STATE OF DELAWARE
Department of Natural Resources and Environmental Control
Division of Parks and Recreation
89 Kings Highway
Dover, DE 19901
DNREC Contract No.: NAT25805-NATCTR

PROJECT MANUAL

WHITE CLAY CREEK STATE PARK NATURE CENTER
at
WHITE CLAY CREEK STATE PARK
1475 Creek Road
Newark, DE 19711

DELAWARE STATE PARKS
YOUR OUTDOOR ADVENTURE STARTS HERE

Prepared by

Architect/Engineer
GWWO Architects
1215 E. Fort Ave, Suite 24
Baltimore, MD 21230

Issued for Bid
March 20, 2026

THIS PAGE INTENTIONALLY LEFT BLANK

STATE OF DELAWARE
Department of Natural Resources and Environmental Control
Division of Parks and Recreation
89 Kings Highway
Dover, DE 19901
DNREC Contract No.: NAT25805-NATCTR

PROJECT MANUAL

WHITE CLAY CREEK STATE PARK NATURE CENTER
at
WHITE CLAY CREEK STATE PARK
1475 Creek Road
Newark, DE 19711

DELAWARE STATE PARKS
YOUR OUTDOOR ADVENTURE STARTS HERE

Prepared by

Architect/Engineer
GWWO Architects
1215 E. Fort Ave, Suite 24
Baltimore, MD 21230

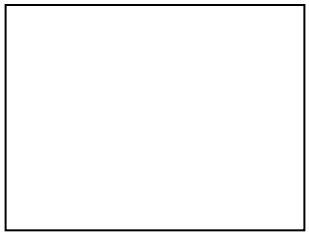
Issued for Bid
March 20, 2026

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 00 01 07 – SEALS PAGE

1.1 DESIGN PROFESSIONAL OF RECORD

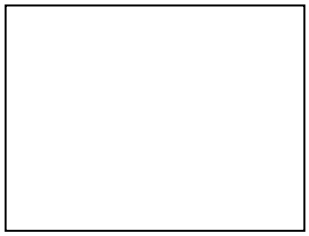
A. ARCHITECT
Alan Reed
GWWO Architects
1215 E. Fort Ave, Suite 24
Baltimore, MD 21230



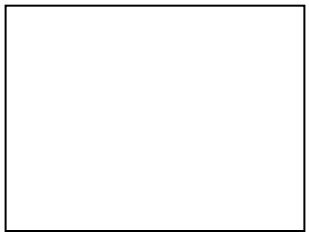
B. CIVIL ENGINEER
Colmcille DeAscanis
CDA Engineering, Inc
6 Larch Ave, Suite 401
Wilmington, DE 19804



C. MECHANICAL/PLUMBING ENGINEER
Justin Bem
James Posey Associates
11155 Red Run Boulevard, Suite 310
Baltimore, MD 21117



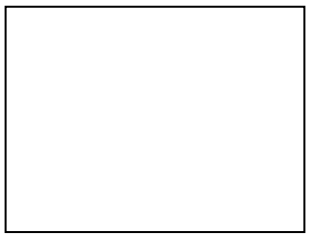
D. ELECTRICAL ENGINEER
Thomas Clippinger
James Posey Associates
11155 Red Run Boulevard, Suite 310
Baltimore, MD 21117



E. STRUCTURAL ENGINEER
Matthew Edwards
Orndorf & Associates, Inc
8600 West Chester Pike, Suite 201
Upper Darby PA 19082



F. LANDSCAPE ARCHITECT
Geoffrey Lee Anderson
Robinson Anderson Summers. Inc.
28 West State Street
Media, PA 19063



END OF SECTION 00 01 07

Specifications for this project are arranged in accordance with the Construction Specification Institute numbering system and format. Section numbering is discontinuous and all numbers not appearing in the Table of Contents are not used for this Project.

DOCUMENTS BOUND HEREWITH

Division	Section Title	Pages
DIVISION 00 - PROCUREMENT AND CONTRACT REQUIREMENTS		
INTRODUCTORY INFORMATION		
00 01 01	PROJECT TITLE PAGE	2
00 01 07	SEALS PAGE	2
00 01 10	TABLE OF CONTENTS	8
00 01 15	LIST OF DRAWING SHEETS	4
PROCUREMENT REQUIREMENTS		
00 11 16	INVITATION TO BID	2
00 21 13	INSTRUCTIONS TO BIDDERS	14
00 41 13	BID FORM	14
00 43 13	BID BOND	2
CONTRACTING REQUIRMENTS		
00 52 13	STANDARD FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR A101-2017 (SAMPLE AIA A101-2017)	18
00 54 13	SUPPLEMENT TO AGREEMENT BETWEEN OWNER AND CONTRACTOR A101-2017	4
00 54 14	SUPPLEMENT TO A101-2017 – EXHIBIT A – INSURANCE & BONDS	2
00 61 13.13	PERFORMANCE BOND	2
00 61 13.16	PAYMENT BOND	2
00 62 76	APPLICATION OF PAYMENT & CERTIFICATION FORMS (SAMPLE AIA G702 & G703)	4
00 72 13	GENERAL CONDITIONS TO THE CONTRACT (AIA A201-2017)	42
00 73 13	SUPPLEMENTARY GENERAL CONDITIONS A201-2017	16
00 73 43	DELAWARE DEPARTMENT OF LABOR PREVAILING WAGE RATES	2
00 81 13	GENERAL REQUIREMENTS	16
00 81 14	DRUG TESTING FORMS	8
00 81 15	AFFIDAVIT OF CRAFT TRAINING COMPLIANCE	2
APPENDIX A (INITIAL IMPLEMENTAION GUIDANCE ON APPLICATION OF BUY AMERICA PREFERENCE IN FEDERAL FINANCIAL ASSISTANCE PROGRAMS FOR INFRASTRUCTURE)		18

DIVISION 1 – GENERAL REQUIREMENTS

01 10 00	SUMMARY	8
01 14 00	WORK RESTRICTIONS	2
01 21 00	ALLOWANCES	4
01 22 00	UNIT PRICES	2
01 23 00	ALTERNATES	2
01 24 00	PERMITS	2
01 26 00	CONTRACT MODIFICATION PROCEDURES	2
01 29 00	PAYMENT PROCEDURES	4
01 31 00	PROJECT MANAGEMENT AND COORDINATION	4
01 31 50	FIELD ENGINEERING	2
01 32 00	CONSTRUCTION PROGRESS DOCUMENTATION	4
01 32 33	PHOTOGRAPHIC DOCUMENTATION	2
01 33 00	SUBMITTAL PROCEDURES	12
01 40 00	QUALITY REQUIREMENTS	8
01 42 00	REFERENCE STANDARDS AND DEFINITIONS	4
01 50 00	TEMPORARY FACILITIES AND CONTROLS	12
01 56 00	ENVIRONMENTAL PROTECTION	4
01 56 39	TEMPORARY TREE AND PLANT PROTECTION	8
01 60 00	PRODUCT REQUIREMENTS	10
01 73 00	EXECUTION REQUIREMENTS	6
01 73 29	CUTTING AND PATCHING	4
01 74 19	CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL	8
01 77 00	CLOSEOUT PROCEDURES	6
01 78 23	OPERATION AND MAINTENANCE DATA	4
01 78 39	PROJECT RECORD DOCUMENTS	4
01 79 00	DEMONSTRATION AND TRAINING	4

DIVISION 2 – EXISTING CONDITIONS

02 32 00	GEOTECHNICAL INVESTIGATION	2
02 41 00	SELECTIVE DEMOLITION	8
02 41 16	STRUCTURE DEMOLITION	8

DIVISION 3 – CONCRETE

03 20 00	CONCRETE REINFORCING	6
03 30 00	CAST-IN-PLACE CONCRETE	22

DIVISION 4 – MASONRY

04 20 00	UNIT MASONRY	14
04 43 13	STONE MASONRY VENEER	8
04 72 00	CAST STONE MASONRY	6

DIVISION 5 – METALS

05 12 00	STRUCTURAL STEEL	10
05 12 13	ARCHITECTURALLY EXPOSED STRUCTURAL STEEL FRAMING	6
05 21 00	STEEL JOIST FRAMING	6
05 31 00	STEEL DECKING	8
05 40 00	COLD-FORMED METAL FRAMING	14
05 50 00	METAL FABRICATIONS	8
05 51 00	METAL STAIRS	6
05 52 13	PIPE AND TUBE RAILINGS	6
05 73 00	DECORATIVE METAL RAILINGS	10

DIVISION 6 – WOOD, PLASTICS AND COMPOSITES

06 10 00	ROUGH CARPENTRY	8
06 41 00	ARCHITECTURAL WOOD CASEWORK	12
06 42 00	WOOD PANELING	4

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

07 13 00	SHEET WATERPROOFING	8
07 21 00	THERMAL INSULATION	8
07 21 63	FLUID-APPLIED INSULATIVE COATING	10
07 25 00	WEATHER BARRIERS	6
07 41 13	METAL ROOF PANELS	8
07 42 13	METAL SOFFIT PANELS	6
07 42 13.16	METAL PLATE COLUMN COVERS	6
074213.23	METAL COMPOSITE MATERIAL WALL PANELS	8
07 46 46	FIBER CEMENT SIDING	8
07 54 00	THERMOPLASTIC MEMBRANE ROOFING	10
07 55 56	FLUID-APPLIED PROTECTED MEMBRANE ROOFING	8
07 55 63	VEGETATED PROTECTED ROOF MEMBRANE	14
07 62 00	SHEET METAL FLASHING AND TRIM	6
07 76 00	ROOF PAVERS	6
07 81 00	APPLIED FIRE PROTECTION	4
07 81 23	INTUMESCENT FIRE PROTECTION	6
07 84 00	FIRESTOPPING	4
07 92 00	JOINT SEALANTS	12

DIVISION 8 – OPENINGS

08 06 71	DOOR HARDWARE SCHEDULE	18
08 14 16	FLUSH WOOD DOORS	6
08 16 13	FIBERGLASS DOORS AND FRAMES	8
08 31 00	ACCESS DOORS & PANELS	2

08 43 13	ALUMINUM-FRAMED STOREFRONTS	12
08 43 33	FOLDING GLASS STOREFRONT	12
08 44 13	GLAZED ALUMINUM CURTAIN WALLS	10
08 71 00	DOOR HARDWARE	22
08 71 13	AUTOMATIC DOOR OPERATORS	8
08 80 00	GLAZING	10
08 91 00	LOUVERS	4

DIVISION 9 – FINISHES

09 21 16	GYPSUM BOARD ASSEMBLIES	8
09 22 16	NON-STRUCTURAL METAL FRAMING	6
09 30 00	TILING	6
09 51 00	ACOUSTICAL CEILINGS	12
09 65 00	RESILIENT BASE	4
09 66 13	PORTLAND CEMENT TERRAZZO FLOORING	4
09 67 00	FLUID-APPLIED FLOORING	6
09 68 13	TILE CARPETING	2
09 77 20	FIBERGLASS REINFORCED PANELS	4
09 91 13	EXTERIOR PAINTING	8
09 91 23	INTERIOR PAINTING	10
09 96 00	HIGH-PERFORMANCE COATINGS	8

DIVISION 10 – SPECIALTIES

10 14 19	DIMENSIONAL LETTER SIGNAGE	4
10 14 23	PANEL SIGNAGE	6
10 22 26	OPERABLE PARTITIONS	10
10 28 00	TOILET, BATH AND LAUNDRY ACCESSORIES	6
10 44 00	FIRE PROTECTION SPECIALTIES	4
10 73 10	METAL CANOPIES	6

DIVISION 11 – EQUIPMENT – (NOT USED)

DIVISION 12 – FURNISHINGS

12 24 00	WINDOW SHADES	4
12 48 13	ENTRANCE FLOOR MATS	2
12 93 13	BICYCLE RACKS	4

DIVISION 13 – SPECIAL CONSTRUCTION – (NOT USED)

DIVISION 14 – CONVEYING SYSTEMS

14 24 00	HYDRAULIC ELEVATORS	14

DIVISIONS 20 THRU 21 – (NOT USED)

DIVISION 22 – PLUMBING

22 01 01	PLUMBING GENERAL PROVISIONS	12
22 05 00	COMMON WORK RESULTS FOR PLUMBING	16
22 05 01	EXCAVATION AND FILL FOR PLUMBING WORK	6
22 05 02	SLEEVES AND PLATES FOR PLUMBING PIPING	4
22 05 04	PLUMBING DEMOLITION	2
22 05 05	EQUIPMENT CONNECTIONS FOR PLUMBING	2
22 05 06	FLASHINGS AND ROOFTOP SUPPORTS FOR PLUMBING PIPING	2
22 05 09	PLUMBING EXPANSION SYSTEM	4
22 05 13	COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT	6
22 05 19	METERS AND GAUGES FOR PLUMBING PIPING	4
22 05 23	GENERAL-DUTY VALVES FOR PLUMBING PIPING	10
22 05 29	HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT	16
22 05 48	VIBRATION CONTROL SUPPORTS FOR PLUMBING	2
22 07 00	PLUMBING INSULATION	2
22 07 16	PLUMBING EQUIPMENT INSULATION	6
22 07 19	PLUMBING PIPING INSULATION	12
22 11 16	DOMESTIC WATER PIPING	8
22 11 19	DOMESTIC WATER PIPING SPECIALTIES	10
22 11 23	DOMESTIC WATER PUMPS	4
22 13 16	SANITARY WASTE AND VENT PIPING	8
22 13 19	SANITARY WASTE PIPING SPECIALTIES	6
22 14 13	STORM DRAINAGE PIPING	8
22 14 23	STORM DRAINAGE PIPING SPECIALTIES	6
22 14 30	ELEVATOR SUMP PUMPS	6
22 33 00	STORAGE ELECTRIC DOMESTIC WATER HEATERS	4
22 42 00.01	PLUMBING FIXTURES – WATER CLOSETS	4
22 42 00.03	PLUMBING FIXTURES – LAVATORIES	8
22 42 00.04a	PLUMBING FIXTURES – MOP SINKS	4
22 42 00.05a	PLUMBING FIXTURES – SINKS	8
22 42 00.06	PLUMBING FIXTURES – DRINKING FOUNTAINS AND WATER COOLERS	4

