curing method as directed by Contracting Officer's Representative.

B. Cure concrete for minimum 7 days by one of the following methods appropriate to weather conditions preventing moisture loss and rapid temperature change:

1. Burlap Mat: Provide minimum two layers kept saturated with water during curing period. Overlap Mats at least 150 mm (6 inches).
2. Sheet Materials:
   a. Wet exposed concrete surface with fine water spray and cover with sheet materials.
   b. Overlap sheets minimum 300 mm (12 inches).
   c. Securely anchor sheet materials preventing displacement.
3. Curing Compound:
   a. Protect joints indicated to receive sealants preventing contamination from curing compound.
   b. Insert moistened paper or fiber rope into joint or cover joint with waterproof paper.
   c. Apply curing compound before concrete dries.
   d. Apply curing compound in two coats at right angles to each other.
   e. Application Rate: Maximum 5 sq. m/L (200 sq. ft./gallon), both coats.
   f. Immediately reapply curing compound to surfaces damaged during curing period.

3.20 CONCRETE PROTECTIVE COATING

A. Apply protective coating of linseed oil mixture to exposed-to-view concrete surfaces, drainage structures, and features that project through, into, or against concrete exterior improvements to protect the concrete against deicing materials.

B. Complete backfilling and curing operation before applying protective coating.

C. Dry and thoroughly clean concrete before each application.

D. Apply two coats, with maximum coverage of 11 sq. m/L (50 sq. yds./gal.); first coat, and maximum 16 sq. m/L (70 sq. yds./gal.); second coat, except apply commercially prepared mixture according to manufacturer's instructions.

E. Protect coated surfaces from vehicular and pedestrian traffic until dry.

F. Do not heat protective coating, and do not expose protective coating to open flame, sparks, or fire adjacent to open containers or applicators. Do not apply material at temperatures lower than 10 degrees C (50 degrees F).

3.21 FIELD QUALITY CONTROL

A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.
   1. Compaction.
      a. Pavement subgrade.
      b. Curb, gutter, and sidewalk.
   2. Concrete:
      a. Delivery samples.
      b. Field samples.
   3. Slip Resistance: Steps and pedestrian paving.

3.22 CLEANING

A. After completing curing:
   1. Remove burlap and sheet curing materials.
   2. Sweep concrete clean, removing foreign matter from the joints.
   3. Seal joints as specified.

3.23 PROTECTION

A. Protect exterior improvements from traffic and construction operations.
   1. Prohibit traffic on paving for minimum seven days after placement, or longer as directed by Contracting Officer's Representative.
B. Remove protective materials immediately before acceptance.
C. Repair damage.
   1. Replace concrete containing excessive cracking, fractures, spalling, and other defects within joint boundary, when directed by Contracting Officer's Representative, and at no additional cost to the Government.

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SECTION 32 12 16
ASPHALT PAVING

PART 1 - GENERAL

1.1 DESCRIPTION

This work shall cover the composition, mixing, construction upon the prepared subgrade, and the protection of hot asphalt concrete pavement. The hot asphalt concrete pavement shall consist of an aggregate or asphalt base course and asphalt surface course constructed in conformity with the lines, grades, thickness, and cross sections as shown. Each course shall be constructed to the depth, section, or elevation required by the drawings and shall be rolled, finished, and approved before the placement of the next course.

1.2 RELATED WORK

A. Laboratory and field-testing requirements: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Subgrade Preparation: Paragraph 3.3 and Section 31 20 11, EARTHWORK (SHORT FORM) .

C. Pavement Markings: Section 32 17 23, PAVEMENT MARKINGS.

1.3 INSPECTION OF PLANT AND EQUIPMENT

The COR shall have access at all times to all parts of the material producing plants for checking the mixing operations and materials and the adequacy of the equipment in use.

1.4 ALIGNMENT AND GRADE CONTROL

The Contractor’s Registered Professional Land Surveyor shall establish and control the pavement (aggregate or asphalt base course and asphalt surface course) alignments, grades, elevations, and cross sections as shown on the Drawings.

1.5 SUBMITTALS

A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:

B. Data and Test Reports:

1. Aggregate Base Course: Sources, gradation, liquid limit, plasticity index, percentage of wear, and other tests required by State Highway Department.

2. Asphalt Base/Surface Course: Aggregate source, gradation, soundness loss, percentage of wear, and other tests required by State Highway Department.
3. Job-mix formula.

C. Certifications:
1. Asphalt prime and tack coat material certificate of conformance to State Highway Department requirements.
2. Asphalt cement certificate of conformance to State Highway Department requirements.
3. Job-mix certification - Submit plant mix certification that mix equals or exceeds the State Highway Specification.

D. One copy of State Highway Department Specifications.

E. Provide MSDS (Material Safety Data Sheets) for all chemicals used on ground.

PART 2 - PRODUCTS

2.1 GENERAL

A. Aggregate base, Asphaltic base, and asphalt concrete materials shall conform to the requirements of the following and other appropriate sections of the latest version of the State Highway Material Specifications, including amendments, addenda and errata. Where the term "Engineer" or "Commission" is referenced in the State Highway Specifications, it shall mean the COR.

2.2 AGGREGATES

A. Provide aggregates consisting of crushed stone, gravel, sand, or other sound, durable mineral materials processed and blended, and naturally combined.

B. Subbase aggregate (where required) maximum size: 38mm(1-1/2").

C. Base aggregate maximum size:
1. Base course over 152mm(6") thick: 38mm(1-1/2");
2. Other base courses: 19mm(3/4").

D. Asphaltic base course:
1. Maximum particle size not to exceed 25.4mm(1”).
2. Where conflicts arise between this specification and the requirements in the latest version of the State Highway Specifications, the State Specifications shall control.

E. Aggregates for asphaltic concrete paving: Provide a mixture of sand, mineral aggregate, and liquid asphalt mixed in such proportions that the percentage by weight will be within:

Sieve Sizes	Percentage Passing
19mm(3/4")	100
9.5mm(3/8")	67 to 85
6.4mm(1/4")	50 to 65
2.4mm(No. 8 mesh)	37 to 50
600µm(No. 30 mesh)	15 to 25
75µm(No. 200 mesh)	3 to 8

plus 50/60 penetration liquid asphalt at 5 percent to 6-1/2 percent of the combined dry aggregates.

2.3 ASPHALTS

A. Comply with provisions of Asphalt Institute Specification SS2:
   1. Asphalt cement: Penetration grade 50/60
   2. Prime coat: Cut-back type, grade MC-250
   3. Tack coat: Uniformly emulsified, grade SS-1H

2.4 SEALER

A. Provide a sealer consisting of suitable fibrated chemical type asphalt base binders and fillers having a container consistency suitable for troweling after thorough stirring, and containing no clay or other deleterious substance.

B. Where conflicts arise between this specification and the requirements in the latest version of the State Highway Specifications, the State Specifications shall control.

PART 3 - EXECUTION

3.1 GENERAL

The Asphalt Concrete Paving equipment, weather limitations, job-mix formula, mixing, construction methods, compaction, finishing, tolerance, and protection shall conform to the requirements of the appropriate sections of the State Highway Specifications for the type of material specified.

3.2 MIXING ASPHALTIC CONCRETE MATERIALS

A. Provide hot plant-mixed asphaltic concrete paving materials.
   1. Temperature leaving the plant: 143 degrees C(290 degrees F) minimum, 160 degrees C(320 degrees F) maximum.

2. Temperature at time of placing: 138 degrees C(280 degrees F) minimum.

3.3 SUBGRADE

A. Shape to line and grade and compact with self-propelled rollers.

B. All depressions that develop under rolling shall be filled with acceptable material and the area re-rolled.

C. Soft areas shall be removed and filled with acceptable materials and the area re-rolled.

D. Should the subgrade become rutted or displaced prior to the placing of the subbase, it shall be reworked to bring to line and grade.

E. Proof-roll the subgrade with maximum 45 tonne (50 ton) gross weight dump truck as directed by VA Resident Engineer or VA Contracting Officer. If pumping, pushing, or other movement is observed, rework the area to provide a stable and compacted subgrade.

3.4 BASE COURSES

A. Subbase (when required)

1. Spread and compact to the thickness shown on the drawings.
2. Rolling shall begin at the sides and continue toward the center and shall continue until there is no movement ahead of the roller.
3. After completion of the subbase rolling there shall be no hauling over the subbase other than the delivery of material for the top course.

B. Base

1. Spread and compact to the thickness shown on the drawings.
2. Rolling shall begin at the sides and continue toward the center and shall continue until there is no movement ahead of the roller.
3. After completion of the base rolling there shall be no hauling over the base other than the delivery of material for the top course.

C. Thickness tolerance: Provide the compacted thicknesses shown on the Drawings within a tolerance of minus 0.0mm (0.0") to plus 12.7mm (0.5").

D. Smoothness tolerance: Provide the lines and grades shown on the Drawings within a tolerance of 5mm in 3m (3/16 inch in ten feet).

E. Moisture content: Use only the amount of moisture needed to achieve the specified compaction.

3.5 PLACEMENT OF ASPHALTIC CONCRETE PAVING

A. Remove all loose materials from the compacted base.

B. Apply the specified prime coat, and tack coat where required, and allow to dry in accordance with the manufacturer’s recommendations as approved by the Architect or Engineer.

C. Receipt of asphaltic concrete materials:

1. Do not accept material unless it is covered with a tarpaulin until unloaded, and unless the material has a temperature of not less than 130 degrees C(280 degrees F).
2. Do not commence placement of asphaltic concrete materials when the atmospheric temperature is below 10 degrees C (50 degrees F), not during fog, rain, or other unsuitable conditions.

D. Spreading:

1. Spread material in a manner that requires the least handling.
2. Where thickness of finished paving will be 76mm (3") or less, spread in one layer.

E. Rolling:

1. After the material has been spread to the proper depth, roll until the surface is hard, smooth, unyielding, and true to the thickness and elevations shown own the drawings.
2. Roll in at least two directions until no roller marks are visible.
3. Finished paving smoothness tolerance:
   a. No depressions which will retain standing water.
   b. No deviation greater than 3mm in 1.8m (1/8" in six feet).

3.7 PROTECTION

Protect the asphaltic concrete paved areas from traffic until the sealer is set and cured and does not pick up under foot or wheeled traffic.

3.8 FINAL CLEAN-UP

Remove all debris, rubbish, and excess material from the work area.

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SECTION 32 17 23
PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

B. Paint on pavement surfaces, in form of traffic lanes, parking bays, areas restricted to handicapped persons, crosswalks, and other detail pavement markings.

1.2 RELATED REQUIREMENTS

A. Paint Color: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. Federal Specifications (Fed. Spec.):

1. TT-B-1325D - Beads (Glass Spheres) Retro-Reflective.
2. TT-P-1952F - Paint, Traffic and Airfield Marking, Waterborne.

C. Master Painters Institute (MPI):

1. No. 97 - Traffic Marking Paint, Latex.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:

1. Show pavement marking configuration and dimensions.
2. Show international symbol of accessibility at designated parking spaces.