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING

23 01 00	OPERATION AND MAINTENANCE OF HVAC SYSTEMS	4
23 01 01	HVAC GENERAL PROVISIONS	12
23 05 00	COMMON WORK RESULTS FOR HVAC	16

23 05 02	SLEEVES AND PLATES FOR HVAC PIPING	6
23 05 06	CURBS, RAILS, AND FLASHINGS FOR HVAC PIPING AND EQUIPMENT	4
23 05 13	COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT	8
23 05 19	METERS AND GAUGES FOR HVAC	2
23 05 29	HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT	12
23 05 48	VIBRATION CONTROL SUPPORTS FOR HVAC	4
23 05 93	TESTING, ADJUSTING, AND BALANCING	6
23 07 00	HVAC INSULATION	2
23 07 13	DUCT INSULATION	8
23 07 19	HVAC PIPING INSULATION	12
23 08 00	SYSTEMS COMMISSIONING	10
23 09 01	AUTOMATIC TEMPERATURE CONTROL SYSTEM	4
23 09 02	CONTROL SYSTEMS WIRING	6
23 09 07	CONTROL DAMPERS	4
23 09 13	INSTRUMENTATION AND CONTROL DEVICES FOR HVAC	16
23 09 23	DIRECT DIGITAL BUILDING SYSTEMS CONTROL	18
23 23 00	REFRIGERANT PIPING	12
23 31 13	METAL DUCTS	14
23 31 14	HANGERS AND SUPPORTS FOR DUCTWORK	8
23 33 00	DUCT ACCESSORIES	14
23 33 46	FLEXIBLE DUCTS	2
23 34 00	HVAC FANS	6
23 37 13	DIFFUSERS, REGISTERS, AND GRILLES	6
23 41 00	PARTICULATE AIR FILTRATION	6
23 63 13	AIR-COOLED REFRIGERANT CONDENSING UNITS	8
23 73 22	AIR-HANDLING UNITS WITH COILS	12
23 81 29	VARIABLE-REFRIGERANT-FLOW HVAC SYSTEMS	14
23 82 38	ELECTRIC RESISTANCE TERMINAL UNITS	4

DIVISION 25 – INTEGRATED AUTMATION – (NOT USED)

DIVISION 26 – ELECTRICAL

26 01 01	ELECTRICAL GENERAL PROVISIONS	12
26 05 00	COMMON WORK RESULTS FOR ELECTRICAL	6
26 05 07	FIRESTOPPING FOR ELECTRICAL WORK	6
26 05 19	WIRES AND CABLES	10
26 05 21	WIRING CONNECTIONS	4
26 05 26	GROUNDING AND BONDING	6
26 05 28	EQUIPMENT FOUNDATIONS	2
26 05 33	CONDUITS	12
26 05 34	BOXES	6
26 05 41	SERVICE ENTRANCE	4
26 05 44	UNDERGROUND DUCTS AND UTILITY STRUCTURES	8
26 05 53	IDENTIFICATION FOR ELECTRICAL SYSTEMS	10
26 05 73	OVERCURRENT PROTECTIVE DEVICE STUDIES	8
26 09 23	LIGHTING CONTROL DEVICES	8
26 24 16	PANELBOARDS	10

26 27 16	CABINETS AND ENCLOSURES	2
26 27 26	WIRING DEVICES	4
26 28 00	ENCLOSED CIRCUIT PROTECTIVE DEVICES	4
26 28 13	FUSES	2
26 29 14	ENCLOSED MOTOR CONTROLLERS	4
26 33 23	CENTRAL BATTERY EQUIPMENT	10
26 43 13	SURGE PROTECTIVE DEVICES	6
26 51 00	INTERIOR LIGHTING	8
26 56 00	EXTERIOR LIGHTING	6

DIVISION 27 – COMMUNICATIONS – (NOT USED)

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

28 01 01	ELECTRONIC SAFETY AND SECURITY GENERAL PROVISIONS	12
28 05 00	COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY	6
28 31 00	FIRE DETECTION AND ALARM SYSTEM	14

DIVISION 31 – EARTHWORK

31 10 00	SITE CLEARING	6
31 20 00	EARTHWORK SITE	12
31 23 19	DEWATERING	6

DIVISION 32 – EXTERIOR IMPROVEMENTS

32 12 16	ASPHALT PAVING	4
32 13 13	PORTLAND CEMENT CONCRETE PAVING	10
32 22 10	EROSION AND SEDIMENT CONTROL	4
32 25 10	WATER DISTRIBUTION	8
32 31 19	DECORATIVE METAL FENCES & GATES	6
32 91 15	AMENDED PLANTING SOIL	6
32 91 19	TOPSOILING	8
32 92 00	SEEDING	6
32 93 00	PLANTING	16

DIVISION 33 – UTILITIES

33 41 00	STORM DRAINAGE AND SANITARY SEWER PIPING	12

DIVISIONS 34 THRU 48 – (NOT USED)

END OF TABLE OF CONTENTS 00 01 00

SECTION 00 01 15 - LIST OF DRAWINGS

Sheet No.	Title
CS.1	Cover Sheet
CS.2	Abbreviations, Keynotes, & Symbols
CS.3	Code Study
CS.4	Egress Plans
C.01	Cover Sheet
C.02	Pre-Construction Site Stormwater Management Plan
C.03	Construction Site Stormwater Management Plan
C.04	Construction Stormwater Details & Notes
C.05	Construction Site Stormwater Details & Notes
C.06	Construction Stormwater Details & Notes
C.07	Construction Stormwater Details & Notes
C.08	Construction Stormwater Details & Notes
C.09	Construction Stormwater Details & Notes
C.10	Post-Construction Stormwater Management Plan
C.11	Overall Grading & Drainage Plan
C.12	Grading & Drainage Plan
C.13	Grading & Drainage Plan
C.14	Overall Site Utilities Plan
C.15	Site Utilities Plan
C.16	Site Utilities Plan
C.17	Overall Site Layout Plan
C.18	Site Layout Plan
C.19	Site Layout Plan
C.20	Site Construction Details
C.21	Site Construction Details
C.22	Site Construction Details
C.23	Site Construction Details
C.24	Site Construction Details
L100	Tree Protection & Removal Plan
L200	Site Reference Plan
L500	Bed Preparation Plan
L505	Bed Preparation Plan
L510	Tree Planting & Seeding Plan
L520	Tree Planting & Seeding Plan
L550	Basin Planting Plans & Notes
L551	Planting Notes & Details
L552	Seeding Mix Charts & Notes
L700	Hardscape Details
AS.1	Architectural Site Plan
AS.2	Chambers House
AC.1	Construction Types
AC.2	Construction Types
AC.3	Typical Details

A1.1	Lower Floor Plan
A1.2	Upper Floor Plan
A1.3	Outdoor Terrace Slab Plan & Roof Plan
A1.4	Deduct Alternates
A1.5	Deduct Alternates
A1.6	Deduct Alternates
A2.1	Reflected Ceiling Plan – Lower Floor
A2.2	Reflected Ceiling Plan – Upper Floor
A3.1	Exterior Elevations
A4.1	Building Sections
A4.2	Building Sections
A4.3	Wall Sections
A4.4	Wall Sections
A5.1	Stair and Elevator Plans & Sections
A5.2	Stair & Railing Details
A6.1	Plan Details
A6.2	Section Details
A6.3	Section Details
A6.4	Section Details
A6.5	Section Details
A6.6	Section Details
A6.7	Plan Details
A7.1	Enlarged Plans & Interior Elevations
A7.2	Interior Elevations
A7.3	Interior Elevations & Casework Details
A8.1	Door & Louver Schedule and Details
A8.2	Door & Louver Details
A8.3	Window Schedule
A8.4	Window Details
A9.1	Finish Plan – Lower Floor
A9.2	Finish Plan – Upper Floor
S0.0	Structural Cover Sheet
S0.1	Structural Notes
S0.2	Structural Notes
S1.0	Foundation Plans
S1.1	Slab Plan
S1.2	Framing Plans
S1.3	Framing Plans
S1.4	Framing Plans
S5.0	Foundation Details
S5.1	Foundation Details
S5.2	Foundation Details
S5.3	Framing Details
S5.4	Framing Details
S5.5	Framing Details
S5.6	Framing Details
S6.0	Structural Schedules
M0.1	Symbols and Abbreviations

M1.1	Floor Plans – HVAC
M1.2	Roof Plan – HVAC
M2.1	Floor Plans – Piping
M4.1	Part Plans – HVAC
M5.1	Details and Diagrams
M5.2	Details and Diagrams
M6.1	Schedules
M6.2	Schedules
M6.3	Schedules
M7.1	Automatic Temperature Controls
M7.2	Automatic Temperature Controls
M7.3	Automatic Temperature Controls
P1.1	Lower & Upper Floor Plans – Plumbing
P1.2	Chambers House Floor Plan – Plumbing
P4.1	Part Plans – Plumbing
P5.1	Details & Diagrams
P5.2	Details & Diagrams
P5.3	Details & Diagrams
P5.4	Sanitary Riser Diagram
P5.5	Domestic Water Riser Diagram
P6.1	Schedules
E0.1	Symbols and Abbreviations
ED0.1	Electrical Site Plan - Demolition
ES.01	Electrical Site Plan
ES0.2	Electrical Site Plan
EL1.1	Lower & Upper Floor Plan – Lighting – New Work
EP1.1	Lower & Upper Floor Plan – Power – New Work
EP1.2	Roof Plan – Power – New Work
EM1.1	Lower & Upper Floor Plan – Mechanical Coordination – New Work
EY1.1	Lower & Upper Floor Plan – Systems – New Work
EF1.1	Lower & Upper Floor Plan – Fire Alarm – New Work
E5.1	Lighting Details, Diagrams, and Sequence of Operations
E5.2	Details
E5.3	Details
E5.4	Details
E5.5	Details
E5.6	Fire Alarm Annunciator Panel
E6.1	Power One-Line & Fire Alarm Riser Diagrams
E6.3	Schedules
E6.4	Schedules
A-1	Foundation, Framing & Floor Plans
A-2	Building Elevations
A-3	Building Sections
A-4	Details
PE-1	Plumbing & Electric

END OF SECTION 00 01 15

SECTION 00 11 16

INVITATION TO BID

Sealed bids for **DNREC Contract No. NAT25805-NATCTR**, will be received by the State of Delaware, DNREC, Division of Parks and Recreation at 89 Kings Highway, Dover DE 19901 until **1:00 P.M.** local time on **Tuesday, June 2, 2026** The bids will be opened and read aloud live at **1:00 P.M.** local time on **Tuesday, June 2, 2026**, via an online video conference with an option to call in using a telephone. The bid opening will not be held in-person. To attend the bid opening, the public may join via Microsoft Teams enabled computer or mobile app, using Teams Meeting ID: **225 679 685 011 59** and Passcode: "**Jw6AH2X8**". Audio-only, conference call type of participation is available by calling 1-302-504-8986 and using ID: "**491 221 723#**"

Project involves the construction of a new Nature Center Facility in White Clay Creek State Park including sitework, utilities, and facility construction.

A MANDATORY Pre-Bid Meeting will be held on **Wednesday, April 29, 2026**, at **1:00 P.M.** at White Clay Creek State Park – Chambers House Nature Center, 1475 Creek Road, Newark, DE 19711, for the purpose of establishing the listing of subcontractors and to answer questions. Representatives of each party to any Joint Venture must attend this meeting. **ATTENDANCE OF THIS MEETING IS A PREREQUISITE FOR BIDDING ON THIS CONTRACT**.

Sealed bids shall be addressed to the DNREC - Division of Parks and Recreation, 89 Kings Highway, Dover, DE 19901. The outer envelope should clearly indicate: "**DNREC CONTRACT NO. NAT25805-NATCTR - SEALED BID - DO NOT OPEN**." We are also accepting, and prefer, emailed bids. They must be emailed to Shawn.Heacock@delaware.gov and Kevin.Rychlicki@delaware.gov prior to the bid deadline. Bidders bear the risk of late delivery regardless of submission method. Any bids received after the deadline will be rejected.

Contract documents shall be obtained by using the online form located at https://bit.ly/2TVIu2z and filling in the required fields. Once the information is provided, bid documents will be sent by email using Egress Switch (State's secure email drop-box type of system). The documents will be e-mailed at no cost.

Bidders will not be subject to discrimination on the basis of race, creed, color, sex, sexual orientation, gender identity or national origin in consideration of this award, and Minority Business Enterprises, Disadvantaged Business Enterprises, Women-Owned Business Enterprises and Veteran-Owned Business Enterprises will be afforded full opportunity to submit bids on this contract. Each bid must be accompanied by a bid security equivalent to ten percent of the bid amount and all additive alternates. The successful bidder must post a performance bond and payment bond in a sum equal to 100 percent of the contract price upon execution of the contract. The Owner reserves the right to reject any or all bids and to waive any informalities therein. The Owner may extend the time and place for the opening of the bids from that described in the advertisement, with not less than two calendar days' notice by e-mail to those bidders receiving plans.

Gregory Patterson, Secretary

END OF SECTION 00 11 16

THIS PAGE
LEFT INTENTIONALLY BLANK

SECTION 00 21 13

INSTRUCTIONS TO BIDDERS

TABLE OF ARTICLES

1. GENERAL

2. BIDDER'S REPRESENTATION

3. BIDDING DOCUMENTS

4. BIDDING PROCEDURES

5. CONSIDERATION OF BIDS

6. POST-BID INFORMATION

7. PERFORMANCE BOND AND PAYMENT BOND

8. FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

ARTICLE 1: GENERAL

1.1 DEFINITIONS

1.1.1 Whenever the following terms are used, their intent and meaning shall be interpreted as follows:

1.2 STATE: The State of Delaware.

1.3 AGENCY: Contracting State Agency as noted on cover sheet.

1.4 DESIGNATED OFFICIAL: The agent authorized to act for the Agency.

1.5 BIDDING DOCUMENTS: Bidding Documents include the Bidding Requirements and the proposed Contract Documents. The Bidding Requirements consist of the Advertisement for Bid, Invitation to Bid, Instructions to Bidders, Supplementary Instructions to Bidders (if any), General Conditions, Supplementary General Conditions, General Requirements, Special Provisions (if any), the Bid Form (including the Non-collusion Statement), and other sample bidding and contract forms. The proposed Contract Documents consist of the form of Agreement between the Owner and Contractor, as well as the Drawings, Specifications (Project Manual) and all Addenda issued prior to execution of the Contract.

1.6 CONTRACT DOCUMENTS: The Contract Documents consist of the, Instructions to Bidders, Supplementary Instructions to Bidders (if any), General Conditions, Supplementary General Conditions, General Requirements, Special Provisions (if any), the form of agreement between the Owner and the Contractor, Drawings (if any), Specifications (Project Manual), and all addenda.

1.7 AGREEMENT: The form of the Agreement shall be AIA Document A101, Standard Form of Agreement between Owner and Contractor where the basis of payment is a STIPULATED SUM. In the case of conflict between the instructions contained therein and the General Requirements herein, these General Requirements shall prevail.

1.8 GENERAL REQUIREMENTS (or CONDITIONS): General Requirements (or conditions) are instructions pertaining to the Bidding Documents and to contracts in general. They contain, in summary, requirements of laws of the State; policies of the Agency and instructions to bidders.

1.9 SPECIAL PROVISIONS: Special Provisions are specific conditions or requirements peculiar to the bidding documents and to the contract under consideration and are supplemental to the General Requirements. Should the Special Provisions conflict with the General Requirements, the Special Provisions shall prevail.

1.10 ADDENDA: Written or graphic instruments issued by the Owner/Architect prior to the execution of the contract which modify or interpret the Bidding Documents by additions, deletions, clarifications or corrections.

1.11 BIDDER OR VENDOR: A person or entity who formally submits a Bid for the material or Work contemplated, acting directly or through a duly authorized representative who meets the requirements set forth in the Bidding Documents.

1.12 SUB-BIDDER: A person or entity who submits a Bid to a Bidder for materials or labor, or both for a portion of the Work.

1.13 BID: A complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

1.14 BASE BID: The sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents as the base, to which Work may be added or from which Work may be deleted for sums stated in Alternate Bids (if any are required to be stated in the bid).

1.15 ALTERNATE BID (or ALTERNATE): An amount stated in the Bid, where applicable, to be added to or deducted from the amount of the Base Bid if the corresponding change in the Work, as described in the Bidding Documents is accepted.

1.16 UNIT PRICE: An amount stated in the Bid, where applicable, as a price per unit of measurement for materials, equipment or services or a portion of the Work as described in the Bidding Documents.

1.17 SURETY: The corporate body which is bound with and for the Contract, or which is liable, and which engages to be responsible for the Contractor's payments of all debts pertaining to and for his acceptable performance of the Work for which he has contracted.

1.18 BIDDER'S DEPOSIT: The security designated in the Bid to be furnished by the Bidder as a guaranty of good faith to enter into a contract with the Agency if the Work to be performed or the material or equipment to be furnished is awarded to him.

1.19 CONTRACT: The written agreement covering the furnishing and delivery of material or work to be performed.

1.20 CONTRACTOR: Any individual, firm or corporation with whom a contract is made by the Agency.

1.21 SUBCONTRACTOR: An individual, partnership or corporation which has a direct contract with a contractor to furnish labor and materials at the job site, or to perform construction labor and furnish material in connection with such labor at the job site.

1.22 CONTRACT BOND: The approved form of security furnished by the contractor and his surety as a guaranty of good faith on the part of the contractor to execute the work in accordance with the terms of the contract.

1.23 CUSTOM FABRICATION: As defined in 29 Del. C. § 6902, the term "custom fabrication" means the offsite fabrication, assembly, or other production of non-standard goods or materials, including components, fixtures or parts thereof, specifically for a public works project. Such goods and materials shall include those used in the following trades or systems: (1) Plumbing or pipe fitting systems, including heating, ventilating, air-conditioning, refrigeration systems, sheet metal or other duct systems; (2) Electrical systems; (3) Mechanical insulation work; (4) Ornamental iron work; and (5) Commercial signage that does not attempt or appear to direct the movement of traffic on highways or roadways or interfere with, imitate, or resemble any official traffic sign, signal or device.

ARTICLE 2: BIDDER'S REPRESENTATION

2.1 PRE-BID MEETING

2.1.1 A pre-bid meeting for this project will be held at the time and place designated. Attendance at this meeting is a pre-requisite for submitting a Bid, unless this requirement is specifically waived elsewhere in the Bid Documents.

2.2 By submitting a Bid, the Bidder represents that:

2.2.1 The Bidder has read and understands the Bidding Documents and that the Bid is made in accordance therewith.

2.2.2 The Bidder has visited the site, become familiar with existing conditions under which the Work is to be performed, and has correlated the Bidder's personal observations with the requirements of the proposed Contract Documents.

2.2.3 The Bid is based upon the materials, equipment, and systems required by the Bidding Documents without exception.

2.3 JOINT VENTURE REQUIREMENTS

2.3.1 For Public Works Contracts, each Joint Venturer shall be qualified and capable to complete the Work with their own forces.

2.3.2 Included with the Bid submission, and as a requirement to bid, a copy of the executed Joint Venture Agreement shall be submitted and signed by all Joint Venturers involved.

2.3.3 All required Bid Bonds, Performance Bonds, Material and Labor Payment Bonds must be executed by both Joint Venturers and be placed in both of their names.

2.3.4 All required insurance certificates shall name both Joint Venturers.

2.3.5 Both Joint Venturers shall sign the Bid Form.

2.3.6 Both Joint Venturers shall include their Federal E.I. Number with the Bid.

2.3.7 In the event of a mandatory Pre-bid Meeting, each Joint Venturer shall have a representative in attendance.

2.3.8 Due to exceptional circumstances and for good cause shown, one or more of these provisions may be waived at the discretion of the State.

2.4 ASSIGNMENT OF ANTITRUST CLAIMS

2.4.1 As consideration for the award and execution by the Owner of this contract, the Contractor hereby grants, conveys, sells, assigns and transfers to the State of Delaware all of its right, title and interests in and to all known or unknown causes of action it presently has or may now or hereafter acquire under the antitrust laws of the United States and the State of

Delaware, relating to the particular goods or services purchased or acquired by the Owner pursuant to this contract.

ARTICLE 3: BIDDING DOCUMENTS

3.1 COPIES OF BID DOCUMENTS

3.1.1 Bidders may obtain complete sets of the Bidding Documents from the Architectural/Engineering firm designated in the Advertisement or Invitation to Bid in the number and for the deposit sum, if any, stated therein.

3.1.2 Bidders shall use complete sets of Bidding Documents for preparation of Bids. The issuing Agency nor the Architect assumes no responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

3.1.3 Any errors, inconsistencies or omissions discovered shall be reported to the Architect immediately.

3.1.4 The Agency and Architect may make copies of the Bidding Documents available on the above terms for the purpose of obtaining Bids on the Work. No license or grant of use is conferred by issuance of copies of the Bidding Documents.

3.2 INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS

3.2.1 The Bidder shall carefully study and compare the Bidding Documents with each other, and with other work being bid concurrently or presently under construction to the extent that it relates to the Work for which the Bid is submitted, shall examine the site and local conditions, and shall report any errors, inconsistencies, or ambiguities discovered to the Architect.

3.2.2 Bidders or Sub-bidders requiring clarification or interpretation of the Bidding Documents shall make a written request to the Architect at least seven days prior to the date for receipt of Bids. Interpretations, corrections and changes to the Bidding Documents will be made by written Addendum. Interpretations, corrections, or changes to the Bidding Documents made in any other manner shall not be binding.

3.2.3 The apparent silence of the specifications as to any detail, or the apparent omission from it of detailed description concerning any point, shall be regarded as meaning that only the best commercial practice is to prevail and only material and workmanship of the first quality are to be used. Proof of specification compliance will be the responsibility of the Bidder.

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

3.2.5 The Owner will bear the costs for all impact and user fees associated with the project.

3.3 SUBSTITUTIONS

3.3.1 The materials, products and equipment described in the Bidding Documents establish a standard of quality, required function, dimension, and appearance to be met by any proposed substitution. The specification of a particular manufacturer or model number is not intended to be proprietary in any way. Substitutions of products for those named will be considered, providing that the Vendor certifies that the function, quality, and performance characteristics of the material offered is equal or superior to that specified. It shall be the Bidder's responsibility to assure that the proposed substitution will not affect the intent of the design, and to make any installation modifications required to accommodate the substitution.

3.3.2 Requests for substitutions shall be made in writing to the Architect at least ten days prior to the date of the Bid Opening. Such requests shall include a complete description of the proposed substitution, drawings, performance and test data, explanation of required installation modifications due the substitution, and any other information necessary for an evaluation. The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect’s decision of approval or disapproval shall be final. The Architect is to notify Owner prior to any approvals.

3.3.3 If the Architect approves a substitution prior to the receipt of Bids, such approval shall be set forth in an Addendum. Approvals made in any other manner shall not be binding.

3.3.4 The Architect shall have no obligation to consider any substitutions after the Contract award.

3.4 ADDENDA

3.4.1 Addenda will be mailed or delivered to all who are known by the Architect to have received a complete set of the Bidding Documents.

3.4.2 Copies of Addenda will be made available for inspection wherever Bidding Documents are on file for that purpose.

3.4.3 No Addenda will be issued later than 2 calendar days prior to the date for receipt of Bids except an Addendum withdrawing the request for Bids or one which extends the time or changes the location for the opening of bids.

3.4.4 Each bidder shall ascertain prior to submitting his Bid that they have received all Addenda issued, and shall acknowledge their receipt in their Bid in the appropriate space. Not acknowledging an issued Addenda could be grounds for determining a bid to be non-responsive.

ARTICLE 4: BIDDING PROCEDURES

4.1 PREPARATION OF BIDS

4.1.1 Submit the bids on the Bid Forms included with the Bidding Documents.

4.1.2 Submit the original Bid Form for each bid. Bid Forms may be removed from the project manual for this purpose.

4.1.3 Execute all blanks on the Bid Form in a non-erasable medium (typewriter or manually in ink).

4.1.4 Where so indicated by the makeup on the Bid Form, express sums in both words and figures, in case of discrepancy between the two, the written amount shall govern.

4.1.5 Interlineations, alterations or erasures must be initialed by the signer of the Bid.

4.1.6 BID ALL REQUESTED ALTERNATES AND UNIT PRICES, IF ANY. If there is no change in the Base Bid for an Alternate, enter "No Change". The Contractor is responsible for verifying that they have received all addenda issued during the bidding period. Work required by Addenda shall automatically become part of the Contract.

4.1.7 Make no additional stipulations on the Bid Form and do not qualify the Bid in any other manner.

4.1.8 Each copy of the Bid shall include the legal name of the Bidder and a statement whether the Bidder is a sole proprietor, a partnership, a corporation, or any legal entity, and each copy shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further give the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current Power of Attorney attached, certifying agent's authority to bind the Bidder.

4.1.9 Bidder shall complete the Non-Collusion Statement form included with the Bid Forms and include it with their Bid.

4.1.10 In the construction of all Public Works projects for the State of Delaware or any agency thereof, preference in employment of laborers, workers or mechanics shall be given to bona fide legal citizens of the State who have established citizenship by residence of at least 90 days in the State.

4.1.11 Each bidder shall include a signed Affidavit for the Bidder certifying compliance with OMB Regulation 4104 - "Regulations for the Drug Testing of Contractor and Subcontractor Employees Working on "Large Public Works Projects." "Large Public Works" is based upon the current threshold required for bidding Public Works as set by the Purchasing and Contracting Advisory Council.

4.2 BID SECURITY

4.2.1 All bids shall be accompanied by a deposit of either a good and sufficient bond to the agency for the benefit of the agency, with corporate surety authorized to do business in this State, the form of the bond and the surety to be approved by the agency, or a security of the bidder assigned to the agency, for a sum equal to at least 10% of the bid plus all add alternates, or in lieu of the bid bond a security deposit in the form of a certified check, bank treasurer's check, cashier's check, money order, or other prior approved secured deposit assigned to the State. The bid bond need not be for a specific sum, but may be stated to be for a sum equal to 10% of the bid plus all add alternates to which it relates and not to exceed a certain stated sum, if said sum is equal to at least 10% of the bid. The Bid Bond form used shall be the standard OMB form (attached).