C. Manufacturer's Literature and Data:

1. Description of each product.
2. Application instructions.

D. Samples:

1. Paint: 200 mm (8 inches) square, each type and color.

E. Certificates: Certify products comply with specifications.

F. Qualifications: Substantiate qualifications comply with specifications.

1. Installer with project experience list.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Regularly installs specified products.

2. Installed specified products with satisfactory service on five similar installations for minimum five years.
   a. Project Experience List: Provide contact names and addresses for completed projects.

1.6 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.
B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.
C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight conditioned facility.
B. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

A. Environment:
   1. Product Temperature: Minimum 13 degrees C (55 degrees F) for minimum 48 hours before installation.
      a. Surface to be painted and ambient temperature: Minimum 10 degrees C (50 degrees F) and maximum 35 degrees C (95 degrees F).
B. Field Measurements: Verify field conditions affecting traffic marking installation. Show field measurements on Submittal Drawings.

1.9 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Design paint complying with specified performance:
   1. Application: Fed. Spec. TT-P-1952F.

2.2 PRODUCTS - GENERAL

A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.
B. Provide each product from one manufacturer and from one production run.

1. Low Pollutant-Emitting Materials: Comply with VOC limits specified in Section 01 81 11, SUSTAINABLE DESIGN REQUIREMENTS for the following products:
   a. Paints and coatings.

2.3 SANDBLASTING EQUIPMENT

A. Air compressor, hoses, and nozzles of proper size and capacity as required for cleaning surfaces to be painted. Compressor to provide minimum 0.08 cu. m/s (150 cfm) of air at pressure of minimum 625 kPa (90 psi) at each nozzle used.

2.4 PAINT APPLICATOR

A. Apply marking paint with approved mechanical equipment. Provide equipment constant agitation of paint and travel at controlled speeds. Synchronize one or more paint "guns" to automatically begin and cut off paint flow in case of skip lines. Provide pneumatic spray guns for hand application of paint in areas where mobile paint applicator cannot be used.

2.5 PAINT

A. Paint: MPI No. 97. For obliterating existing markings comply with Fed. Spec. TT-P-1952F. Provide minimum 18 L (5 gal.) containers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.
   1. Allow new pavement surfaces to cure for minimum 14 days before application of marking materials.
B. Protect existing construction and completed work from damage.
C. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.
   1. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or combination of these methods.
   2. Completely remove rubber deposits, existing paint markings, and other coatings adhering to pavement with scrapers, wire brushings, sandblasting, mechanical abrasion, or approved chemicals as directed by (Contracting Officer's Representative (COR)).
   3. Application of paint conforming to Fed. Spec. TT-P-1952F is an option to removal of existing paint markings on asphalt pavement.

Apply black paint in as many coats as necessary to completely obliterate existing markings.

4. Where oil or grease are present on old pavements to be marked, scrub affected areas with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinse thoroughly after each application.
   a. After cleaning, seal oil-soaked areas with cut shellac to prevent bleeding through new paint.
5. Pavement marking to follow as closely as practicable after surface has been cleaned and dried, but do not begin any marking until COR has inspected surface and gives permission to proceed.

3.2 TEMPORARY PAVEMENT MARKING

A. Apply Temporary Pavement Markings of colors, widths and lengths shown on drawings or directed by COR. Upon COR's direction, remove temporary marking by carefully controlled sandblasting, approved grinding equipment, or other approved method to avoid damaged. As an option, provide approved preformed pressure sensitive, adhesive tape type of temporary pavement marking of required colors, widths and lengths in lieu of temporary painted marking. Remove any unsatisfactory tape type marking and replace with painted markings at no additional cost to Government.

3.3 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions and approved submittal drawings.
   1. When manufacturer's instructions deviate from specifications, submit proposed resolution for COR consideration.

3.4 PAINT APPLICATION

A. Apply uniformly painted pavement marking of required colors, length, and width with true, sharp edges and ends on properly cured, prepared, and dried surfaces in conformance with details shown on drawings and established control points.
   1. Skip Markings Line Tolerances:
      a. Length: Plus or minus 75 mm (3 inches).
      b. Width: Plus or minus 3 mm (1/8 inch).
      c. Length of intervals exceeding line length tolerance are not acceptable.

2. Apply paint at wet film thickness of 0.4 mm (0.015 inch). Apply paint in one coat.
3. At the direction of COR, apply additional coats at markings showing light spots.
4. Comply with paint manufacturer's maximum drying time requirements to prevent undue softening of asphalt, and pick-up, displacement, or discoloration by tires of traffic.
5. If any deficiency in marking drying occurs, discontinue paint operations until cause of slow drying is determined and corrected.
6. Remove and replace marking applied at less than minimum material rates, deviates from true alignment, exceeds stipulated length and width tolerances, or shows light spots, , smears, or other deficiencies or irregularities. Remove marking so that surface to which marking was applied will not be damaged by carefully controlled sand blasting, approved grinding equipment, or other approved method.

3.5 DETAIL PAVEMENT MARKING

A. Apply Detail Pavement Markings in locations indicated on drawings. Apply International Handicapped Symbol where indicated in parking spaces. Color as shown on drawings. Apply paint for symbol using suitable template that will provide pavement marking with true, sharp edges and ends. Place detail pavement markings of colors, widths and lengths, and design pattern at locations shown on drawings.

3.6 CLEANING

A. Remove excess paint before paint sets.
B. Remove all debris, rubbish and excess material from project site.

3.7 PROTECTION

A. Protect pavement markings from traffic and construction operations.
   1. Protect newly painted markings track free.
   2. Place warning signs to alert traffic from both directions.
   3. Place small flags or other similarly small objects near freshly applied markings at frequent intervals to reduce crossing by traffic.
B. Repair damage.

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SECTION 33 10 00

WATER UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies materials and procedures for construction of underground water distribution for domestic and/or fire supply systems outside the building that are complete and ready for operation. This includes piping, structures, appurtenances and all other incidentals.

1.2 RELATED WORK

A. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 11, EARTH WORK (SHORT FORM).

B. Concrete: Section 03 30 00, CAST IN-PLACE CONCRETE.

C. General plumbing: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

D. Submittals: Refer to Division 1, General Requirements Specifications

E. Erosion and Sediment Control: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

1.3 DEFINITIONS

A. Water distribution system: Pipelines and appurtenances which are part of the distribution system outside the building for potable water and fire supply.

B. Water service line: Pipeline from main line to 5 feet outside of building.

1.4 ABBREVIATIONS

A. PVC: Polyvinyl chloride plastic.

B. DI: Ductile iron pipe.

C. WOG: Water, Oil and Gas.

D. PE: Polyethylene pipe

1.5 DELIVERY, STORAGE AND HANDLING

A. Ensure that valves are dry and internally protected against rust and corrosion. Protect valves against damage to threaded ends and flange faces.

B. Use a sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

C. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
D. Protect stored piping from moisture and dirt by elevating above grade. Protect flanges, fittings, and specialties from moisture and dirt.
E. Store plastic piping protected from direct sunlight and support to prevent sagging and bending.
F. Cleanliness of Piping and Equipment Systems:
   1. Care shall be exercised in the storage and handling of equipment and piping material to be incorporated in the work. Debris arising from cutting, threading and welding of piping shall be removed.
   2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.

1.6 COORDINATION

A. Coordinate connection to water main with Contracting Officers Representative (COR).
B. Coordinate water service lines with COR.

1.7 QUALITY ASSURANCE:

A. Products Criteria:
   1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
   2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be either cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.
B. Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least three years. Digital electronic devices, software and systems such as controls, instruments or computer work stations shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years.
C. Regulatory requirements:
   1. Comply with the rules and regulations of the Virginia Department of Health (VDH).

2. Comply with the rules and regulations of the Federal, State, and/or Department of Environmental Quality having jurisdiction for potable water-service.
3. Comply with rules and regulations of Federal , State, and/or Local authorities having jurisdiction for fire-suppression water-service piping including materials, hose threads, installation and testing.

D. Provide certification of factory hydrostatic testing of not less than 500 psi (3.5 MPa) in accordance with AWWA C151. Piping materials shall bear the label, stamp or other markings of the specified testing agency.

E. Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:
1. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualifications".
2. Comply with provisions of ASME B31 series "Code for Pressure Piping".
3. Certify that each welder has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.
4. All welds shall be stamped according to the provisions of the American Welding Society.

F. Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Resident Engineer prior to installation.

G. Applicable codes:
1. Plumbing Systems: IPC, International Plumbing Code.
2. Electrical components, devices and accessories shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.
3. Fire-service main products shall be listed in the FM Global “Approval Guide” or Underwriters Laboratories (UL) “Fire Protection Equipment Directory”.

1.8 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American National Standards Institute (ANSI):

MSS SP-60-2004 .....Connecting Flange Joint Between Tapping Sleeves and Tapping Valves

MSS SP-108-2002.....Resilient-Seated Cast Iron, Eccentric Plug Valves

MSS SP-123-1998(R2006)..Non-Ferrous Threaded and Solder-Joint Unions for Use With Copper Water Tube

C. American Society of Mechanical Engineers (ASME):

A112.1.2-2004.....Air Gaps in Plumbing Systems (for Plumbing Fixtures and Water-Connected Receptors))

A112.6.3-2001.....Floor Drains

B16.1-2010.....Gray Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250

B16.18-2001.....Cast Copper Alloy Solder Joint Pressure Fittings

B16.22-2001.....Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

B16.24-2006.....Cast Copper Alloy Pipe Flanges and Flanged Fittings; Classes 150, 300, 600, 900, 1500 and 2500

B31.....Code for Pressure Piping Standards

D. American Society for Testing and Materials (ASTM):

A36/A36M-08.....Carbon Structural Steel

A48/A48M-08(2008).....Gray Iron Castings

A536-84(2009).....Ductile Iron Castings

A674-10.....Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids

B61-08.....Steam or Valve Bronze Castings

B62-09.....Composition Bronze or Ounce Metal Castings

B88/B88M-09.....Seamless Copper Water Tube

C651-05.....Disinfecting Water Mains

C858-10e1.....Underground Precast Utility Structures

D1785-06.....Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

D2239-03.....Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter

D2464-06.....Threaded Poly (Vinyl Chloride) PVC Pipe Fittings, Schedule 80

D2466-06.....Poly (Vinyl Chloride) (PVC) Pipe Fittings, Schedule 40

D2467-06.....Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

D2609-02(2008).....Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe

D2774-21.....Standard Practice for Underground Installation of Thermoplastic Pressure Piping