4.2.2 The Agency has the right to retain the bid security of Bidders to whom an award is being considered until either a formal contract has been executed and bonds have been furnished or the specified time has elapsed so the Bids may be withdrawn or all Bids have been rejected.

4.2.3 In the event of any successful Bidder refusing or neglecting to execute a formal contract and bond within 20 days of the awarding of the contract, the bid bond or security deposited by the successful bidder shall be forfeited.

4.3 SUBCONTRACTOR LIST

4.3.1 In accordance with Title 29, Chapter 69, Section 6962(d)(10)b of the Delaware Code, each Bidder shall submit with their Bid a completed List of Sub-Contractors included with the Bid Form. NAME ONLY ONE SUBCONTRACTOR FOR EACH TRADE. The bidder must list **in each category** the full name and address (City & State) of the sub-contractor that the Bidder will be using to perform the work and provide material for that subcontractor category. Should the Bidder's listed subcontractor intend to provide any of their subcontractor category of work through a third-tier contractor, the Bidder shall list that third-tier contractor's full name and address (City & State). **If the Bidder intends to perform any category of work itself, it must list its full name and address.** For clarification, if the Bidder intends to perform the work themselves, the Bidder **may not** insert "not applicable", "N/A", "self" or anything other than its own full name and address (City & State). To do so shall cause the bid to be rejected. In addition, the failure to produce a completed subcontractor list with the bid submittal shall cause the bid to be rejected. If you have more than three (3) third-tier contractors to report in any subcontractor category, print out additional page(s) containing the appropriate category, complete the rest of your list of third-tier contractors for that category, notate the addition in parentheses as (CONTINUATION) next to the subcontractor category and an asterisk (*) next to any additional third-tier contractors, and submit it with your bid.

4.3.2 It is the responsibility of the Contractor to ensure that their Subcontractors are in compliance with the provisions of this law. Also, if a Contractor elects to list themselves as a Subcontractor for any category, they must specifically name themselves on the Bid Form and be able to document their capability to act as Subcontractor in that category in accordance with this law.

4.4 AFFIDAVIT OF CONTRACTOR QUALIFICATIONS

4.4.1 In accordance with Title 29, Chapter 69, Section 6962(d)(10)b.3 of the Delaware Code, each Bidder shall submit with their Bid the Affidavit of Contractor Qualifications certifying that the Bidder will abide by the contractor's qualifications outlined in the construction bid specifications for the duration of the contract term. After a contract has been awarded the successful bidder shall not substitute another subcontractor whose name was submitted on the Subcontractor Form except for the reasons in the statute and not without written consent from the awarding agency. Failure to utilize the subcontractors on the list will subject the successful bidder to penalties as outlined in the General Requirements Section 5.2 of the contract.

4.5 AFFIDAVIT OF CRAFT TRAINING COMPLIANCE

4.5.1 In accordance with Title 29, Chapter 69, Section 6962(c)(13) of the Delaware Code, contractors and subcontractors must provide craft training for journeyman and apprentice levels if **all** of the following apply:

A. A project meets the prevailing wage requirement under Title 29, Chapter 69, Section 6960 of the Delaware Code.
B. The contractor employs 10 or more total employees.
C. The project is not a federal highway project

Failure to provide required craft training on the project may subject the successful contractor and/or subcontractor(s) to penalties as outlined in Title 29, Chapter 69, Section 6962(c)(13) of the Delaware Code.

Bidders shall submit the Affidavit of Craft Training Compliance prior to contract execution.

4.6 EQUALITY OF EMPLOYMENT OPPORTUNITY ON PUBLIC WORKS

4.6.1 During the performance of this contract, the contractor agrees as follows:

A. The Contractor will not discriminate against any employee or applicant for employment because of race, creed, sex, color, sexual orientation, gender identity or national origin. The Contractor will take affirmative action to ensure the applicants are employed, and that employees are treated during employment, without regard to their race, creed, sex, color, sexual orientation, gender identity or national origin. Such action shall include, but not be limited to, the following: Employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places available to employees and applicants for employment notices to be provided by the contracting agency setting forth this nondiscrimination clause.

B. The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, creed, sex, color, sexual orientation, gender identity or national origin."

4.7 PREVAILING WAGE REQUIREMENT

4.7.1 Wage Provisions: For renovation and new construction projects whose costs exceed the thresholds contained in Delaware Code, Title 29, Section 6960, the minimum wage rates for various classes of laborers and mechanics shall be as determined by the Department of Labor, Division of Industrial Affairs of the State of Delaware.

4.7.2 The employer shall pay all mechanics and labors employed directly upon the site of work, or engaged in custom fabrication work, as that term is defined in Article 1.23 herein and as also as defined in 29 Del. C § 6902 and described in 29 Del. C. § 6960(b), regardless of where the work is performed, unconditionally and not less often than once a week and without

subsequent deduction or rebate on any account, the full amounts accrued at time of payment, computed at wage rates not less than those stated in the specifications, regardless of any contractual relationship which may be alleged to exist between the employer and such laborers and mechanics.

4.7.3 As per 29 Del. C. § 6960(b), the scale of the wages to be paid must be posted by the employer in a prominent and easily accessible place at the site of the work. There may be withheld from the employer so much of accrued payments as may be considered necessary by the Department of Labor to pay laborers and mechanics employed by the employer the difference between the rates of wages required by the contract to be paid laborers and mechanics on the work and rates of wages received by such laborers and mechanics to be remitted to the Department of Labor for distribution upon resolution of any claims.

4.7.4 Every contract based upon these specifications shall contain a stipulation that sworn payroll information, as required by the Department of Labor, be furnished weekly. The Department of Labor shall keep and maintain the sworn payroll information for a period of 6 months from the last day of the work week covered by the payroll.

4.8 SUBMISSION OF BIDS

4.8.1 Enclose the Bid, the Bid Security, and any other documents required to be submitted with the Bid in a sealed opaque envelope. Address the envelope to the party receiving the Bids. Identify with the project name, project number, and the Bidder's name and address. If the Bid is sent by mail, enclose the sealed envelope in a separate mailing envelope with the notation "BID ENCLOSED" on the face thereof. The State is not responsible for the opening of bids prior to bid opening date and time that are not properly marked.

4.8.2 Deposit Bids at the designated location prior to the time and date for receipt of bids indicated in the Advertisement for Bids. Bids received after the time and date for receipt of bids will be marked “LATE BID” and returned.

4.8.3 Bidder assumes full responsibility for timely delivery at location designated for receipt of bids.

4.8.4 Oral, telephonic or telegraphic bids are invalid and will not receive consideration.

4.8.5 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids, provided that they are then fully in compliance with these Instructions to Bidders.

4.9 MODIFICATION OR WITHDRAW OF BIDS

4.9.1 Prior to the closing date for receipt of Bids, a Bidder may withdraw a Bid by personal request and by showing proper identification to the Architect. A request for withdraw by letter or fax, if the Architect is notified in writing prior to receipt of fax, is acceptable. A fax directing a modification in the bid price will render the Bid informal, causing it to be ineligible for consideration of award. Telephone directives for modification of the bid price shall not be permitted and will have no bearing on the submitted proposal in any manner.

4.9.2 Bidders submitting Bids that are late shall be notified as soon as practicable and the bid shall be returned.

4.9.3 A Bid may not be modified, withdrawn or canceled by the Bidder during a thirty (30) day period following the time and date designated for the receipt and opening of Bids, and Bidder so agrees in submitting their Bid. Bids shall be binding for 30 days after the date of the Bid opening.

ARTICLE 5: CONSIDERATION OF BIDS

5.1 OPENING/REJECTION OF BIDS

5.1.1 Unless otherwise stated, Bids received on time will be publicly opened and will be read aloud. An abstract of the Bids will be made available to Bidders.

5.1.2 The Agency shall have the right to reject any and all Bids. A Bid not accompanied by a required Bid Security or by other data required by the Bidding Documents, or a Bid which is in any way incomplete or irregular is subject to rejection.

5.1.3 If the Bids are rejected, it will be done within thirty (30) calendar day of the Bid opening.

5.2 COMPARISON OF BIDS

5.2.1 After the Bids have been opened and read, the bid prices will be compared and the result of such comparisons will be made available to the public. Comparisons of the Bids may be based on the Base Bid plus desired Alternates. The Agency shall have the right to accept Alternates in any order or combination.

5.2.2 The Agency reserves the right to waive technicalities, to reject any or all Bids, or any portion thereof, to advertise for new Bids, to proceed to do the Work otherwise, or to abandon the Work, if in the judgment of the Agency or its agent(s), it is in the best interest of the State.

5.2.3 An increase or decrease in the quantity for any item is not sufficient grounds for an increase or decrease in the Unit Price.

5.2.4 The prices quoted are to be those for which the material will be furnished F.O.B. Job Site and include all charges that may be imposed during the period of the Contract.

5.2.5 No qualifying letter or statements in or attached to the Bid, or separate discounts will be considered in determining the low Bid except as may be otherwise herein noted. Cash or separate discounts should be computed and incorporated into Unit Bid Price(s).

5.3 DISQUALIFICATION OF BIDDERS

5.3.1 An agency shall determine that each Bidder on any Public Works Contract is responsible before awarding the Contract. Factors to be considered in determining the responsibility of a Bidder include:

A. The Bidder’s financial, physical, personnel or other resources including Subcontracts;

B. The Bidder's record of performance on past public or private construction projects, including, but not limited to, defaults and/or final adjudication or admission of violations of the Prevailing Wage Laws in Delaware or any other state;

C. The Bidder's written safety plan;

D. Whether the Bidder is qualified legally to contract with the State;

E. Whether the Bidder supplied all necessary information concerning its responsibility; and,

F. Any other specific criteria for a particular procurement, which an agency may establish; provided however, that, the criteria be set forth in the Invitation to Bid and is otherwise in conformity with State and/or Federal law.

5.3.2 If an agency determines that a Bidder is nonresponsive and/or nonresponsible, the determination shall be in writing and set forth the basis for the determination. A copy of the determination shall be sent to the affected Bidder within five (5) working days of said determination.

5.3.3 In addition, any one or more of the following causes may be considered as sufficient for the disqualification of a Bidder and the rejection of their Bid or Bids.

5.3.3.1 More than one Bid for the same Contract from an individual, firm or corporation under the same or different names.

5.3.3.2 Evidence of collusion among Bidders.

5.3.3.3 Unsatisfactory performance record as evidenced by past experience.

5.3.3.4 If the Unit Prices are obviously unbalanced either in excess or below reasonable cost analysis values.

5.3.3.5 If there are any unauthorized additions, interlineation, conditional or alternate bids or irregularities of any kind which may tend to make the Bid incomplete, indefinite or ambiguous as to its meaning.

5.3.3.6 If the Bid is not accompanied by the required Bid Security and other data required by the Bidding Documents.

5.3.3.7 If any exceptions or qualifications of the Bid are noted on the Bid Form.

5.4 ACCEPTANCE OF BID AND AWARD OF CONTRACT

5.4.1 A formal Contract shall be executed with the successful Bidder within twenty (20) calendar days after the award of the Contract.

5.4.2 Per Section 6962(d)(13)a., Title 29, Delaware Code, "The contracting agency shall award any public works contract within thirty (30) days of the bid opening to the lowest

responsive and responsible Bidder, unless the Agency elects to award on the basis of best value, in which case the election to award on the basis of best value shall be stated in the Invitation To Bid. Any public school district and its board shall award public works contracts in accordance with this section's requirements except it shall award the contract within 60 days of the bid opening."

5.4.3 Each Bid on any Public Works Contract must be deemed responsive by the Agency to be considered for award. A responsive Bid shall conform in all material respects to the requirements and criteria set forth in the Contract Documents and specifications.

5.4.4 The Agency shall have the right to accept Alternates in any order or combination, and to determine the low Bidder on the basis of the sum of the Base Bid, plus accepted Alternates.

5.4.5 The successful Bidder shall execute a formal contract, submit the required Insurance Certificate, and furnish good and sufficient bonds, unless specifically waived in the General Requirements, in accordance with the General Requirement, within twenty (20) days of official notice of contract award. The successful Bidder shall provide, at least two business days prior to contract execution, copies of the Employee Drug Testing Program for the Bidder and all listed Subcontractors. Bonds shall be for the benefit of the Agency with surety in the amount of 100% of the total contract award. Said Bonds shall be conditioned upon the faithful performance of the contract. Bonds shall remain in affect for period of two (2) years after the date of the Certificate of Final Payment.

5.4.6 If the successful Bidder fails to execute the required Contract, Bond and all required information, as aforesaid, within twenty (20) calendar days after the date of official Notice of the Award of the Contract, their Bid guaranty shall immediately be taken and become the property of the State for the benefit of the Agency as liquidated damages, and not as a forfeiture or as a penalty. Award will then be made to the next lowest qualified Bidder of the Work or readvertised, as the Agency may decide.

5.4.7 Each bidder shall supply with its bid its taxpayer identification number (i.e., federal employer identification number or social security number) and should the vendor be awarded a contract, such vendor shall provide to the agency the taxpayer identification license numbers of such subcontractors. Such numbers shall be provided on the later of the date on which such subcontractor is required to be identified or the time the contract is executed. The successful Bidder shall provide to the agency to which it is contracting, within 30 days of entering into such public works contract, copies of all Delaware Business licenses of subcontractors and/or independent contractors that will perform work for such public works contract. However, if a subcontractor or independent contractor is hired or contracted more than 20 days after the Bidder entered the public works contract the Delaware Business license of such subcontractor or independent contractor shall be provided to the agency within 10 days of being contracted or hired.

5.4.8 The Bid Security shall be returned to the successful Bidder upon the execution of the formal contract. The Bid Securities of unsuccessful bidders shall be returned within thirty (30) calendar days after the opening of the Bids.

ARTICLE 6: POST-BID INFORMATION

6.1 CONTRACTOR'S QUALIFICATION STATEMENT

6.1.1 Bidders to whom an award of a Contract is under consideration shall, if requested by the Agency, submit a properly executed AIA Document A305, Contractor's Qualification Statement, unless such a statement has been previously required and submitted.

6.2 Bidders to whom an award of a Contract has been made must produce their Delaware Business License before the Contract can be executed.

ARTICLE 7: PERFORMANCE BOND AND PAYMENT BOND

7.1 BOND REQUIREMENTS

7.1.1 The cost of furnishing the required Bonds, that are stipulated in the Bidding Documents, shall be included in the Bid.

7.1.2 If the Bidder is required by the Agency to secure a bond from other than the Bidder's usual sources, changes in cost will be adjusted as provide in the Contract Documents.

7.1.3 The Performance and Payment Bond forms used shall be the standard OMB forms (attached).

7.2 TIME OF DELIVERY AND FORM OF BONDS

7.2.1 The bonds shall be dated on or after the date of the Contract.

7.2.2 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix a certified and current copy of the power of attorney.

ARTICLE 8: FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

8.1 Unless otherwise required in the Bidding Documents, the Agreement for the Work will be written on AIA Document A101, Standard Form of Agreement Between Owner and Contractor Where the Basis of Payment is a Stipulated Sum.

END OF SECTION

WHITE CLAY CREEK STATE PARK NATURE CENTER
WHITE CLAY CREEK STATE PARK
1475 CREEK ROAD, NEWARK, DE 19711
DIVISION OF PARKS AND RECREATION CONTRACT No. NAT25805-NATCTR

BID FORM

For Bids Due: June 2, 2026 and 1:00 pm

To: Dept. of Natural Resources and Environmental Control
Division of Parks and Recreation
Office of Design and Development
89 Kings Highway, Dover DE 19901

Name of Bidder: _____

Delaware Business License No.: _____ **Taxpayer ID No.:** _____

(Other License Nos.): _____

Phone No.: ( ) _____ - _____ **Fax No.: ( ) _____ - _____**

The undersigned, representing that he has read and understands the Bidding Documents and that this bid is made in accordance therewith, that he has visited the site and has familiarized himself with the local conditions under which the Work is to be performed, and that his bid is based upon the materials, systems and equipment described in the Bidding Documents without exception, hereby proposes and agrees to provide all labor, materials, plant, equipment, supplies, transport and other facilities required to execute the work described by the aforesaid documents for the lump sum itemized below:

$_____

($_____)

Contingency Allowance Sixty Thousand Dollars and Zero Cents ($60,000.00)

Total Bid

$_____

($_____)

WHITE CLAY CREEK STATE PARK NATURE CENTER
WHITE CLAY CREEK STATE PARK
1475 CREEK ROAD, NEWARK, DE 19711
DIVISION OF PARKS AND RECREATION CONTRACT No. NAT25805-NATCTR

BID FORM

ALTERNATES

Alternate prices conform to applicable project specification section. Refer to specifications for a complete description of the following Alternates. An "ADD" or "DEDUCT" amount is indicated by the crossed-out part that does not apply.

DEDUCT ALTERNATE No. 1: Shrubs

Deduct: _____
($)

No. of Days to Complete Alternate 1: _____

DEDUCT ALTERNATE No. 2: Seed Mix

Deduct: _____
($)

No. of Days to Complete Alternate 2: _____

DEDUCT ALTERNATE No. 3: Railing Material

Deduct: _____
($)

No. of Days to Complete Alternate 3: _____

DEDUCT ALTERNATE No.4: Railing Material

Deduct: _____
($)

No. of Days to Complete Alternate 4: _____

DEDUCT ALTERNATE No. 5: Green Roof

Deduct: _____

($)

No. of Days to Complete Alternate 5: _____

DEDUCT ALTERNATE No. 6: Stone Veneer

Deduct: _____

($)

No. of Days to Complete Alternate 6: _____

DEDUCT ALTERNATE No. 7: Folding Glass Storefront

Deduct: _____

($)

No. of Days to Complete Alternate 7: _____

WHITE CLAY CREEK STATE PARK NATURE CENTER
WHITE CLAY CREEK STATE PARK
1475 CREEK ROAD, NEWARK, DE 19711
DIVISION OF PARKS AND RECREATION CONTRACT No. NAT25805-NATCTR

BID FORM

UNIT PRICES

Unit prices conform to applicable project specification section. Refer to the specifications for a complete description of the following Unit Prices:

		DEDUCT	ADD
UNIT PRICE No. 1:	Additional Excavation	$ _____	$ _____
UNIT PRICE No. 2	Additional Tree & Brush Removal	$ _____	$ _____
UNIT PRICE No. 3	Additional Installation of Asphalt Paving	$ _____	$ _____
UNIT PRICE No. 4	Additional Installation of Concrete Paving	$ _____	$ _____
UNIT PRICE No. 5	Removal of Unsatisfactory Soils	$ _____	$ _____
UNIT PRICE No. 6	Excavation of Rock/Boulders	$ _____	$ _____

WHITE CLAY CREEK STATE PARK NATURE CENTER
WHITE CLAY CREEK STATE PARK
1475 CREEK ROAD, NEWARK, DE 19711
DIVISION OF PARKS AND RECREATION CONTRACT No. NAT25805-NATCTR

BID FORM

I/We acknowledge Addendums numbered _____ and the price(s) submitted include any cost/schedule impact they may have.

This bid shall remain valid and cannot be withdrawn for thirty (30) days from the date of opening of bids (60 days for School Districts and Department of Education), and the undersigned shall abide by the Bid Security forfeiture provisions. Bid Security is attached to this Bid.

The Owner shall have the right to reject any or all bids, and to waive any informality or irregularity in any bid received.

This bid is based upon work being accomplished by the Sub-Contractors named on the list attached to this bid.

Should I/We be awarded this contract, I/We pledge to achieve substantial completion of all the work within _____ calendar days of the Notice to Proceed.

The undersigned represents and warrants that he has complied and shall comply with all requirements of local, state, and national laws; that no legal requirement has been or shall be violated in making or accepting this bid, in awarding the contract to him or in the prosecution of the work required; that the bid is legal and firm; that he has not, directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken action in restraint of free competitive bidding.

Upon receipt of written notice of the acceptance of this Bid, the Bidder shall, within twenty (20) calendar days, execute the agreement in the required form and deliver the Contract Bonds, and Insurance Certificates, required by the Contract Documents.

I am / We are an Individual / a Partnership / a Corporation

By _____ Trading as _____
(Individual's / General Partner's / Corporate Name)

_____
(State of Corporation)

Business Address: _____
_____
_____

WHITE CLAY CREEK STATE PARK NATURE CENTER
WHITE CLAY CREEK STATE PARK
1475 CREEK ROAD, NEWARK, DE 19711
DIVISION OF PARKS AND RECREATION CONTRACT No. NAT25805-NATCTR

BID FORM

Witness: _____ **By:** _____
(Authorized Signature)

(SEAL)

_____
(Title)

Date: _____

ATTACHMENTS

Sub-Contractor List
Non-Collusion Statement
Affidavit of Employee Drug Testing Program
Affidavit of Contractor Qualifications
Bid Security
(Others as Required by Project Manuals)

WHITE CLAY CREEK STATE PARK NATURE CENTER
WHITE CLAY CREEK STATE PARK
1475 CREEK ROAD, NEWARK, DE 19711
DIVISION OF PARKS AND RECREATION CONTRACT No. NAT25805-NATCTR

BID FORM

SUBCONTRACTOR LIST

In accordance with Title 29, Chapter 69, Section 6962(d)(10)b of the Delaware Code, the following subcontractor listing must accompany any bid submittal. The bidder must list **in each category** the full name and address (City & State) of the sub-contractor that the bidder will be using to perform the work and provide material for that subcontractor category. Should the bidder's listed subcontractor intend to provide any of their subcontractor category of work through a third-tier contractor, the bidder shall list that third-tier contractor's full name and address (City & State). **If the bidder intends to perform any category of work itself, it must list its full name and address.** For clarification, if the bidder intends to perform the work themselves, the bidder **may not** insert "not applicable", "N/A", "self" or anything other than its own full name and address (City & State). To do so shall cause the bid to be rejected. In addition, the failure to produce a completed subcontractor list with the bid submittal shall cause the bid to be rejected. If you have more than three (3) third-tier contractors to report in any subcontractor category, print out additional page(s) containing the appropriate category, complete the rest of your list of third-tier contractors for that category, notate the addition in parentheses as (CONTINUATION) next to the subcontractor category and an asterisk (*) next to any additional third-tier contractors, and submit it with your bid.

	Subcontractor Category	Subcontractor	Address (City & State)	Subcontractors tax payer ID # or Delaware Business license #
1.	Sitework-A			
	Sitework-B			
	Sitework-C			
2.	Paving -A			
	Paving -B			
	Paving -C			
3.	Hardscape-A			
	Hardscape-B			
	Hardscape-C			
4.	Landscape-A			
	Landscape-B			

	Landscape-C			
5.	Masonry-A			
	Masonry-B			
	Masonry-C			
6.	Doors, Frames & Hardware-A			
	Doors, Frames & Hardware-B			
	Doors, Frames & Hardware-C			
7.	Painting-A			
	Painting-B			
	Painting-C			
8.	Concrete-A			
	Concrete-B			
	Concrete-C			
9.	Roofing-A			
	Roofing-B			
	Roofing-C			
10.	Mechanical-A			
	Mechanical-B			
	Mechanical-C			
11.	Plumbing-A			
	Plumbing-B			
	Plumbing-C			
12.	Electric-A			
	Electric-B			
	Electric-C			

13.	Site Utilities-A			
	Site Utilities-B			
	Site Utilities-C			
14.	Electric-A			
	Electric-B			
	Electric-C			
15.	Structural Steel-A			
	Structural Steel -B			
	Structural Steel -C			
16.	Cold Formed Metal Framing-A			
	Cold Formed Metal Framing-B			
	Cold Formed Metal Framing-C			
17.	Gypsum Wall Board Assemblies-A			
	Gypsum Wall Board Assemblies-B			
	Gypsum Wall Board Assemblies -C			
18.	Insulation-A			
	Insulation-B			
	Insulation-C			
19.	Storefront-A			
	Storefront-B			
	Storefront-C			

20.	Ceilings-A			
	Ceilings-B			
	Ceilings-C			
21.	Epoxy Flooring-A			
	Epoxy Flooring-B			
	Epoxy Flooring-C			
22.	HVAC Controls-A			
	HVAC Controls-B			
	HVAC Controls-C			

WHITE CLAY CREEK STATE PARK NATURE CENTER
WHITE CLAY CREEK STATE PARK
1475 CREEK ROAD, NEWARK, DE 19711
DIVISION OF PARKS AND RECREATION CONTRACT No. NAT25805-NATCTR

BID FORM
NON-COLLUSION STATEMENT

This is to certify that the undersigned bidder has neither directly nor indirectly, entered into any agreement, participated in any collusion or otherwise taken any action in restraint of free competitive bidding in connection with this proposal submitted this date to the Division of Natural Resources and Environmental Control.

All the terms and conditions of CONTRACT No. NAT25805-NATCTR have been thoroughly examined and are understood.

NAME OF BIDDER: _____

AUTHORIZED REPRESENTATIVE (TYPED): _____

AUTHORIZED REPRESENTATIVE (SIGNATURE): _____

TITLE: _____

ADDRESS OF BIDDER: _____

_____

_____

E-MAIL: _____

PHONE NUMBER: _____

Sworn to and Subscribed before me this _____ day of _____ 20____.

My Commission expires _____. NOTARY PUBLIC _____.

THIS PAGE MUST BE SIGNED AND NOTARIZED FOR YOUR BID TO BE CONSIDERED.

WHITE CLAY CREEK STATE PARK NATURE CENTER
WHITE CLAY CREEK STATE PARK
1475 CREEK ROAD, NEWARK, DE 19711
DIVISION OF PARKS AND RECREATION CONTRACT No. NAT25805-NATCTR

AFFIDAVIT
OF
EMPLOYEE DRUG TESTING PROGRAM

4104 Regulations for the Drug Testing of Contractor and Subcontractor Employees Working on Large Public Works Projects requires that Contractors and Subcontractors implement a program of mandatory drug testing for Employees who work on Large Public Works Contracts funded all or in part with public funds.

We hereby certify that we have in place or will implement during the entire term of the contract a Mandatory Drug Testing Program for our employees on the jobsite, including subcontractors, that complies with this regulation:

Contractor/Subcontractor Name: _____

Contractor/Subcontractor Address: _____

_____

_____

Authorized Representative (typed or printed): _____

Authorized Representative (signature): _____

Title: _____

Sworn to and Subscribed before me this _____day of _____ 20____.

My Commission expires _____. NOTARY PUBLIC _____.

THIS PAGE MUST BE SIGNED AND NOTARIZED FOR YOUR BID TO BE CONSIDERED.

WHITE CLAY CREEK STATE PARK NATURE CENTER
WHITE CLAY CREEK STATE PARK
1475 CREEK ROAD, NEWARK, DE 19711
DIVISION OF PARKS AND RECREATION CONTRACT No. NAT25805-NATCTR

AFFIDAVIT
OF
CONTRACTOR QUALIFICATIONS

We hereby certify that we will abide by the contractor's qualifications outlined in the construction bid specifications for the duration of the contract term.