D3350-10a.....Polyethylene Plastics Pipe and Fittings Materials

F714-10.....Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter

F1267-07.....Metal, Expanded, Steel

E. American Water Works Association (AWWA):

B300-10.....Hypochlorites

B301-10.....Liquid Chlorine

C104-08.....Cement-Mortar Lining for Ductile Iron Pipe and Fittings

C105/A21.5-10.....Polyethylene Encasement for Ductile Iron Pipe Systems

C110-08.....Ductile Iron and Gray-Iron Fittings

C111/A21.11-07.....Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings

C115/A21.11-11.....Flanged Ductile Iron Pipe with Ductile Iron or Gray-Iron Threaded Flanges

C151/A21.51-09.....Ductile Iron Pipe, Centrifugally Cast

C153/A21.53-11.....Ductile Iron Compact Fittings for Water Service

C502-05.....Dry-Barrel Fire Hydrants

C503-05.....Wet-Barrel Fire Hydrants

C504-10.....Rubber-Seated Butterfly Valves

C508-09.....Swing-Check Valves for Waterworks Service, 2-In. Through 24-In. (50-mm Through 600-mm) NPS

C509-09.....Resilient-Seated Gate Valves for Water Supply Service

C510-07.....Double Check Valve Backflow Prevention Assembly

C511-07.....Reduced-Pressure Principle Backflow Prevention Assembly

C512-07.....Air Release, Air/Vacuum and Combination Air Valves

C550-05.....Protective Interior Coatings for Valves and Hydrants

C600-10.....Installation of Ductile Iron Mains and Their Appurtenances

C605-11.....Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water

C606-11.....Grooved and Shouldered Joints

C651-05.....Disinfecting Water Mains

C700-09.....Cold-Water Meters, “Displacement Type,” Bronze Main Case

C800-05.....Underground Service Line Valves and Fittings

C900-09.....Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution

C906-07.....Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 64 In. (1,600 mm), for Water Distribution and Transmission

C907-04.....Injection-Molded PVC Pressure Fittings, 4 Inch through 12 Inch (100 mm through 300 mm), for Water Distribution

M23-2nd Ed.....PVC Pipe, Design and Installation

M44-2nd Ed.....Distribution Valves: Selection, Installation, Field Testing and Maintenance

F. National Fire Protection Association (NFPA):

NFPA 24-2010 Ed.....Installation of Private Fire Service Mains and Their Appurtenances

NFPA 1963-2009 Ed.....Fire Hose Connections

G. NSF International (NSF):

NSF/ANSI 14 (2013).....Plastics Piping System Components and Related Materials

NSF/ANSI 61-2012.....Drinking Water System Components - Health Effects

NSF/ANSI 372-2011.....Drinking Water System Components – Lead Content

H. American Welding Society (AWS):

A5.8/A5.8M-2004 .....Filler Metals for Brazing and Braze Welding

I. American Society of Safety Engineers (ASSE):

1003-2009 .....Water Pressure Reducing Valves

1015-2009.....Double Check Backflow Prevention Assemblies and Double Check Fire Protection Backflow Prevention Assemblies

1020-2004.....Pressure Vacuum Breaker Assembly

1047-2009.....Performance Requirements for Reduced Pressure Detector Fire Protection Backflow Prevention Assemblies

1048-2009.....Performance Requirements for Double Check Detector Fire Protection Backflow Prevention Assemblies

1060-2006.....Performance Requirements for Outdoor Enclosures for Fluid Conveying Components

J. Underwriters' Laboratories (UL):

246.....Hydrants for Fire-Protection Service

262.....Gate Valves for Fire-Protection Service

312.....Check Valves for Fire-Protection Service

405.....Fire Department Connection Devices

753.....Alarm Accessories for Automatic Water-Supply Control Valves for Fire Protection Service

789.....Indicator Posts for Fire-Protection Service

1091.....Butterfly Valves for Fire-Protection Service

1285.....Pipe and Couplings, Polyvinyl Chloride (PVC), and Oriented Polyvinyl Chloride (PVCO) for Underground Fire Service

1.9 WARRANTY

A. The Contractor shall remedy any defect due to faulty material or workmanship and pay for any damage to other work resulting therefrom within a period of one year from final acceptance. Further, the Contractor will furnish all manufacturers’ and supplier's written guarantees and warranties covering materials and equipment furnished under this Contract.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Material or equipment containing a weighted average of greater than 0.25 percent lead shall not be used in any potable water system intended for human consumption, and shall be certified in accordance with NSF/ANSI 61 or NSF 372.

B. Plastic pipe, fittings, and solvent cement shall meet NSF/ANSI 14 and shall be NSF listed for the service intended.

2.2 FACTORY-ASSEMBLED PRODUCTS

A. Standardization of components shall be maximized to reduce spare part requirements. The contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

2.3 SAFETY GUARDS

A. All equipment shall have moving parts protected to prevent personal injury. Pump shafts and couplings shall be fully guarded by a sheet steel guard, covering coupling and shaft but not bearings. Material shall be minimum 16-gauge sheet steel; ends shall be braked and drilled and attached to pump base with minimum of four 1/4 inch (6 mm) bolts. Reinforce guard as necessary to prevent side play forcing guard onto couplings.

2.4 LIFTING ATTACHMENTS

A. Equipment shall be provided with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

2.5 DUCTILE IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated, 350 psi (2400 kPa).
   1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
   2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated, 350 psi (2400 kPa).
   1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
   2. Gaskets: AWWA C111, rubber.

C. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, round-grooved ends.

1. Grooved-End, Ductile-Iron Pipe Appurtenances: ASTM A47, malleable-iron castings or ASTM A536, ductile-iron castings with dimensions matching pipe, 350 psi (3400 kPa).
2. Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions, Include ferrous housing sections, gasket suitable for water, and bolts and nuts.
3. Gaskets: AWWA C111.

D. Flanged Ductile Iron Pipe: AWWA C115/A21.11, with factory applied screwed long hub flanges.
1. Flanges: ASME B16.1 for 125 psi (850 kPa) or 250 psi (1725 kPa) pressure ratings, as necessary.
2. Wall Sleeve Castings, size and types shown on the drawings, shall be hot dipped galvanized per ASTM A123.
3. Pipe and fittings exposed to view in the finished work are to be painted in accordance with Section 09 91 00, PAINTING. Pipe shall be shop primed with one coat of rust inhibitive primer. Final paint color shall match the final wall color.

E. Cement Mortar Internal Lining: Cement mortar lining and bituminous seal coat as per AWWA C104.

F. Exterior Pipe Coating: The exterior of pipe shall have the standard asphaltic coating.

2.6 POLYVINYL CHLORIDE PIPE AND FITTINGS

A. PVC, Schedule 40 Pipe: ASTM D1785.
1. PVC, Schedule 40 Socket Fittings: ASTM D2466.

B. PVC, Schedule 80 Pipe: ASTM D1785.
1. PVC, Schedule 80 Socket Fittings: ASTM D2467.
2. PVC, Schedule 80 Threaded Fittings: ASTM D2464.

C. PVC, AWWA Pipe: AWWA C900, Class 150 and Class 200 , with bell end with gasket, and with spigot end.
1. Comply with UL 1285 for fire-service mains if indicated.
2. PVC Fabricated Fittings: AWWA C900, Class 150 and Class 200 , with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
3. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
4. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern//.

a. Gaskets: AWWA C111, rubber.

5. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
   a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.7 PE PIPE AND FITTINGS

A. PE, ASTM Pipe: ASTM D2239, SIDR No. 5.3, 7, or 9; with PE compound number required to give pressure rating not less than 160 psi (1100 kPa) .
   1. Insert Fittings for PE Pipe: ASTM D2609, made of PA, PP, or PVC with serrated male insert ends matching inside of pipe. Include bands or crimp rings.
   2. Molded PE Fittings: ASTM D3350, PE resin, socket- or butt-fusion type, made to match PE pipe dimensions and class.

B. PE, AWWA Pipe: AWWA C906, DR No. 7.3, 9, or 9.3; with PE compound number required to give pressure rating not less than 160 psi (1100 kPa) .
   1. PE, AWWA Fittings: AWWA C906, socket- or butt-fusion type, with DR number matching pipe and PE compound number required to give pressure rating not less than 160 psi (1100 kPa)

C. PE, Fire-Service Pipe: ASTM F714, AWWA C906, or equivalent for PE water pipe; FMG approved, with minimum thickness equivalent to FMG Class 150 and Class 200 .
   1. Molded PE Fittings: ASTM D3350, PE resin, socket-or butt-fusion type, made to match PE pipe dimensions and class.

2.8 COPPER TUBE AND FITTINGS

A. Soft Copper Tubing: ASTM B88, Type K water tube, annealed temper.

B. Hard Copper Tubing: ASTM B88, Type K water tube, drawn temper.

C. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper alloy, solder joint pressure fittings.

D. Brazing Alloy: AWS A5.8/A5.8M, Classification BCuP.

E. Bronze Flanges: ASME B16.24, Class 150, with solder joint ends. ASME B16.24, Class 300 flanges if required to match piping.

F. Copper Unions: ANSI MSS SP-123, cast copper alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

2.9 VALVES

A. Gate Valves: AWWA C509, Non-rising Stem, Resilient Seat, 200 psi (1380 kPa).
   1. Valves 3 inches (75 mm) and larger: Resilient seat valve with gray- or ductile iron body and bonnet; cast iron or bronze double-disc gate; bronze gate rings; non-rising bronze stem and stem nut.
   2. Interior and exterior coating: AWWA C550, thermo-setting or fusion epoxy.
   3. Underground valve nut: Furnish valves with 2 inch (50 mm) nut for socket wrench operation.
   4. Aboveground and pit operation: Furnish valves with hand wheels.
   5. End connections shall match main line pipe .

B. Gate Valve Accessories and Specialties
   1. Tapping-Sleeve Assembly: ANSI MSS SP-60; sleeve and valve to be compatible with the drilling matching.
      a. Tapping Sleeve: Cast or Ductile Iron or Stainless-Steel , two-piece bolted sleeve. Sleeve to match the size and type of pipe material being tapped.
      b. Valve shall include one raised face flange mating tapping-sleeve flange.
   2. Valve Boxes: AWWA M44 with top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel.
   3. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut. (Provide two wrenches for Project.)
   4. Indicator Posts: UL 789, FMG approved, vertical-type, cast iron body with operating wrench, extension rod, and adjustable cast iron barrel of length required for depth of burial of valve.

C. Swing Check Valves:
   1. Valves smaller than 2 inches (25 mm): ASTM B61, resilient seat, bronze body and bonnet, pressure rating of 200 psi (1380 kPa). Ends to match main line piping.
   2. Valves 2 inches (25 mm) or larger: AWWA 508, resilient seat valve with iron body and bonnet, pressure rating of 200 psi (1380 kPa).
   3. Coating: AWWA C550, fusion epoxy coated.