In accordance with Title 29, Chapter 69, Section 6962(d)(10)b.3 of the Delaware Code, after a contract has been awarded the successful bidder shall not substitute another subcontractor whose name was submitted on the Subcontractor Form except for the reasons in the statute and not without written consent from the awarding agency. Failure to utilize the subcontractors on the list will subject the successful bidder to penalties as outlined in the General Requirements Section 5.2 of the contract.

Contractor Name: _____

Contractor Address: _____

_____

_____

Authorized Representative (typed or printed): _____

Authorized Representative (signature): _____

Title: _____

Sworn to and Subscribed before me this _____day of _____ 20____.

My Commission expires _____. NOTARY PUBLIC _____.

THIS PAGE MUST BE SIGNED AND NOTARIZED FOR YOUR BID TO BE CONSIDERED.

(This Page Intentionally Left Blank)

STATE OF DELAWARE
OFFICE OF MANAGEMENT AND BUDGET

BID BOND

TO ACCOMPANY PROPOSAL
(Not necessary if security is used)

KNOW ALL MEN BY THESE PRESENTS That: _____ _____of _____ in the County of _____ _____and State of _____as **Principal**, and _____ _____ of _____ in the County of _____ and State of _____ as **Surety**, legally authorized to do business in the State of Delaware ("**State**"), are held and firmly unto the **State** in the sum of _____ _____ Dollars ($_____), or _____ percent not to exceed _____ _____ Dollars ($_____) of amount of bid on Contract No. NAT25805-NATCTR, to be paid to the **State** for the use and benefit of **Department of Natural Resources and Environmental Control** for which payment well and truly to be made, we do bind ourselves, our and each of our heirs, executors, administrators, and successors, jointly and severally for and in the whole firmly by these presents.

NOW THE CONDITION OF THIS OBLIGATION IS SUCH That if the above bonded **Principal** who has submitted to the **Department of Natural Resources and Environmental Control** a certain proposal to enter into this contract for the furnishing of certain material and/or services within the **State**, shall be awarded this Contract, and if said **Principal** shall well and truly enter into and execute this Contract as may be required by the terms of this Contract and approved by the **Department of Natural Resources and Environmental Control** this Contract to be entered into within twenty days after the date of official notice of the award thereof in accordance with the terms of said proposal, then this obligation shall be void or else to be and remain in full force and virtue.

Sealed with _____ seal and dated this _____day of _____ in the year of our Lord two thousand and _____ (20___).

SEALED, AND DELIVERED IN THE
Presence of _____
Name of Bidder (Organization)

Corporate Seal By: _____
Authorized Signature

Attest _____ _____
Title

_____
Name of Surety

Witness:_____ By: _____

_____
Title

(This page intentionally left blank)

SECTION 00 52 13

STANDARD FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR AIA 101-2017

The contract to be utilized on this project shall be the "Standard Form of Agreement Between Owner and Contractor" AIA Document A101-2017, including AIA Document A101 – 2017 Exhibit A, as well as Supplements to A101-2017 and Exhibit A and the State of Delaware's General Requirements.

(THIS PAGE INTENTIONALLY LEFT BLANK)

AIA® Document A101™ – 2017

Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum

AGREEMENT made as of the day of in the year
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

and the Contractor:
(Name, legal status, address and other information)

for the following Project:
(Name, location and detailed description)

The Architect:
(Name, legal status, address and other information)

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

The parties should complete A101™–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201™–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

Init.
/

AIA Document A101™ – 2017. Copyright © 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1967, 1974, 1977, 1987, 1991, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 13:21:35 ET on 08/16/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA4C)

TABLE OF ARTICLES

1 THE CONTRACT DOCUMENTS

2 THE WORK OF THIS CONTRACT

3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

4 CONTRACT SUM

5 PAYMENTS

6 DISPUTE RESOLUTION

7 TERMINATION OR SUSPENSION

8 MISCELLANEOUS PROVISIONS

9 ENUMERATION OF CONTRACT DOCUMENTS

EXHIBIT A INSURANCE AND BONDS

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:
(Check one of the following boxes.)

[ ] The date of this Agreement.

[ ] A date set forth in a notice to proceed issued by the Owner.

[ ] Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:

AIA Document A101™ – 2017. Copyright © 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1967, 1974, 1977, 1987, 1991, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 13:21:35 ET on 08/16/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA4C)

(Check one of the following boxes and complete the necessary information.)

[ ] Not later than ( ) calendar days from the date of commencement of the Work.

[ ] By the following date:

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be ($), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item	Price

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance

§ 4.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item	Price

§ 4.4 Unit prices, if any:
(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit ($0.00)

§ 4.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any.)

§ 4.6 Other:
(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)

AIA Document A101™ – 2017. Copyright © 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1967, 1974, 1977, 1987, 1991, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 13:21:35 ET on 08/16/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes:
(3B9ADA4C)

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the day of the month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than ( ) days after the Architect receives the Application for Payment.
(Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

.1 That portion of the Contract Sum properly allocable to completed Work;

.2 That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and

.3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

.1 The aggregate of any amounts previously paid by the Owner;

.2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;

.3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;

.4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and

.5 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:
(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

AIA Document A101™ – 2017. Copyright © 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1967, 1974, 1977, 1987, 1991, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 13:21:35 ET on 08/16/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA4C)

§ 5.1.7.1.1 The following items are not subject to retainage:
(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:
(Insert any other conditions for release of retainage upon Substantial Completion.)

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and

.2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

§ 5.3 Interest

Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
(Insert rate of interest agreed upon, if any.)

%

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.
(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

AIA Document A101™ – 2017. Copyright © 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1967, 1974, 1977, 1987, 1991, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 13:21:35 ET on 08/16/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA4C)

§ 6.2 Binding Dispute Resolution
For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

[ ] Arbitration pursuant to Section 15.4 of AIA Document A201–2017

[ ] Litigation in a court of competent jurisdiction

[ ] Other *(Specify)*

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

ARTICLE 7 TERMINATION OR SUSPENSION
§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

§ 7.1.1 If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:
(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

ARTICLE 8 MISCELLANEOUS PROVISIONS
§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:
(Name, address, email address, and other information)

§ 8.3 The Contractor's representative:
(Name, address, email address, and other information)

AIA Document A101™ – 2017. Copyright © 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1967, 1974, 1977, 1987, 1991, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 13:21:35 ET on 08/16/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA4C)

§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™–2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:
(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

§ 8.7 Other provisions:

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor

.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds

.3 AIA Document A201™–2017, General Conditions of the Contract for Construction

.4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013 incorporated into this Agreement.)

.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

.8 Other Exhibits:
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

AIA Document A101™ – 2017. Copyright © 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1967, 1974, 1977, 1987, 1991, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 13:21:35 ET on 08/16/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA4C)

[ ] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017 incorporated into this Agreement.)

[ ] The Sustainability Plan:

Title	Date	Pages

[ ] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

This Agreement entered into as of the day and year first written above.

OWNER *(Signature)*	**CONTRACTOR** *(Signature)*
(Printed name and title)	*(Printed name and title)*

Init.
/

AIA Document A101™ – 2017. Copyright © 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1967, 1974, 1977, 1987, 1991, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 13:21:35 ET on 08/16/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes:
(3B9ADA4C)

AIA® Document A101™ – 2017 Exhibit A

Insurance and Bonds

This Insurance and Bonds Exhibit is part of the Agreement, between the Owner and the Contractor, dated the day of in the year
(In words, indicate day, month and year.)

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

THE OWNER:
(Name, legal status and address)

THE CONTRACTOR:
(Name, legal status and address)

TABLE OF ARTICLES

A.1 GENERAL

A.2 OWNER'S INSURANCE

A.3 CONTRACTOR'S INSURANCE AND BONDS

A.4 SPECIAL TERMS AND CONDITIONS

ARTICLE A.1 GENERAL

The Owner and Contractor shall purchase and maintain insurance, and provide bonds, as set forth in this Exhibit. As used in this Exhibit, the term General Conditions refers to AIA Document A201™–2017, General Conditions of the Contract for Construction.

ARTICLE A.2 OWNER'S INSURANCE

§ A.2.1 General

Prior to commencement of the Work, the Owner shall secure the insurance, and provide evidence of the coverage, required under this Article A.2 and, upon the Contractor's request, provide a copy of the property insurance policy or policies required by Section A.2.3. The copy of the policy or policies provided shall contain all applicable conditions, definitions, exclusions, and endorsements.

§ A.2.2 Liability Insurance

The Owner shall be responsible for purchasing and maintaining the Owner's usual general liability insurance.

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

This document is intended to be used in conjunction with AIA Document A201™–2017, General Conditions of the Contract for Construction. Article 11 of A201™–2017 contains additional insurance provisions.

Init.
/

AIA Document A101™ – 2017 Exhibit A. Copyright © 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:54:07 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA55)

§ A.2.3 Required Property Insurance

§ A.2.3.1 Unless this obligation is placed on the Contractor pursuant to Section A.3.3.2.1, the Owner shall purchase and maintain, from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located, property insurance written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis. The Owner's property insurance coverage shall be no less than the amount of the initial Contract Sum, plus the value of subsequent Modifications and labor performed and materials or equipment supplied by others. The property insurance shall be maintained until Substantial Completion and thereafter as provided in Section A.2.3.1.3, unless otherwise provided in the Contract Documents or otherwise agreed in writing by the parties to this Agreement. This insurance shall include the interests of the Owner, Contractor, Subcontractors, and Sub-subcontractors in the Project as insureds. This insurance shall include the interests of mortgagees as loss payees.

§ A.2.3.1.1 Causes of Loss. The insurance required by this Section A.2.3.1 shall provide coverage for direct physical loss or damage, and shall not exclude the risks of fire, explosion, theft, vandalism, malicious mischief, collapse, earthquake, flood, or windstorm. The insurance shall also provide coverage for ensuing loss or resulting damage from error, omission, or deficiency in construction methods, design, specifications, workmanship, or materials. Sub-limits, if any, are as follows:
(Indicate below the cause of loss and any applicable sub-limit.)

Causes of Loss	Sub-Limit

§ A.2.3.1.2 Specific Required Coverages. The insurance required by this Section A.2.3.1 shall provide coverage for loss or damage to falsework and other temporary structures, and to building systems from testing and startup. The insurance shall also cover debris removal, including demolition occasioned by enforcement of any applicable legal requirements, and reasonable compensation for the Architect's and Contractor's services and expenses required as a result of such insured loss, including claim preparation expenses. Sub-limits, if any, are as follows:
(Indicate below type of coverage and any applicable sub-limit for specific required coverages.)

Coverage	Sub-Limit

§ A.2.3.1.3 Unless the parties agree otherwise, upon Substantial Completion, the Owner shall continue the insurance required by Section A.2.3.1 or, if necessary, replace the insurance policy required under Section A.2.3.1 with property insurance written for the total value of the Project that shall remain in effect until expiration of the period for correction of the Work set forth in Section 12.2.2 of the General Conditions.

§ A.2.3.1.4 Deductibles and Self-Insured Retentions. If the insurance required by this Section A.2.3 is subject to deductibles or self-insured retentions, the Owner shall be responsible for all loss not covered because of such deductibles or retentions.

§ A.2.3.2 Occupancy or Use Prior to Substantial Completion. The Owner's occupancy or use of any completed or partially completed portion of the Work prior to Substantial Completion shall not commence until the insurance company or companies providing the insurance under Section A.2.3.1 have consented in writing to the continuance of coverage. The Owner and the Contractor shall take no action with respect to partial occupancy or use that would cause cancellation, lapse, or reduction of insurance, unless they agree otherwise in writing.

§ A.2.3.3 Insurance for Existing Structures

If the Work involves remodeling an existing structure or constructing an addition to an existing structure, the Owner shall purchase and maintain, until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, "all-risks" property insurance, on a replacement cost basis, protecting the existing structure against direct physical loss or damage from the causes of loss identified in Section A.2.3.1, notwithstanding the undertaking of the Work. The Owner shall be responsible for all co-insurance penalties.

§ A.2.4 Optional Extended Property Insurance.

The Owner shall purchase and maintain the insurance selected and described below.
(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to

AIA Document A101™ – 2017 Exhibit A. Copyright © 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:54:07 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA55)

the description(s) of selected insurance. For each type of insurance selected, indicate applicable limits of coverage or other conditions in the fill point below the selected item.)

[ ] **§ A.2.4.1 Loss of Use, Business Interruption, and Delay in Completion Insurance**, to reimburse the Owner for loss of use of the Owner's property, or the inability to conduct normal operations due to a covered cause of loss.

[ ] **§ A.2.4.2 Ordinance or Law Insurance**, for the reasonable and necessary costs to satisfy the minimum requirements of the enforcement of any law or ordinance regulating the demolition, construction, repair, replacement or use of the Project.

[ ] **§ A.2.4.3 Expediting Cost Insurance**, for the reasonable and necessary costs for the temporary repair of damage to insured property, and to expedite the permanent repair or replacement of the damaged property.

[ ] **§ A.2.4.4 Extra Expense Insurance**, to provide reimbursement of the reasonable and necessary excess costs incurred during the period of restoration or repair of the damaged property that are over and above the total costs that would normally have been incurred during the same period of time had no loss or damage occurred.

[ ] **§ A.2.4.5 Civil Authority Insurance**, for losses or costs arising from an order of a civil authority prohibiting access to the Project, provided such order is the direct result of physical damage covered under the required property insurance.

[ ] **§ A.2.4.6 Ingress/Egress Insurance**, for loss due to the necessary interruption of the insured's business due to physical prevention of ingress to, or egress from, the Project as a direct result of physical damage.