D. Detector Check Valves
   1. Galvanized cast iron body, bolted cover with air-bleed device for access to internal parts, and flanged ends. Include one-piece bronze disc with bronze bushings, pivot, and replaceable seat. Include threaded bypass taps in inlet and outlet for bypass meter connection. Set valve to allow minimal water flow through bypass meter when major water flow is required.
      a. Standards: UL 312 and FMG approved, 175 psi (1207 kPa).
      b. Water Meter: AWWA C700, disc type, at least one-fourth size of detector check valve. Include meter, bypass piping, gate valves, check valve, and connections to detector check valve.
   2. Iron body, corrosion-resistant clapper ring and seat ring material, flanged ends, with connections for bypass and installation of water meter.
      a. Standards: UL 312 and FMG approved, 175 psi (1207 kPa).
E. Butterfly Valves
   1. Rubber-Seated Butterfly Valve: AWWA C504.
      a. Provide rubber seated butterfly valve cast or ductile iron body , wafer or flanged , minimum pressure of 150 psi (1035 kPa).
   2. UL Butterfly Valve: UL 1091 and FMG approved.
      a. Provide metal on resilient material seating butterfly valves that are UL 1091 and FMG approved, cast or ductile iron body , wafer or flanged minimum pressure of 175 psi (1207 kPa).
F. Plug Valves: ANSI MSS SP-108, resilient-seated eccentric plug valve, minimum pressure of 175 psi (1207 kPa).
G. Corporation Valves and Curb Valves
   1. Service-Saddle Assemblies: AWWA C800.
      a. Service Saddle: Copper alloy with seal and threaded outlet for corporation valve.
      b. Corporation Valve: Bronze body and ground-key plug, with threaded inlet and outlet matching service piping material.
      c. Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.
   2. Curb Valves: AWWA C800, bronze body, ground-key plug or ball, wide tee head, with inlet and outlet matching service piping material, minimum pressure of 200 psi (1375 kPa).

3. Service Boxes for Curb Valves: AWWA M44, cast iron telescoping top section; plug shall include lettering "WATER"; bottom section with base that fits over curb valve.
4. Shutoff Rods: Steel, tee-handle with one pointed end. Stem length shall extend 2 feet (600 mm) above top of valve box for operation of deepest buried valve, with slotted end matching curb valve.

H. Post-Indicator: NFPA 24 and be fully compatible with the valve and supervisory switches.

I. Pressure Reducing Valves
1. Pressure reducing valve: ASSE 1003 with pressure of 150 psi (1035 kPa).
2. Body: Bronze for NPS 2 (DN 50) and smaller.
3. Body: Cast iron for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).
4. End connections: Threaded for NPS 2 (DN 50) and smaller.
5. End connections: Flanged for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).

J. Water Control Valves
1. Valve to be pilot operation, diaphragm-type, single-seated, pressure rating should be 150 psi (1035 kPa) minimum. Include small pilot control valve, restrictor device, specialty fittings and sensor piping.
2. Body shall be cast or ductile iron with AWWA C550 epoxy coating or stainless steel.
3. End connections: Threaded for NPS 2 (DN 50) and smaller.
4. End connections: Flanged for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).
5. Interior coating: AWWA C550.

K. Relief Valves
1. Air-Release Valve: AWWA C512, Hydromechanical device to automatically release accumulated air.
2. Air/Vacuum Valve: AWWA C512, Direct-acting, float-operated, hydromechanical device with large orifice to automatically release accumulated air or to admit air during filling of piping.
3. Combination Air Valve: AWWA C512, Float-operated, hydromechanical device to automatically release accumulated air or to admit air during filling of piping.

L. Pressure Vacuum Breaker Assembly
1. ASSE 1020 Vacuum breaker assembly for use in continuous-pressure applications.

M. Backflow Preventer
   1. Backflow Preventer shall not be located in any area containing fumes that are toxic, poisonous or corrosive.
   2. Direct connections between potable water piping and sewer connected wastes shall not exist under any condition with or without backflow protection.
   3. Backflow Preventer shall be accessed and have clearances for the required testing, maintenance and repair. Access and clearances shall maintain a minimum of 1 foot (305 mm) between the lowest portion of the assembly and grace, floor or platform. Installations elevated more than 5 feet (1524 mm) above the floor or grade shall be provided with a permanent platform capable of supporting a tester or maintenance person.

N. Reduced-Pressure-Principle Backflow Preventer: AWWA C511 for continuous-pressure applications.
   1. Pressure loss: 15 psi (100 kPa).
   2. Body:
      a. Bronze: NPS 2 (DN 50) and smaller .
      b. Steel with interior lining complying with AWWA C550 stainless steel for NPS 2-1/2 (DN 65) or larger.
   3. End connections:
      a. Threaded for NPS 2 (DN 50) and smaller.
      b. Flanged for NPS 2-1/2 (DN 65) and larger.
   4. Configuration: Designed for horizontal, straight through or vertical inlet, horizontal center section and vertical outlet vertical flow.
   5. Valves:
      a. Ball type with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller.
      b. Resilient seated gate type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.
   6. Air-gap fitting: ASME A112.1.2, matching backflow Preventer connection.

O. Double-Check, Backflow-Prevention Assemblies: ASSE 1015 or AWWA C510 for continuous-pressure applications, unless otherwise indicated.
   1. Pressure loss: 5 psi (35 kPa).
   2. Body:
      a. Bronze for NPS 2 (DN 50) and smaller.

b. Cast iron with interior lining complying with AWWA C550; Steel with interior lining complying with AWWA C550; Stainless steel for NPS 2-1/2 (DN 65) or larger.

3. End connections:
   a. Threaded for DN 50 (NPS 2) and smaller.
   b. Flanged for NPS 2-1/2 (DN 65) and larger.
4. Configuration: Designed for horizontal, straight through
5. Valves:
   a. Ball type with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller.
   b. OS&Y gate type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.

P. Reduced-Pressure-Detector, Fire-Protection Backflow Preventer Assemblies: ASSE 1047 and UL listed or FMG approved for continuous-pressure applications.
1. Pressure loss: 12 psi (83 kPa)
2. Body: Cast iron with interior lining complying with AWWA C550; Steel with interior lining complying with AWWA C550; or Stainless steel.
3. End connections: Flanged
4. Configuration: Designed for horizontal, straight through.
5. Accessories:
   a. Valves: UL 262, FMG approved, OS&Y gate type with flanged ends on inlet and outlet.
   b. Air-gap fitting: ASME A112.1.2, matching backflow Preventer connection.
   c. Bypass with displacement-type water meter, shutoff valves and reduced-pressure backflow Preventer.

Q. Double-Check, Detector-Assembly Backflow Preventers: ASSE 1048 and UL listed or FMG approved for continuous-pressure applications.
1. Pressure loss: 5 psi (35 kPa)
2. Body: Cast iron with interior lining complying with AWWA C550; Steel with interior lining complying with AWWA C550; or Stainless steel
3. End connections: Flanged
4. Configuration: Designed for horizontal, straight through
5. Accessories
   a. Valves: UL 262, FMG approved, OS&Y gate type with flanged ends on inlet and outlet.

b. Bypass with displacement-type water meter, shutoff valves and reduced-pressure Backflow Preventer.

R. Backflow Preventer Test Kits

1. Provide factory calibrated test kit with gauges, fittings, hoses and carrying case with test-procedure instructions.

2.10 WATER METER BOXES

A. Cast iron body and cover for disc-type water meter, with lettering "WATER METER" in cover; and with slotted, open-bottom base section of length to fit over service piping.

1. Base section may be cast iron, PVC, PE, or other pipe.

B. Cast iron body and double cover for disc-type water meter, with lettering "WATER METER" in top cover; and with separate inner cover; air space between covers; and slotted, open-bottom base section of length to fit over service piping.

C. Polymer-concrete body and cover for disc-type water meter, with lettering "WATER METER" in cover; and with slotted, open-bottom base section of length to fit over service piping, vertical and lateral design loadings of 15,000 lb minimum over 10 by 10 inches (6800 kg minimum over 254 mm by 254 mm) square.

2.11 CONCRETE VAULTS

A. Precast, reinforced-concrete vault: ASTM C858, designed for AASHTO H20-44 load designation.

1. Ladder: ASTM A36, steel or polyethylene-encased steel steps.
2. Drain: ASME A112.6.3, cast iron floor drain with outlet. Include body anchor flange, light-duty cast iron grate, bottom outlet, and integral or field-installed bronze ball or clapper-type backwater valve.
3. Manhole Frame and Cover: ASTM A48, Class No. 35A minimum tensile strength, 24 inch (610 mm) minimum diameter, unless otherwise indicated.
4. Manhole Frame and Cover: ASTM A536, Grade 60-40-18, ductile iron, 24 inch (610 mm) minimum diameter, unless otherwise indicated.

2.12 PROTECTIVE ENCLOSURES

A. Freeze-Protection Enclosures: Designed to protect aboveground water piping, equipment, or specialties from freezing and damage, with heat source to maintain minimum internal temperature of 40 deg F (4 deg C)

when external temperatures reach as low as minus 34 deg F (minus 36 deg C) meeting the requirements of ASSE 1060.

1. Class I, for equipment or devices other than pressure or atmospheric vacuum breakers.
2. Class I-V, for pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.

3. Reinforced-aluminum fiberglass housing with dimensions indicated, but not less than those required for access and service of protected unit. Include a drain opening for units with drain connection; access doors with locking devices; insulation inside housing; and anchoring devices for attaching the housing to the concrete base.
4. Include an electric heating cable or heater with self-limiting temperature control.

B. Weather-Resistant Enclosures: Un-insulated enclosure designed to protect aboveground water piping, equipment, or specialties from weather and damage meeting the requirements of ASSE 1060.

1. Class III, for equipment or devices other than pressure or atmospheric vacuum breakers.
2. Class III-V, for pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.

3. Provide reinforced aluminum fiberglass housing with dimensions indicated, but not less than those required for access and service of protected unit. Include a drain opening for units with drain connection; access doors with locking devices; insulation inside housing; and anchoring devices for attaching the housing to the concrete base.

C. Expanded-Metal Enclosures: ASTM F1267; designed to protect aboveground water piping, equipment, or specialties from damage; expanded metal side and top panels, of weight and with reinforcement of same metal at edges as required for rigidity.

1. Type I, expanded or Type II, expanded and flattened.
2. Class 1, uncoated carbon steel; Class 2, hot-dip, zinc-coated carbon steel; or Class 3 corrosion-resisting steel.

3. Provide a finish of the manufacturer's enamel paint. Size enclosure to match the dimensions indicated, but not less than those required for access and service of the protected unit. Include a locking device and lugs or devices necessary for securing enclosure to base.

D. Enclosure Bases: 6 inch (150 mm) minimum thickness precast concrete, extending at least 6 inches (150 mm) beyond edges of enclosure housings. Include openings for piping.

2.13 FLUSHING HYDRANTS

A. Post-Type Flushing Hydrants: Non-freeze and drainable, of length required for shutoff valve installation below frost line.
   1. Pressure Rating: 150 psi (1035 kPa) minimum
   2. Outlet: One, with horizontal discharge
   3. Hose Thread: NPS 2-1/2 (DN 65), with NFPA 1963 external hose thread for use by local fire department, and with cast iron cap with brass chain
   4. Barrel: Cast iron or steel pipe with breakaway feature
   5. Valve: Bronze body with bronze-ball or plunger closure, and automatic draining
   6. Security: Locking device for padlock
   7. Exterior Finish: Red alkyd-gloss enamel paint.
   8. Inlet: NPS 2 (DN 50) minimum
   9. Operating Wrench: One for each unit

B. Ground-Type Flushing Hydrants: Non-freeze and drainable, of length required for shutoff valve installation below frost line.
   1. Pressure Rating: 150 psi (1035 kPa) minimum
   2. Outlet: One, with vertical or angled discharge
   3. Hose Thread: NPS 2-1/2 (DN 65), with NFPA 1963 external hose thread for use by local fire department, and with cast iron cap with brass chain
   4. Barrel: Cast iron or steel pipe
   5. Valve: Bronze body with bronze-ball or plunger closure, and automatic draining
   6. Inlet: NPS 2 (DN 50) minimum
   7. Hydrant Box: Cast iron with cover, for ground mounting
   8. Operating Wrench: One for each unit

C. Post-Type Sampling Station: Non-freeze and drainable, of length required for shutoff valve installation below frost line.

1. Pressure Rating: 100 psi (690 kPa) minimum
2. Sampling Outlet: One unthreaded nozzle with handle
3. Valve: Bronze body with bronze-ball or plunger closure . Include operating handle.
4. Drain: Tubing with separate manual vacuum pump
5. Inlet: NPS 3/4 (DN 20) minimum
6. Housing: Weatherproof material with locking device. Include anchor device
7. Operating Wrench: One for each unit

2.14 FIRE HYDRANTS

A. All hydrants shall have removable interiors capable of replacement without digging up the hydrant and be packable under pressure. Threaded joints or spindles shall be bronze and upper and lower barrels shall be of equal diameter. Upper barrel shall be of sufficient length to permit setting hydrant with barrel flange not more than 4 inches (100 mm) above finished grade. All fire hydrants shall have 6 inch (150 mm) bottom connection. Provide two of hydrant wrenches not less than 14 inches (350 mm) long. Pressure Rating: 150 psi (1035 kPa) minimum . Hydrant valve shall open by turning operating nut to left or counterclockwise. Exterior finish shall be red alkyd-gloss enamel paint, unless otherwise indicated. Outlet threads shall meet NFPA 1963, with external hose thread used by local fire department. Include cast iron caps with steel chains and Pentagon, 1-1/2 inch (38 mm) point to flat operating and cap nuts.

B. Dry-Barrel Fire Hydrants:

1. AWWA C502, freestanding, one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets, 5-1/4 inch (133 mm) main valve, drain valve, and NPS 6 (DN 150) mechanical-joint inlet; interior coating according to AWWA C550; cast iron body, compression-type valve opening against pressure and closing.
2. UL 246, freestanding, one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets, 5-1/4 inch (133 mm) main valve, drain valve, and NPS 6 (DN 150) mechanical-joint inlet; cast iron body, compression-type valve opening against pressure and closing.

C. Wet-Barrel Fire Hydrants:

1. AWWA C503, freestanding, with one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets, NPS 6 (DN 150) threaded or flanged inlet, and base section with NPS 6 (DN 150) mechanical-joint inlet; interior coating according to AWWA C550.
2. UL 246, freestanding, one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets, NPS 6 (DN 150) threaded or flanged inlet, and base section with NPS 6 (DN 150) mechanical-joint inlet.

2.15 FIRE DEPARTMENT CONNECTIONS

A. Fire system base water supply must provide a minimum of 1000 gpm (3785 l/m) at 150 psi (1035 kPa) and 700 gpm (2650 l/m) at 200 psi (1380 kPa) at the Fire Department connection. For hydraulic calculations, the calculated demand shall not fall less than 10 percent below the water supply curve.

B. Fire Department connections: UL 405, NFPA 1963, freestanding, cast bronze body, thread inlets, and matching local fire department hose threads, threaded bottom outlet, lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; 18 inch (460 mm) high brass sleeve; round escutcheon plate, meeting the requirements of UL 405.
   1. Connections: Two NPS 2-1/2 (DN 65) inlets and one NPS 4 (DN 100) outlet
   2. Connections: Four NPS 2-1/2 (DN 65) inlets and one NPS 6 (DN 150) outlet
   3. Connections: Six NPS 2-1/2 (DN 65) inlets and one NPS 6 (DN 150) NPS 8 (DN 200) outlet
   4. Inlet Alignment: Inline, horizontal
   5. Finish Including Sleeve: Polished chrome-plated or Rough chrome-plated or Polished bronze
   6. Escutcheon Plate Marking: “AUTO SPKR” & “STANDPIPE”

2.16 ALARM DEVICES

A. Alarm Devices-General: UL 753 and FMG approved, of types and sizes to mate and match piping and equipment.

B. Water-Flow Indicators: Vane-type water-flow detector, rated for 250-psi (1725-kPa) working pressure; designed for horizontal or vertical installation; 2 single-pole, double-throw circuit switches to provide isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to

prevent false signals and tamperproof cover that sends signal when cover is removed.

C. Supervisory Switches: Single pole, double throw; designed to signal valve in other than fully open position.

D. Pressure Switches: Single pole, double throw; designed to signal increase in pressure.

2.17 DISINFECTION CHLORINE

A. Liquid chlorine: AWWA B301.

B. Sodium Hypochlorite: AWWA B300 with 5 percent to 15 percent available chlorine.

C. Calcium hypochlorite: AWWA B300 supplied in granular form of 5 g. tablets, and shall contain 65 percent chlorine by weight.

2.18 WARNING TAPE

A. Warning tape shall be standard, 4 mil. Polyethylene, 3 inch (76 mm) wide tape, detectable type, blue with black letters and imprinted with "CAUTION BURIED WATER LINE BELOW".

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Use pipe, fittings, and joining methods for piping systems according to the following applications.

1. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.
2. Do not use flanges or unions for underground piping.
3. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

B. Underground water-service piping NPS 3/4 to NPS 3 (DN 20 to DN 80) shall be any of the following:

1. PE, ASTM pipe; fittings for PE pipe; and clamped molded PE fittings; and heat-fusion joints.
2. PVC, Schedule 40 pipe, or 80 pipe, socket fittings; and solvent-cemented joints.

C. Underground water-service piping NPS 4 to NPS 8 (DN 100 to DN 200) shall be any of the following:

1. PE, AWWA pipe; PE, AWWA fittings; and heat-fusion joints.
2. PVC, Schedule 40 pipe; or Schedule 80 socket fittings; and solvent-cemented joints.
3. PVC, AWWA Class 150 pipe for NPS 4 and NPS 6 (DN 100 and DN 150): NPS 6 (DN 150) PVC, AWWA Class 150 pipe; PVC, AWWA Class 150 fabricated or molded fittings; and gasketed joints.
4. PVC, AWWA Class 200 pipe for NPS 8 (DN 200): PVC, AWWA Class 200 fabricated push-on-joint, ductile iron mechanical-joint, ductile iron fittings; and gasketed joints.

D. Water Meter Box Water-Service Piping NPS 3/4 to NPS 2 (DN 20 to DN 50) shall be same as underground water-service piping.

E. Aboveground and Vault Water-Service Piping NPS 3/4 to NPS 3 (DN 20 to DN 80) shall be any of the following:

1. Hard copper tube with wrought-copper, solder-joint fittings; and brazed copper, pressure-seal fittings; and pressure-sealed joints.
2. PVC, Schedule 80 pipe; socket fittings; and solvent-cemented threaded fittings; and threaded joints.

F. Aboveground and vault water-service piping NPS 4 to NPS 8 (DN 100 to DN 200shall be any of the following:

1. Hard copper tube, with wrought-copper, solder-joint fittings; and brazed joints.
2. Ductile iron, grooved-end pipe; ductile iron, grooved-end appurtenances; and grooved joints.
3. PVC, Schedule 80 with socket fittings; and solvent-cemented threaded fittings; and threaded joints.

G. Underground Fire-Service-Main Piping NPS 4 to NPS 12 (DN 100 to DN 300) shall be any of the following:

1. Ductile iron, push-on-joint pipe; ductile iron, push-on-joint fittings; and gasketed mechanical-joint pipe; ductile iron, mechanical-joint fittings; and mechanical grooved-end pipe; ductile iron-pipe appurtenances; and grooved joints.
2. PE, Class 150, fire-service pipe; molded PE fittings; and heat-fusion joints.
3. PVC, AWWA Class 150 pipe listed for fire-protection service; PVC Class 150 fabricated or molded fittings; and gasketed joints.

H. Aboveground and Vault Fire-Service-Main Piping NPS 4 to NPS 12 (DN 100 to DN 300) shall be ductile iron, grooved-end pipe; ductile iron-

I. Underground Combined Water-Service and Fire-Service-Main Piping NPS 6 to NPS 12 (DN 150 to DN 300) shall be any of the following:

1. Ductile iron, push-on-joint pipe; Ductile Iron, push-on-joint fittings; and gasketed mechanical-joint pipe; Ductile Iron, mechanical-joint fittings; and mechanical grooved-end pipe; Ductile Iron-pipe appurtenances; and grooved joints.
2. PVC, AWWA Class 150 pipe listed for fire-protection service; PVC fabricated or molded fittings of same Class as pipe; and gasketed joints.

J. Aboveground Combined Water Service and Fire-Service-Main Piping NPS 6 to NPS 12 (DN 150 to DN 300) shall be ductile iron, grooved-end pipe; ductile iron-pipe appurtenances; and grooved joints.

3.2 VALVE APPLICATIONS

A. Use mechanical-joint-end valves for NPS 3 (DN 80) and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, non-rising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 (DN 50) and smaller installation.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Underground Valves, NPS 3 (DN 80) and Larger: AWWA, cast iron, non-rising-stem, metal resilient -seated gate valves with valve box.
2. Underground Valves, NPS 4 (DN 100) and Larger, for Indicator Posts: UL/FMG, cast iron, non-rising-stem gate valves with indicator post.
3. Use the following for valves in vaults and aboveground:
   a. Gate Valves, NPS 2 (DN 50) and Smaller: Bronze, rising stem.
   b. Gate Valves, NPS 3 (DN 80) and Larger: AWWA, cast iron, OS&Y rising stem, metal seated AWWA, cast iron, OS&Y rising stem, resilient seated UL/FMG, cast iron, OS&Y rising stem .
   c. Check Valves: AWWA C508 or UL/FMG, swing type.

3.3 DUCTILE IRON PIPE

A. Install Ductile Iron, water-service piping according to AWWA C600 and AWWA M41-3rd Edition.

1. Install PE corrosion-protection encasement according to ASTM A674 or AWWA C105/A21.5.

B. Pipe shall be sound and clean before laying. When laying is not in progress, the open ends of the pipe shall be closed by watertight plug or other approved means.

C. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Bevel cut ends of pipe to be used with push-on bell to conform to the manufactured spigot end. Cement lining shall be undamaged.

D. Push on joints shall be made in strict accordance with the manufacturer's instruction. Pipe shall be laid with bell ends looking ahead.

3.4 PVC PIPE

A. PVC piping shall be installed in strict accordance with the manufacturer's instructions and ASTM D2774-21. Place bedding material and compact in accordance with ASTM D2774-21 and Section 312011-Earthwork.

B. Install Copper Tracer Wire, No. 14 AWG solid, single conductor, insulated. Install in the trench with piping to allow location of the pipe with electronic detectors. The wire shall not be spiraled around the pipe nor taped to the pipe. Wire connections are to be made by stripping the insulation from the wire and soldering with rosin core solder per ASTM 828. Solder joints shall be wrapped with rubber tape and electrical tape. At least every 1000 feet (300 m) provide a 5 pound (2.3 kg) magnesium anode attached to the main tracer wire by solder. The solder joint shall be wrapped with rubber tape and with electrical tape. An anode shall also be attached at the end of each line.

C. Magnetic markers may be used in lieu of copper tracer wire to aid in future pipe location. Generally, install markers on 20 foot (6 m) centers. If pipe is in a congested piping area, install on 10 foot (3 m) centers. Prepare as-built drawing indicating exact location of magnetic markers.

3.5 COPPER PIPE

A. Copper piping shall be installed in accordance with the Copper Development Association's Copper Tube Handbook and manufacturer's recommendations.

B. Copper piping shall be bedded in 6 inches (150 mm) of sand.

3.6 ANCHORAGE INSTALLATION

A. Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include: concrete thrust blocks, locking mechanical joints, set-screw mechanical retainer glands, bolted flanged joints, heat-fused joints, pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:

1. Gasketed-Joint, Ductile Iron, Water-Service Piping: According to AWWA C600.
2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
3. Fire-Service-Main Piping: According to NFPA 24.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.7 VALVE INSTALLATION

A. AWWA Valves: Install each underground valve with stem pointing up and with valve box.

B. UL/FMG, Valves: Install each underground valve and valves in vaults with stem pointing up and with vertical cast iron indicator post.

C. MSS Valves: Install as component of connected piping system.

D. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

E. Pressure-Reducing Valves: Install in vault or aboveground between shutoff valves.

F. Relief Valves: Install aboveground with shutoff valve on inlet.

G. Raise or lower existing valve and curb stop boxes and fire hydrants to finish grade in areas being graded.

3.8 DETECTOR-CHECK VALVE INSTALLATION

A. Install in vault or aboveground and for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter.

B. Support detector check valves, meters, shutoff valves, and piping on brick or concrete piers.

3.9 WATER METER INSTALLATION

A. Install water meters, piping, and specialties according to utility company's written instructions.

B. Install displacement or turbine -type water meters, NPS 2 (DN 50) and smaller, in meter boxes with shutoff valves on water meter inlets. Include valves on water meter outlets and valved bypass around meters unless prohibited by authorities having jurisdiction.

C. Install compound or turbine -type water meters, NPS 3 (DN 80) and larger, in meter vaults. Include shutoff valves on water meter inlets and outlets and valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.

D. Install detector-type water meters in meter vault according to AWWA M6. Include shutoff valves on water meter inlets and outlets and full-size valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.

3.10 ROUGHING-IN FOR WATER METERS

A. Rough-in piping and specialties for water meter installation according to utility company's written instructions.

3.11 WATER METER BOX INSTALLATION

A. Install water meter boxes in paved areas flush with surface.

B. Install water meter boxes in grass or earth areas with top // 2 inches (50 mm) // Insert dimension // above surface.

3.12 VACUUM BREAKER ASSEMBLY INSTALLATION

A. Install pressure vacuum breaker assemblies of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install pressure vacuum breaker assemblies in vault or other space subject to flooding.

3.13 BACKFLOW PREVENTER INSTALLATION

A. Install backflow Preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install backflow Preventers that have relief drain in vault or in other spaces subject to flooding.

C. Do not install bypass piping around backflow Preventers.

D. Support NPS 2-1/2 (DN 65) and larger backflow Preventers, valves, and piping near floor and on brick or concrete piers.

3.14 CONCRETE VAULT INSTALLATION

A. Install precast concrete vaults according to ASTM C891.

3.15 PROTECTIVE ENCLOSURE INSTALLATION

A. Install concrete base level and with top approximately 2 inches (50 mm) above grade.

B. Install protective enclosure over valves and equipment and anchor protective enclosure to concrete base.

3.16 FLUSHING HYDRANT INSTALLATION

A. Install post-type flushing hydrants with valve below frost line and provide for drainage. Support in upright position. Include separate gate valve or curb valve and restrained joints in supply piping.

B. Install ground-type flushing hydrants with valve below frost line and provide for drainage. Install hydrant box flush with grade. Include separate gate valve or curb valve and restrained joints in supply piping.

C. Install sampling stations with valve below frost line and provide for drainage. Attach weather-resistant housing and support in upright position. Include separate curb valve in supply piping.

3.17 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install ball drip valves at each check valve for fire department connection to mains.

B. Install protective pipe bollards on at least two sides of each fire department connection.

3.18 FIRE HYDRANT INSTALLATION

A. Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.

B. Install Wet-Barrel Fire Hydrants with valve below frost line. Provide for drainage.

3.19 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties. Install water service lines to a point of connection within approximately 5 feet (1500 mm) outside of building(s) to which service is to be connected and make connections thereto. If building services have not been installed provide temporary caps and mark for future connection.

3.20 FIELD QUALITY CONTROL

A. Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Prior to final acceptance, provide a video record of all piping from the building to the municipal connection to show the lines are free from obstructions, properly sloped and joined.

C. Perform hydrostatic tests at not less than one-and-one-half times working pressure for two hours.

1. Increase pressure in 50-psi (350-kPa) increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psi (0 kPa). Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts (1.89 L) per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

D. Prepare reports of testing activities.

3.21 IDENTIFICATION

A. Install continuous underground warning tape 12 inches (300 mm) directly over piping.

3.22 CLEANING

A. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.

B. Use purging and disinfecting procedure prescribed by local utility provider or other authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:

1. Fill the water system with a water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
2. Drain the system of the previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow system to stand for 3 hours.
3. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
4. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

C. Prepare reports of purging and disinfecting activities.

3.23 SEPARATION OF WATER LINES AND SANITARY SEWERS

The separation of water lines and sanitary sewers shall be in accordance with Virginia Administrative Code, Title 12, Agency 5, Chapter 590-1150 (12VAC5- 590-1150). 12VAC5-590-1150 is reproduced here for convenience:

A. The following factors shall be considered in providing adequate separation of water mains and sanitary sewers:
   1. Materials and types of joints for water and sanitary sewer mains;
   2. Soil conditions;
   3. Service branch connections into the water main and sanitary sewer mains;
   4. Compensating variations in the horizontal and vertical separations;
   5. Space for repairs and alterations of water and sanitary sewer mains;
   6. Offsetting of pipes around manholes; and
   7. Identification of the physical restraints preventing normal separation

B. Parallel installation of water lines and sanitary sewers
   1. Under normal conditions, water mains shall be laid at least 10 feet horizontally from a sanitary sewer or sewer manhole. The distance shall be measured edge- to-edge.
   2. Under unusual situations when local conditions prevent a horizontal separation of 10 feet, the water main may be laid closer to a sanitary sewer or sewer manhole provided that:
      a. The bottom (invert) of the water main shall be at least 18 inches above the top (crown) of the sanitary sewer;
      b. Where this vertical separation cannot be obtained, the sanitary sewer shall be constructed of water distribution pipe and pressure tested in place in accordance with 12VAC5-590-1110 and 12VAC5-590-1140;
      c. The department (i.e., Virginia Department of Health) may approve concrete encasement of the water main or other physical barrier;
      d. The sewer manhole shall be of watertight construction and tested in place; and
      e. No water pipes shall pass through or come into contact with any part of a sewer manhole.

C. Crossing of water mains and sanitary sewers
   1. Under normal conditions, water mains crossing sanitary sewers shall be laid to provide a separation of at least 18 inches between the

bottom of the water main and the top of the sanitary sewer whenever possible.

2. Under unusual situations when local conditions present a vertical separation described in subdivision C 1 of this section, the following construction shall be used:
   a. Sanitary sewers passing over or under water mains shall be constructed of the materials described in subsection B of this section and shall be constructed to a point 10 feet beyond and on each side of the crossing; and
   b. Water mains passing under sanitary sewers shall, in addition, be protected by providing:
      1) A vertical separation of at least 18 inches between the bottom of the sanitary sewer and the top of the water main;
      2) Adequate structural support for the sanitary sewers to prevent excessive deflection of the joints and the settling on and breaking of the water main; and
      3) That the length of the water main be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the sanitary sewer.
   c. The minimum horizontal separation distance between water mains and septic tanks and drainfields, measured edge-to-edge, shall be 10 feet. Greater separation distances shall be provided wherever practical.
   d. Water mains shall be located a safe horizontal distance from sources of contamination not already mentioned in this section, such as sewage treatment works and industrial complexes. The owner’s engineer shall contact the department to determine the safe separation distances.

--- E N D ---

SECTION 33 30 00

SANITARY SEWER UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies materials and procedures for construction of outside, underground sanitary sewer systems that are complete and ready for operation. This includes piping, structures and all other incidentals.

1.2 RELATED WORK

A. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 11, EARTHWORK(SHORT FORM).

B. Fabrication of Steel Ladders: Section 05 50 00, METAL FABRICATION.

C. Submittals: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

D. Erosion and Sediment Control: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

1.3 DEFINITIONS

1.4 ABBREVIATIONS

A. PVC: Polyvinyl chloride plastic

B. DI: Ductile iron pipe

1.5 DELIVERY, STORAGE AND HANDLING

A. Store plastic piping protected from direct sunlight and support to prevent sagging and bending. Protect stored piping from moisture and dirt by elevating above grade. Protect flanges, fittings, and specialties from moisture and dirt.

B. Handle manholes according to manufacturer's written rigging instructions.

1.6 COORDINATION

A. Coordinate connection to sanitary sewer main with Public Utility company. (Approval from public utility has been obtained indicating that the downstream sanitary systems have sufficient capacity to handle the sanitary discharge from the facility.)

B. Contractor to obtain approval from the Public Agency that the existing sanitary sewer systems have the capacity to handle the discharge from the facility.

C. Coordinate exterior utility lines and connections to building lines up to 5 feet of building wall.

D. Coordinate connection to public sewer system with Public Utility Company.

1.7 QUALITY ASSURANCE:

A. Products Criteria:

1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be either cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

B. Comply with the rules and regulations of the Public Utility having jurisdiction over the connection to Public Sanitary Sewer lines and the extension, and/or modifications to Public Utility Systems.