[ ] **§ A.2.4.7 Soft Costs Insurance**, to reimburse the Owner for costs due to the delay of completion of the Work, arising out of physical loss or damage covered by the required property insurance: including construction loan fees; leasing and marketing expenses; additional fees, including those of architects, engineers, consultants, attorneys and accountants, needed for the completion of the construction, repairs, or reconstruction; and carrying costs such as property taxes, building permits, additional interest on loans, realty taxes, and insurance premiums over and above normal expenses.

§ A.2.5 Other Optional Insurance.

The Owner shall purchase and maintain the insurance selected below.

(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance.)

[ ] **§ A.2.5.1 Cyber Security Insurance** for loss to the Owner due to data security and privacy breach, including costs of investigating a potential or actual breach of confidential or private information. *(Indicate applicable limits of coverage or other conditions in the fill point below.)*

AIA Document A101™ – 2017 Exhibit A. Copyright © 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:54:07 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA55)

[ ] **§ A.2.5.2 Other Insurance**

(List below any other insurance coverage to be provided by the Owner and any applicable limits.)

Coverage	Limits

ARTICLE A.3 CONTRACTOR'S INSURANCE AND BONDS

§ A.3.1 General

§ A.3.1.1 Certificates of Insurance. The Contractor shall provide certificates of insurance acceptable to the Owner evidencing compliance with the requirements in this Article A.3 at the following times: (1) prior to commencement of the Work; (2) upon renewal or replacement of each required policy of insurance; and (3) upon the Owner's written request. An additional certificate evidencing continuation of commercial liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment and thereafter upon renewal or replacement of such coverage until the expiration of the periods required by Section A.3.2.1 and Section A.3.3.1. The certificates will show the Owner as an additional insured on the Contractor's Commercial General Liability and excess or umbrella liability policy or policies.

§ A.3.1.2 Deductibles and Self-Insured Retentions. The Contractor shall disclose to the Owner any deductible or self-insured retentions applicable to any insurance required to be provided by the Contractor.

§ A.3.1.3 Additional Insured Obligations. To the fullest extent permitted by law, the Contractor shall cause the commercial general liability coverage to include (1) the Owner, the Architect, and the Architect's consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions for which loss occurs during completed operations. The additional insured coverage shall be primary and non-contributory to any of the Owner's general liability insurance policies and shall apply to both ongoing and completed operations. To the extent commercially available, the additional insured coverage shall be no less than that provided by Insurance Services Office, Inc. (ISO) forms CG 20 10 07 04, CG 20 37 07 04, and, with respect to the Architect and the Architect's consultants, CG 20 32 07 04.

§ A.3.2 Contractor's Required Insurance Coverage

§ A.3.2.1 The Contractor shall purchase and maintain the following types and limits of insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:
(If the Contractor is required to maintain insurance for a duration other than the expiration of the period for correction of Work, state the duration.)

§ A.3.2.2 Commercial General Liability

§ A.3.2.2.1 Commercial General Liability insurance for the Project written on an occurrence form with policy limits of not less than ($) each occurrence, ($) general aggregate, and ($) aggregate for products-completed operations hazard, providing coverage for claims including

.1 damages because of bodily injury, sickness or disease, including occupational sickness or disease, and death of any person;
.2 personal injury and advertising injury;
.3 damages because of physical damage to or destruction of tangible property, including the loss of use of such property;
.4 bodily injury or property damage arising out of completed operations; and
.5 the Contractor's indemnity obligations under Section 3.18 of the General Conditions.

§ A.3.2.2.2 The Contractor's Commercial General Liability policy under this Section A.3.2.2 shall not contain an exclusion or restriction of coverage for the following:

AIA Document A101™ – 2017 Exhibit A. Copyright © 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:54:07 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA55)

.1 Claims by one insured against another insured, if the exclusion or restriction is based solely on the fact that the claimant is an insured, and there would otherwise be coverage for the claim.

.2 Claims for property damage to the Contractor's Work arising out of the products-completed operations hazard where the damaged Work or the Work out of which the damage arises was performed by a Subcontractor.

.3 Claims for bodily injury other than to employees of the insured.

.4 Claims for indemnity under Section 3.18 of the General Conditions arising out of injury to employees of the insured.

.5 Claims or loss excluded under a prior work endorsement or other similar exclusionary language.

.6 Claims or loss due to physical damage under a prior injury endorsement or similar exclusionary language.

.7 Claims related to residential, multi-family, or other habitational projects, if the Work is to be performed on such a project.

.8 Claims related to roofing, if the Work involves roofing.

.9 Claims related to exterior insulation finish systems (EIFS), synthetic stucco or similar exterior coatings or surfaces, if the Work involves such coatings or surfaces.

.10 Claims related to earth subsidence or movement, where the Work involves such hazards.

.11 Claims related to explosion, collapse and underground hazards, where the Work involves such hazards.

§ A.3.2.3 Automobile Liability covering vehicles owned, and non-owned vehicles used, by the Contractor, with policy limits of not less than ($) per accident, for bodily injury, death of any person, and property damage arising out of the ownership, maintenance and use of those motor vehicles along with any other statutorily required automobile coverage.

§ A.3.2.4 The Contractor may achieve the required limits and coverage for Commercial General Liability and Automobile Liability through a combination of primary and excess or umbrella liability insurance, provided such primary and excess or umbrella insurance policies result in the same or greater coverage as the coverages required under Section A.3.2.2 and A.3.2.3, and in no event shall any excess or umbrella liability insurance provide narrower coverage than the primary policy. The excess policy shall not require the exhaustion of the underlying limits only through the actual payment by the underlying insurers.

§ A.3.2.5 Workers' Compensation at statutory limits.

§ A.3.2.6 Employers' Liability with policy limits not less than ($) each accident, ($) each employee, and ($) policy limit.

§ A.3.2.7 Jones Act, and the Longshore & Harbor Workers' Compensation Act, as required, if the Work involves hazards arising from work on or near navigable waterways, including vessels and docks

§ A.3.2.8 If the Contractor is required to furnish professional services as part of the Work, the Contractor shall procure Professional Liability insurance covering performance of the professional services, with policy limits of not less than ($) per claim and ($) in the aggregate.

§ A.3.2.9 If the Work involves the transport, dissemination, use, or release of pollutants, the Contractor shall procure Pollution Liability insurance, with policy limits of not less than ($) per claim and ($) in the aggregate.

§ A.3.2.10 Coverage under Sections A.3.2.8 and A.3.2.9 may be procured through a Combined Professional Liability and Pollution Liability insurance policy, with combined policy limits of not less than ($) per claim and ($) in the aggregate.

§ A.3.2.11 Insurance for maritime liability risks associated with the operation of a vessel, if the Work requires such activities, with policy limits of not less than ($) per claim and ($) in the aggregate.

§ A.3.2.12 Insurance for the use or operation of manned or unmanned aircraft, if the Work requires such activities, with policy limits of not less than ($) per claim and ($) in the aggregate.

AIA Document A101™ – 2017 Exhibit A. Copyright © 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:54:07 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA55)

§ A.3.3 Contractor's Other Insurance Coverage

§ A.3.3.1 Insurance selected and described in this Section A.3.3 shall be purchased from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:
(If the Contractor is required to maintain any of the types of insurance selected below for a duration other than the expiration of the period for correction of Work, state the duration.)

§ A.3.3.2 The Contractor shall purchase and maintain the following types and limits of insurance in accordance with Section A.3.3.1.
(Select the types of insurance the Contractor is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. Where policy limits are provided, include the policy limit in the appropriate fill point.)

[ ] **§ A.3.3.2.1** Property insurance of the same type and scope satisfying the requirements identified in Section A.2.3, which, if selected in this section A.3.3.2.1, relieves the Owner of the responsibility to purchase and maintain such insurance except insurance required by Section A.2.3.1.3 and Section A.2.3.3. The Contractor shall comply with all obligations of the Owner under Section A.2.3 except to the extent provided below. The Contractor shall disclose to the Owner the amount of any deductible, and the Owner shall be responsible for losses within the deductible. Upon request, the Contractor shall provide the Owner with a copy of the property insurance policy or policies required. The Owner shall adjust and settle the loss with the insurer and be the trustee of the proceeds of the property insurance in accordance with Article 11 of the General Conditions unless otherwise set forth below:
(Where the Contractor's obligation to provide property insurance differs from the Owner's obligations as described under Section A.2.3, indicate such differences in the space below. Additionally, if a party other than the Owner will be responsible for adjusting and settling a loss with the insurer and acting as the trustee of the proceeds of property insurance in accordance with Article 11 of the General Conditions, indicate the responsible party below.)

[ ] **§ A.3.3.2.2 Railroad Protective Liability Insurance**, with policy limits of not less than ($) per claim and ($) in the aggregate, for Work within fifty (50) feet of railroad property.

[ ] **§ A.3.3.2.3 Asbestos Abatement Liability Insurance**, with policy limits of not less than ($) per claim and ($) in the aggregate, for liability arising from the encapsulation, removal, handling, storage, transportation, and disposal of asbestos-containing materials.

[ ] **§ A.3.3.2.4** Insurance for physical damage to property while it is in storage and in transit to the construction site on an "all-risks" completed value form.

[ ] **§ A.3.3.2.5** Property insurance on an "all-risks" completed value form, covering property owned by the Contractor and used on the Project, including scaffolding and other equipment.

[ ] **§ A.3.3.2.6 Other Insurance**
(List below any other insurance coverage to be provided by the Contractor and any applicable limits.)

Coverage	**Limits**

§ A.3.4 Performance Bond and Payment Bond

The Contractor shall provide surety bonds, from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located, as follows:
(Specify type and penal sum of bonds.)

AIA Document A101™ – 2017 Exhibit A. Copyright © 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:54:07 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA55)

Type	Penal Sum ($0.00)
Payment Bond	
Performance Bond	

Payment and Performance Bonds shall be AIA Document A312™, Payment Bond and Performance Bond, or contain provisions identical to AIA Document A312™, current as of the date of this Agreement.

ARTICLE A.4 SPECIAL TERMS AND CONDITIONS

Special terms and conditions that modify this Insurance and Bonds Exhibit, if any, are as follows:

AIA Document A101™ – 2017 Exhibit A. Copyright © 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:54:07 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA55)

SECTION 00 54 13

AIA 201-2017 SUPPLEMENT TO AGREEMENT BETWEEN OWNER AND CONTRACTOR A101-2017

(THIS PAGE INTENTIONALLY LEFT BLANK)

SECTION 00 52 13

SUPPLEMENT TO AGREEMENT BETWEEN OWNER AND CONTRACTOR A101-2017

The following supplements modify the "Standard Form of Agreement Between Owner and Contractor," AIA Document A101-2017. Where a portion of the Standard Form of Agreement is modified or deleted by the following, the unaltered portions of the Standard Form of Agreement shall remain in effect.

ARTICLE 3: DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

3.1 Delete paragraph 3.1 in its entirety and replace with the following:

"The date of Commencement of the Work shall be a date set forth in a notice to proceed issued by the Owner."

ARTICLE 5: PAYMENTS

5.1 PROGRESS PAYMENTS

5.1.3 Delete paragraph 5.1.3 in its entirety and replace with the following:

"Provided that a valid Application for Payment is received by the Architect that meets all requirements of the Contract, payment shall be made by the Owner not later than 30 days after the Owner receives the valid Application for Payment."

5.3 Insert the interest rate of "1% per month not to exceed 12% per annum."

ARTICLE 6: DISPUTE RESOLUTION

6.2 BINDING DISPUTE RESOLUTION

Check Other – and add the following sentence:

"Any remedies available in law or in equity."

ARTICLE 7: TERMINATION or SUSPENSION

7.1.1 Delete paragraph 7.1.1 in its entirety.

ARTICLE 8: MISCELLANEOUS PROVISIONS

8.4 Delete paragraph 8.4 in its entirety and replace with the following:

"The Contractor's representative shall not be changed without ten days written notice to the Owner."

END OF SUPPLEMENT TO AGREEMENT BETWEEN OWNER AND CONTRACTOR

(This Page Intentionally Left Blank)

SECTION 00 52 14
SUPPLEMENT TO A101-2017 – EXHIBIT 'A' INSURANCE AND BONDS

The following supplements modify the "Standard Form of Agreement Between Owner and Contractor," AIA Document A101-2017 Exhibit A Insurance and Bonds. Where a portion of the Standard Form of Agreement is modified or deleted by the following, the unaltered portions of the Standard Form of Agreement shall remain in effect.

ARTICLE A.2 OWNER'S INSURANCE

A.2.1 General

Delete paragraph A.2.1 in its entirety.

A.2.2 Liability Insurance

Delete paragraph A.2.2 in its entirety, except in the case of school projects this paragraph shall remain.

A.2.3 Required Property Insurance

Delete paragraph A.2.3 in its entirety.

A.2.4 Optional Extended Property Insurance

Delete paragraph A.2.4 in its entirety.

A.2.5 Other Optional Insurance

Delete paragraph A.2.5 in its entirety.

ARTICLE A.3 CONTRACTORS INSURANCE AND BONDS

A.3.1.1 Strike the last sentence of the paragraph.

A.3.1.3 Additional Insured Obligations

In the first sentence after "coverage to include (1)" delete "(1) the Owner,".

Strike the remainder of the first sentence beginning at the semicolon "; and (2) the Owner" through the end of the sentence.

Delete the second sentence in its entirety.

A.3.2.2.1 Insert "$1,000,000.00" in the blank for each occurrence.
Insert "$3,000,000.00" in the blank for general aggregate.
Insert "$3,000,000.00" in the blank for aggregate for products-completed operations hazard.

A.3.2.3 Insert "$1,000,000.00" in the blank for per accident.