C. Virginia Compliance:

1. Comply with the rules and regulations of the Virginia Department of Health.
2. Comply with the rules and regulations of the Virginia Department of Environmental Quality.

1.8 SUBMITTALS:

A. Manufacturers' Literature and Data shall be submitted for the following as one package:

1. Pipe, Fittings, and, Appurtenances.
2. Jointing Material.
3. Manhole and Structure Material.
4. Frames and Covers.
5. Steps and Ladders.
6. Valve Boxes.

1.9 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):

A74-09.....Cast Iron Soil Pipe and Fittings

A185/A185M-07.....Steel Welded Wire Reinforcement, Plain, for Concrete

A615/A615M-09b.....Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

A746-99.....Ductile-Iron Gravity Sewer Pipe

C478-09.....Precast Reinforced Concrete Manhole Sections

C857-11.....Minimum Structural Design Loading for Underground Precast Concrete Utility Structures

C890-11.....Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures

C913-08.....Precast Concrete Water and Wastewater Structures

C923-08.....Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals

C924-02(2009).....Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method

C990-09.....Joints for Concrete Pipe, Manholes, and precast Box Sections using Preformed Flexible Joint Sealants

C1173-10.....Flexible Transition Couplings for Underground Piping Systems

C1440-08.....Thermoplastic Elastomeric (TPE) Gasket Materials for Drain, Waste and Vent (DWV), Sewer, Sanitary and Storm Plumbing Systems

C1460-08.....Shielded Transition Couplings for Use With Dissimilar DWV Pipe and Fittings Above Ground

C1461-08.....Mechanical Couplings Using Thermoplastic Elastomeric (TPE) Gaskets for Joining Drain, Waste and Vent (DWV), Sewer, Sanitary and Storm Plumbing systems for Above and below Ground Use

D2321-20.....Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

D3034-08.....Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings

F477-10.....Elastomeric Seals (Gaskets) for Joining Plastic Pipe

F679-08.....Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings

F891-10.....Coextruded Poly(vinyl Chloride) (PVC) Plastic Pipe With a Cellular Core

F949-10.....Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings

F1417-11.....Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air

F1668-08.....Construction Procedures for Buried Plastic Pipe

C. American Water Works Association (AWWA):

C105/A21.5-10.....Polyethylene Encasement for Ductile-Iron Pipe Systems

C110-08.....Ductile-Iron and Gray-Iron Fittings

C111/A21.11-06.....Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings

C151/A21.51-09.....Ductile Iron Pipe, Centrifugally Cast

C153/A21.53-06.....Ductile Iron Compact Fittings for Water Service

C219-11.....Bolted, Sleeve-Type Couplings for Plain-End Pipe

C512-07.....Air Release, Air/Vacuum and Combination Air Valves for Water Works Service

C600-10.....Installation of Ductile-Iron Mains and Their Appurtenances

C900-07.....Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution

D. American Society of Mechanical Engineers:

A112.14.1-2003.....Backwater Valves

A112.36.2M-1991 .....Cleanouts

1.10 WARRANTY

A. The Contractor shall remedy any defect due to faulty material or workmanship and pay for any damage to other work resulting therefrom within a period of one year from final acceptance. Further, the Contractor will provide all manufacturers' and supplier's written guarantees and warranties covering materials and equipment furnished under this Contract.

PART 2 - PRODUCTS

2.1 FACTORY-ASSEMBLED PRODUCTS

A. Standardization of components shall be maximized to reduce spare part requirements.

B. All pipe and fittings used in the construction of force mains shall be rated to meet the system maximum operating pressure with a minimum of 150 psi (1035 kPa).

C. The Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

2.2 PVC, GRAVITY SEWER PIPE AND FITTINGS

A. PVC Gravity Sewer Piping:

1. Pipe and Fittings shall conform to ASTM D3034 or ASTM F679 , SDR 35.
2. Gaskets: ASTM F477.

B. PVC Cellular-Core Sewer Piping:

1. Pipe and Fittings: ASTM F891, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.
2. Fittings: ASTM D3034, ASTM F679, SDR 35, or SDR 26.

C. PVC Corrugated Sewer Piping:

1. Pipe: ASTM F949, corrugated pipe with bell and spigot ends.
2. Fittings: ASTM F949.
3. Gaskets: ASTM F477.

D. PVC Type PSM Sewer Piping:

1. Pipe shall conform to ASTM D3034 or ASTM F679, SDR 35 SDR 26.
2. Fittings: ASTM D3034.
3. Gaskets: ASTM F477.

2.3 PVC, PRESSURE PIPE AND FITTINGS

A. PVC:
1. Pipe: AWWA C900, Class 100, Class 150, and Class 200 PVC pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: AWWA C900, Class 100, Class 150, and Class 200.
3. Gaskets: ASTM F477.

2.4 GRAVITY FLOW LINES WITH SECONDARY CONTAINMENT (ENCASEMENT)

A. Piping systems conveying hazardous materials shall be constructed with a watertight primary (carrier) pipe completely enclosed within a watertight secondary (containment) pipe.
B. Piping and fittings shall be as per ASTM D3034 or AWWA C105.
C. The carrier pipe shall be installed with manufactured spacers to maintain a minimum interstitial space of 0.75 inch (19 mm) between the carrier pipe and the containment pipe.
D. The encasement piping shall be equipped with vents to detect the presence of fluids within the containment pipe and for the extraction of fluids from the containment pipe.
E. Encasement pipe shall be bell and spigot with adhesive bond.

2.5 NONPRESSURE-TYPE TRANSITION COUPLINGS

A. Comply with ASTM C1173, elastomeric, sleeve type, reducing or transition coupling, for joining underground nonpressure piping. Include ends to match same sizes of main line piping and install corrosion-resistant metal tension bands and tightening mechanism on each end.
B. Sleeve Materials:
1. For Plastic Pipes: ASTM F477, elastomeric seal.
2. For Dissimilar Pipes: PVC or other material compatible with pipe materials being joined.
C. Unshielded, Flexible Couplings:
1. Couplings shall be elastomeric sleeve with corrosion-resistant-metal tension band and tightening mechanism on each end.
D. Ring-Type, Flexible Couplings:
1. Couplings shall be elastomeric compression seal with dimensions to fit inside bell of larger mainline pipe and for spigot of smaller main line pipe to fit inside ring.
E. Nonpressure-Type, Rigid Couplings:

1. Coupling shall be ASTM C1461, sleeve-type, reducing- or transition-type mechanical coupling , molded from ASTM C1440, TPE material; with corrosion-resistant-metal tension band and tightening mechanism on each end.

2.6 PRESSURE-TYPE PIPE COUPLINGS

A. Tubular-Sleeve Couplings:
   1. Couplings shall meet AWWA C219, with center sleeve, gaskets, end rings, and bolt fasteners.

B. Metal, bolted, sleeve-type, reducing or transition couplings for joining underground pressure piping:
   1. Couplings shall meet a 150-psi (1035-kPa) minimum pressure rating and ends of same sizes of the main line piping.

C. Center-Sleeve Material:
   1. Sleeve shall be Ductile iron

D. Gasket material: Gaskets shall be natural or synthetic rubber.

E. Metal component finish: Finish shall be a corrosion-resistant material or coating.

2.7 BACKWATER VALVES

A. PVC Backwater Valves:
   1. PVC valve shall be a horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

2.8 CLEANOUTS

A. PVC Cleanouts:
   1. PVC body with PVC threaded plug: Cleanout shall be as per ASTM D3034. PVC sewer pipe fitting and riser to cleanout.
   2. Cleanout Riser: Sewer pipe fitting on main line sewer and riser shall match main line piping.

2.9 MANHOLES

2.10 CONCRETE

A. Cast-in-place concrete shall be 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio.

B. Reinforcement
   1. Reinforcing fabric shall be ASTM A185, steel, welded wire fabric, plain.
   2. Reinforcing bars shall be ASTM A615, Grade 60 (420 MPa) deformed steel.

C. Benches shall be concrete, sloped to drain into the channel. Provide 6 inches (150 mm) from the cut section of top of pipe to edge of manhole.

D. Ballast and Pipe Supports shall be Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water/cementitious materials ratio.

2.11 WET WELL

2.12 ACID NEUTRALIZATION TANKS

2.13 OIL AND GREASE INTERCEPTOR AND GREASE REMOVAL PIT

2.14 AIR RELEASE VALVE FOR FORCE MAINS

2.15 WARNING TAPE

A. Warning tape shall be standard, 4 mil (0.1 mm) polyethylene 3 inch (76 mm) wide tape detectable type, green with black letters and imprinted with “CAUTION BURIED SEWER LINE BELOW”.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans and details indicate the general location and arrangement of underground sanitary sewer piping. Install piping as indicated, to extent practicable. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at the low point, true to grades and alignment indicated on the drawings, with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Do not lay pipe on unstable material, in wet trench or when trench and weather conditions are unsuitable for the work.

D. Support pipe on compacted bedding material. Excavate bell holes only large enough to properly make the joint.

E. Inspect pipes and fittings for defects before installation. Defective materials shall be plainly marked and removed from the site. Cut pipe shall have smooth regular ends at right angles to axis of pipe.

F. Lower pipe into trench carefully and bring to proper line, grade, and joint. After jointing, interior of each pipe shall be thoroughly wiped or swabbed to remove any dirt, trash or excess jointing materials.

G. Do not walk on pipe in trenches until covered by layers of bedding or backfill material to a depth of 12 inches (300 mm) over the crown of the pipe.

H. Warning tape shall be continuously placed 12 inches (300 mm) above sewer pipe

I. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

J. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

K. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process or microtunneling.

L. Install gravity-flow, non-pressure, drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope of 1 percent unless otherwise indicated.
2. Install PVC cellular-core, PVC corrugated sewer, PSM sewer and PVC gravity sewer according to ASTM D2321 and ASTM F1668.

M. Install force-main, pressure piping according to the following:

1. Install piping with restrained joints at tee fittings and at horizontal and vertical changes in direction. Use corrosion-resistant rods, pipe or fittings, or cast-in-place-concrete supports or anchors. Pressure (force) mains shall have the bells facing the direction of flow.
2. Sections of piping listed on the drawings shall be fully restrained. For devices with twist off nuts, the twist off nuts shall be placed on top of the fitting for the Resident Engineer’s inspection. The Contractor shall torque test all bolts, set screws, identified by the Resident Engineer.
3. Thrust blocks shall not be permitted.

N. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

O. Gravity Flow Lines with Secondary Containment (Encasement Pipe):

1. Install per manufacturer’s recommendations. Install all pipe centering devices to maintain an interstitial space below the invert of the carrier pipe. Both the carrier and containment pipe shall be tested for leaks.

3.2 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, non-pressure, drainage piping according to the following:

1. Join ductile iron, gravity sewer piping according to AWWA C600 for push-on joints.
2. Join PVC piping according to ASTM D2321.
3. Join dissimilar pipe materials with nonpressure-type, flexible or rigid couplings.

B. Join force-main, pressure piping according to the following:
1. Join ductile iron pressure piping according to AWWA C600 for push-on joints.
2. Join PVC pressure piping according to manufacturer’s recommendations.
3. Join dissimilar pipe materials with pressure-type couplings.

C. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
1. Use non-pressure flexible couplings where required to join gravity-flow, non-pressure sewer piping unless otherwise indicated.
a. Unshielded, Shielded, Flexible, or Rigid couplings for pipes of same or slightly different OD.
b. Unshielded, increaser/reducer-pattern, flexible, or rigid couplings for pipes with different OD.
c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
2. Use pressure pipe couplings for force-main joints.

3.3 BUILDING SERVICE LINES

A. Install sanitary sewer service lines to point of connection within approximately 5 feet (1500 mm) outside of building(s) where service is required and make connections. Coordinate the invert and location of the service line with the Contractor installing the building lines.

3.4 MANHOLE INSTALLATION

A. Install manholes complete with appurtenances and accessories indicated.
1. Precast concrete segmental blocks shall lay true and plumb. All horizontal and vertical joints shall be completely filled with mortar. Parge interior and exterior of structure with 1/2 inch (15 mm) or cement mortar applied with a trowel and finished to an even glazed surface.
2. Precast reinforced concrete rings shall be installed true and plumb. The joints between rings and between rings and the base and top, shall be sealed as per manufacturer’s recommendations. Adjust the

length of the rings so that the top section will be at the required elevation. Cutting the top section is not acceptable.

3. Concrete manhole risers and tops: Install as specified.

B. Designed Concrete Structures:

1. Concrete structures shall be installed in accordance with Section 03 30 00, CAST-IN-PLACE CONCRETE.

C. Do not build structures when air temperature is 32 deg F (0 deg C), or below.

D. The wall that supports access rungs or ladder shall be 90 deg vertical from the floor of structure to manhole cover.

E. Install steps and ladders per the manufacturer’s recommendations. Steps and ladders shall not move or flex when used. All loose steps and ladders shall be replaced by the Contractor.

F. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. In unpaved areas, the rim elevation shall be 2 inches (50 mm) above the adjacent finish grade.

G. Install manhole frames and covers on a mortar bed, such that frames and covers shall not move when subject to vehicular traffic. Install a concrete collar around the frame to protect the frame from moving until the adjacent pavement is placed. Install an 8 inches (200 mm) thick, by 12 inches (300 mm) wide concrete collar around the perimeter of the frame. Slope the top of the collar away from the frame.

3.5 BACKWATER VALVE INSTALLATION

A. Install horizontal-type backwater valves in piping manholes or pits.

B. Install combination horizontal and manual gate valves in piping and in manholes.

C. Install terminal-type backwater valves on end of piping and in manholes. Secure units to sidewalls.

3.6 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Cleanouts should be 6 inches (150 mm) in diameter and consist of a ductile iron 45 degree fitting on end of run, or combination Y fitting and 1/8 bend in the run with ductile iron pipe extension, water tight plug or cap and cast frame and cover flush with finished grade. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.

B. Set cleanout frames and covers in earth in cast-in-place-concrete, 18 by 18 by 12 inches (450 by 450 by 300 mm) 1 inch (25 mm) above surrounding grade.

C. Where cleanout is in force main, provide a blind flange top connection. The center of the flange shall be equipped with a 2 inches (50 mm) base valve to allow the pressure in the line to be relieved prior to removal of the blind flange. Frames and covers for pressure (force) mains shall be 24 inches (600 mm) in diameter.

D. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

E. The top of the cleanout assembly shall be 2 inches (50 mm) below the bottom of the cover to prevent loads being transferred from the frame and cover to the piping.

3.7 CONNECTIONS

A. Make connections to existing piping and underground manholes by coring and installing the pipe at the design invert. Install an elastomeric gasket around the pipe, and grout the interstitial space between the pipe and the core.

B. Connection to an existing manhole: The bench of the manhole shall be cleaned and reshaped to provide a smooth flowline for all new pipes connected to the manhole.

C. Use commercially manufactured wye fittings for piping branch connections. Encase entire wye fitting plus 6-inch (150-mm) overlap with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).

1. Make branch connections from the side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500), by removing a section of the existing pipe.
2. Make branch connections from the side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes by cutting an opening into existing unit large enough to allow 3 inches (76 mm) of concrete

to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in concrete to provide additional support of collar from connection to undisturbed ground.

3. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.8 AIR RELEASE VALVES

A. Set valves in vault or force mains with adequate space for maintenance of the valve. The vault shall have a solid floor to prevent all sanitary blowoff from being absorbed into the soils.

B. Valves shall be set plumb and supported to the vault. Maintain accessibility to the isolation valve on the air valve line.

C. Install the valve after the completion of testing of the pressure (force) main.

3.9 REGRADING

A. Raise or lower existing manholes and structures frames and covers, cleanout frames and covers and valve boxes in regraded areas to finish grade. Carefully remove, clean and salvage cast iron frames and covers. Adjust the elevation of the top of the manhole or structure as detailed on the drawings. Adjust the elevation of the cleanout pipe riser, and reinstall the cap or plug. Reset cast iron frame and cover, grouting below and around the frame. Install concrete collar around reset frame and cover as specified for new construction.

B. During periods when work is progressing on adjusting manholes or structures cover elevations, the Contractor shall install a temporary cover above the bench of the structure or manhole. The temporary cover shall be installed above the high flow elevation within the structure, and shall prevent debris from entering the wastewater stream.

3.10 CLOSING ABANDONED SANITARY SEWER SYSTEMS

A. Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed.

1. Piping under and within 5 feet (1500 mm) of building areas shall be completely removed.
2. Piping outside of building areas shall be completely removed

B. Excavate around manholes as required and use either procedure below:
   1. Manholes and structures outside of building areas: Remove frame and cover, cut and remove the top of an elevation of 2 feet (600 mm) below finished grade. Fill the remaining portion with compacted gravel or crushed rock or concrete.
   2. Manholes and structures with building areas: Remove frame and cover and remove the entire structure and the base.
C. Backfill to grade according to Division 31 Section 31 20 11, EARTH MOVING.
D. When the limit of the abandonment terminates in an existing manhole to remain, the flow line in the bench of the manhole to the abandoned line shall be filled with concrete and shaped to maintain the flowline of the lines to remain.

3.11 SEPARATION OF WATER LINES AND SANITARY SEWERS

THE SEPARATION OF WATER LINES AND SANITARY SEWERS SHALL BE IN ACCORDANCE WITH VIRGINIA ADMINISTRATIVE CODE, TITLE 12, AGENCY 5, CHAPTER 590-1150 (12VAC5-590-1150). 12VAC5-590-1150 IS REPRODUCED HERE FOR CONVENIENCE:

A. The following factors shall be considered in providing adequate separation of water mains and sanitary sewers:
   1. Materials and types of joints for water and sanitary sewer mains;
   2. Soil conditions;
   3. Service branch connections into the water main and sanitary sewer mains;
   4. Compensating variations in the horizontal and vertical separations;
   5. Space for repairs and alterations of water and sanitary sewer mains;
   6. Offsetting of pipes around manholes; and
   7. Identification of the physical restraints preventing normal separation
B. Parallel installation of water lines and sanitary sewers
   1. Under normal conditions, water mains shall be laid at least 10 feet horizontally from a sanitary sewer or sewer manhole. The distance shall be measured edge- to-edge.
   2. Under unusual situations when local conditions prevent a horizontal separation of 10 feet, the water main may be laid closer to a sanitary sewer or sewer manhole provided that:
      a. The bottom (invert) of the water main shall be at least 18 inches above the top (crown) of the sanitary sewer;

b. Where this vertical separation cannot be obtained, the sanitary sewer shall be constructed of water distribution pipe and pressure tested in place in accordance with 12VAC5-590-1110 and 12VAC5-590-1140;
c. The department (i.e., Virginia Department of Health) may approve concrete encasement of the water main or other physical barrier;
d. The sewer manhole shall be of watertight construction and tested in place; and
e. No water pipes shall pass through or come into contact with any part of a sewer manhole.

C. Crossing of water mains and sanitary sewers
1. Under normal conditions, water mains crossing sanitary sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water main and the top of the sanitary sewer whenever possible.
2. Under unusual situations when local conditions present a vertical separation described in subdivision C 1 of this section, the following construction shall be used:
a. Sanitary sewers passing over or under water mains shall be constructed of the materials described in subsection B of this section and shall be constructed to a point 10 feet beyond and on each side of the crossing; and
b. Water mains passing under sanitary sewers shall, in addition, be protected by providing:
1) A vertical separation of at least 18 inches between the bottom of the sanitary sewer and the top of the water main;
2) Adequate structural support for the sanitary sewers to prevent excessive deflection of the joints and the settling on and breaking of the water main; and
3) That the length of the water main be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the sanitary sewer.
c. The minimum horizontal separation distance between water mains and septic tanks and drainfields, measured edge-to-edge, shall be 10 feet. Greater separation distances shall be provided wherever practical.
d. Water mains shall be located a safe horizontal distance from sources of contamination not already mentioned in this section,

such as sewage treatment works and industrial complexes. The owner’s engineer shall contact the department to determine the safe separation distances.

3.12 IDENTIFICATION

A. Install green warning tape directly over piping and at outside edges of underground manholes.

3.13 FIELD QUALITY CONTROL

A. All systems shall be inspected and obtain the COR's approval. Prior to final acceptance, provide a video record of all piping to show the lines are free from obstructions, properly sloped and joined.

B. To inspect, thoroughly flush out the lines and manholes before inspection. Lamp test between structures and show full bore indicating sewer is true to line and grade. Lips at joints on the inside of gravity sewer lines are not acceptable.

1. Submit separate report for each system inspection.
2. Defects requiring correction include the following:
   a. Alignment: Less than full diameter of inside of pipe is visible between structures.
   b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
   c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
   d. Infiltration: Water leakage into piping.
   e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Re-inspect and repeat procedure until results are satisfactory.

C. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:

1. Test plastic gravity sewer piping according to ASTM F1417.
2. Test concrete gravity sewer piping according to ASTM C924.
3. Clean and isolate the section of sewer line to be tested. Plug or cap the ends of all branches, laterals, tees, wyes, and stubs to be included in the test to prevent air leakage. The line shall be pressurized to 4 psi (28 kPa) and allowed to stabilize. After pressure stabilization, the pressure shall be dropped to 3.5 psi (24

kPa) greater than the average back-pressure of any groundwater above the sewer.

4. For force mains, perform testing after supports and anchors are installed. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psi (1035 kPa).
5. Testing of Fiberglass Sewage Holding Tanks shall show no leakage during a 5 psi (35 kPa) air pressure test with 5:1 safety factor.
6. Testing of Concrete Wet Well shall show no leakage with the wet well completely filled with water for a duration of 4 hours.

3.14 CLEANING

A. Clean dirt and superfluous material from interior of piping.

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