A.3.2.6 Insert "$500,000.00" in the blank for each accident.
Insert "$500,000.00" in the blank for each employee.
Insert "$500,000.00" in the blank for policy limit.

A.3.2.8 Insert "$1,000,000.00" in the blank for per claim.
Insert "$3,000,000.00" in the blank for in the aggregate.

A.3.2.9 Insert "$1,000,000.00" in the blank for per claim.
Insert "$3,000,000.00" in the blank for in the aggregate.

A.3.2.10 Insert "$2,000,000.00" in the blank for per claim.
Insert "$4,000,000.00" in the blank for in the aggregate.

A.3.2.11 Strike in its entirety.

A.3.2.12 Strike in its entirety.

A.3.3.2.1 Delete paragraph 3.3.2.1 in its entirety

A.3.3.2.2 Strike in its entirety.

A.3.3.2.3 Insert "$1,000,000.00" in the blanks for per claim.
Insert "$3,000,000.00" in the blanks for in the aggregate.

A.3.4 Insert the actual contract price in both the Payment Bond and the Performance Bond Penal Sum blanks. It must be 100% of the contract price.

Strike the last sentence in this section and replace with "Payment and Performance Bonds shall be in the standard form issued by the Delaware Office of Management and Budget."

END OF SECTION

STATE OF DELAWARE
OFFICE OF MANAGEMENT AND BUDGET

PERFORMANCE BOND

Bond Number: _____

KNOW ALL PERSONS BY THESE PRESENTS, that we, _____, as principal ("**Principal**"), and _____, a _____ corporation, legally authorized to do business in the State of Delaware, as surety ("**Surety**"), are held and firmly bound unto the **Department of Natural Resources and Environmental Control** ("**Owner**"), in the amount of _____ ($_____), to be paid to **Owner**, for which payment well and truly to be made, we do bind ourselves, our and each and every of our heirs, executors, administrations, successors and assigns, jointly and severally, for and in the whole, firmly by these presents.

Sealed with our seals and dated this _____ day of _____, 20__.

NOW THE CONDITION OF THIS OBLIGATION IS SUCH, that if **Principal**, who has been awarded by **Owner** that certain contract known as Contract No. NAT25805-NATCTR dated the _____ day of _____, 20__ (the "Contract"), which Contract is incorporated herein by reference, shall well and truly provide and furnish all materials, appliances and tools and perform all the work required under and pursuant to the terms and conditions of the Contract and the Contract Documents (as defined in the Contract) or any changes or modifications thereto made as therein provided, shall make good and reimburse **Owner** sufficient funds to pay the costs of completing the Contract that **Owner** may sustain by reason of any failure or default on the part of **Principal**, and shall also indemnify and save harmless **Owner** from all costs, damages and expenses arising out of or by reason of the performance of the Contract and for as long as provided by the Contract; then this obligation shall be void, otherwise to be and remain in full force and effect.

Surety, for value received, hereby stipulates and agrees, if requested to do so by **Owner**, to fully perform and complete the work to be performed under the Contract pursuant to the terms, conditions and covenants thereof, if for any cause **Principal** fails or neglects to so fully perform and complete such work.

Surety, for value received, for itself and its successors and assigns, hereby stipulates and agrees that the obligation of **Surety** and its bond shall be in no way impaired or affected by any extension of time, modification, omission, addition or change in or to the Contract or the work to be performed thereunder, or by any payment thereunder before the time required therein, or by any waiver of any provisions thereof, or by any assignment, subletting or other transfer thereof or of any work to be performed or any monies due or to become due thereunder; and **Surety** hereby waives notice of any and all such extensions, modifications, omissions, additions, changes, payments, waivers, assignments, subcontracts and transfers and hereby expressly stipulates and agrees that any and all things done and omitted to be done by and in relation to assignees, subcontractors, and other

transferees shall have the same effect as to **Surety** as though done or omitted to be done by or in relation to **Principal**.

Surety hereby stipulates and agrees that no modifications, omissions or additions in or to the terms of the Contract shall in any way whatsoever affect the obligation of **Surety** and its bond.

Any proceeding, legal or equitable, under this Bond may be brought in any court of competent jurisdiction in the State of Delaware. Notices to **Surety** or Contractor may be mailed or delivered to them at their respective addresses shown below.

IN WITNESS WHEREOF, **Principal** and **Surety** have hereunto set their hand and seals, and such of them as are corporations have caused their corporate seal to be hereto affixed and these presents to be signed by their duly authorized officers, the day and year first above written.

PRINCIPAL

Name: _____

Witness or Attest: Address: _____

_____ By: _____(SEAL)
Name: Name:
Title:

(Corporate Seal)

SURETY

Name: _____

Witness or Attest: Address: _____

_____ By: _____ (SEAL)
Name: Name:
Title:

(Corporate Seal)

STATE OF DELAWARE
OFFICE OF MANAGEMENT AND BUDGET

PAYMENT BOND

Bond Number: _____

KNOW ALL PERSONS BY THESE PRESENTS, that we, _____, as principal ("**Principal**"), and _____, a _____ corporation, legally authorized to do business in the State of Delaware, as surety ("**Surety**"), are held and firmly bound unto the **Department Natural Resources and of Environmental Control** ("**Owner**"), in the amount of _____ ($_____), to be paid to **Owner**, for which payment well and truly to be made, we do bind ourselves, our and each and every of our heirs, executors, administrations, successors and assigns, jointly and severally, for and in the whole firmly by these presents.

Sealed with our seals and dated this _____ day of_____, 20__.

NOW THE CONDITION OF THIS OBLIGATION IS SUCH, that if **Principal**, who has been awarded by **Owner** that certain contract known as Contract No. NAT25805-NATCTR dated the _____ day of _____, 20__ (the "Contract"), which Contract is incorporated herein by reference, shall well and truly pay all and every person furnishing materials or performing labor or service in and about the performance of the work under the Contract, all and every sums of money due him, her, them or any of them, for all such materials, labor and service for which **Principal** is liable, shall make good and reimburse **Owner** sufficient funds to pay such costs in the completion of the Contract as **Owner** may sustain by reason of any failure or default on the part of **Principal**, and shall also indemnify and save harmless **Owner** from all costs, damages and expenses arising out of or by reason of the performance of the Contract and for as long as provided by the Contract; then this obligation shall be void, otherwise to be and remain in full force and effect.

Surety, for value received, for itself and its successors and assigns, hereby stipulates and agrees that the obligation of **Surety** and its bond shall be in no way impaired or affected by any extension of time, modification, omission, addition or change in or to the Contract or the work to be performed thereunder, or by any payment thereunder before the time required therein, or by any waiver of any provisions thereof, or by any assignment, subletting or other transfer thereof or of any work to be performed or any monies due or to become due thereunder; and **Surety** hereby waives notice of any and all such extensions, modifications, omissions, additions, changes, payments, waivers, assignments, subcontracts and transfers and hereby expressly stipulates and agrees that any and all things done and omitted to be done by and in relation to assignees, subcontractors, and other transferees shall have the same effect as to **Surety** as though done or omitted to be done by or in relation to **Principal**.

Surety hereby stipulates and agrees that no modifications, omission or additions in or to the terms of the Contract shall in any way whatsoever affect the obligation of **Surety** and its bond.

Any proceeding, legal or equitable, under this Bond may be brought in any court of competent jurisdiction in the State of Delaware. Notices to **Surety** or Contractor may be mailed or delivered to them at their respective addresses shown below.

IN WITNESS WHEREOF, **Principal** and **Surety** have hereunto set their hand and seals, and such of them as are corporations have caused their corporate seal to be hereto affixed and these presents to be signed by their duly authorized officers, the day and year first above written.

PRINCIPAL

Name: _____

Witness or Attest: Address: _____

_____ By: _____(SEAL)
Name: Name:
Title:

(Corporate Seal)

SURETY

Name: _____

Witness or Attest: Address: _____

_____ By: _____(SEAL)
Name: Name:
Title:

(Corporate Seal)

SECTION 00 62 76

APPLICATION & CERTIFICATION OF PAYMENT AIA G-702 WITH CONTINUATION SHEET G-703

(THIS PAGE INTENTIONALLY LEFT BLANK)

AIA® Document G702™ – 1992

Application and Certificate for Payment

TO OWNER:	**PROJECT:**	BHH	**APPLICATION NO:** 001	**Distribution to:**
			PERIOD TO:	OWNER: ☐
			CONTRACT FOR: General Construction	ARCHITECT: ☐
FROM CONTRACTOR:	**VIA ARCHITECT:**	Bernardon Haber Holloway Architects PC Three Mill Road, Suite 211 Wilmington, Delaware 19806	**CONTRACT DATE:** **PROJECT NOS:** / /	CONTRACTOR: ☐ FIELD: ☐ OTHER: ☐

CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract.
Continuation Sheet, AIA Document G703, is attached.

1. **ORIGINAL CONTRACT SUM**		$ 0.00
2. **Net change by Change Orders**		$ 0.00
3. **CONTRACT SUM TO DATE** (Line 1 ± 2)		$ 0.00
4. **TOTAL COMPLETED & STORED TO DATE** (Column G on G703)		$ 0.00
5. **RETAINAGE:**		
a. 0 % of Completed Work (Column D + E on G703)	$ 0.00	
b. 0 % of Stored Material (Column F on G703)	$ 0.00	
Total Retainage (Lines 5a + 5b or Total in Column I of G703)		$ 0.00
6. **TOTAL EARNED LESS RETAINAGE** (Line 4 Less Line 5 Total)		$ 0.00
7. **LESS PREVIOUS CERTIFICATES FOR PAYMENT** (Line 6 from prior Certificate)		$ 0.00
8. **CURRENT PAYMENT DUE**		$ 0.00
9. **BALANCE TO FINISH, INCLUDING RETAINAGE** (Line 3 less Line 6)	$ 0.00	

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner	$ 0.00	$ 0.00
Total approved this Month	$ 0.00	$ 0.00
TOTALS	$ 0.00	$ 0.00
NET CHANGES by Change Order	$ 0.00	

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

CONTRACTOR:

By: _____ Date: _____

State of:

County of:

Subscribed and sworn to before me this day of

Notary Public:

My Commission expires:

ARCHITECT'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based on on-site observations and the data comprising this application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED ..... $ 0.00

(Attach explanation if amount certified differs from the amount applied. Initial all figures on this Application and on the Continuation Sheet that are changed to conform with the amount certified.)

ARCHITECT:

By: _____ Date: _____

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract

AIA Document G702™ – 1992. Copyright © 1953, 1963, 1965, 1978 and 1992 by The American Institute of Architects. **All rights reserved.** WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law. This document was produced by AIA software at 15:47:58 on 03/02/2006 under Order No.1000210037_1 which expires on 12/26/2006, and is not for resale.
(1431372660)
User Notes:

AIA® Document G703™ – 1992

Continuation Sheet

AIA Document G702, APPLICATION AND CERTIFICATION FOR PAYMENT, containing Contractor's signed certification is attached.
In tabulations below, amounts are stated to the nearest dollar.
Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NO: 001
APPLICATION DATE:
PERIOD TO:
ARCHITECT'S PROJECT NO:

A	B	C	D	E	F	G		H	I
ITEM NO.	DESCRIPTION OF WORK	SCHEDULED VALUE	WORK COMPLETED FROM PREVIOUS APPLICATION (D + E)	WORK COMPLETED THIS PERIOD	MATERIALS PRESENTLY STORED (NOT IN D OR E)	TOTAL COMPLETED AND STORED TO DATE (D+E+F)	% (G ÷ C)	BALANCE TO FINISH (C - G)	RETAINAGE (IF VARIABLE RATE)
	GRAND TOTAL	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	0.00 %	$ 0.00	$ 0.00

AIA Document G703™ – 1992. Copyright © 1963, 1965, 1966, 1967,1970, 1978, 1983 and 1992 by The American Institute of Architects. **All rights reserved.** WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law. This document was produced by AIA software at 15:49:49 on 03/02/2006 under Order No.1000210037_1 which expires on 12/26/2006, and is not for resale.
User Notes:
(1016058631)

SECTION 00 72 13

GENERAL CONDITIONS TO THE CONTRACT
A201-2017

The General Conditions of this Contract are as stated in the American Institute of Architects Document AIA A201 (2017 Edition) entitled General Conditions of the Contract for Construction as revised by the Supplementary General Conditions and is part of this project manual as if herein written in full.

(This Page Intentionally Left Blank)

AIA® Document A201™ – 2017

General Conditions of the Contract for Construction

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

THE OWNER:
(Name, legal status and address)

THE ARCHITECT:
(Name, legal status and address)

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

TABLE OF ARTICLES

1 GENERAL PROVISIONS

2 OWNER

3 CONTRACTOR

4 ARCHITECT

5 SUBCONTRACTORS

6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

7 CHANGES IN THE WORK

8 TIME

9 PAYMENTS AND COMPLETION

10 PROTECTION OF PERSONS AND PROPERTY

11 INSURANCE AND BONDS

12 UNCOVERING AND CORRECTION OF WORK

13 MISCELLANEOUS PROVISIONS

14 TERMINATION OR SUSPENSION OF THE CONTRACT

15 CLAIMS AND DISPUTES

Init.

/

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA53)

INDEX
(Topics and numbers in bold are Section headings.)

Acceptance of Nonconforming Work
9.6.6, 9.9.3, 12.3
Acceptance of Work
9.6.6, 9.8.2, 9.9.3, 9.10.1, 9.10.3, 12.3
Access to Work
3.16, 6.2.1, 12.1
Accident Prevention
10
Acts and Omissions
3.2, 3.3.2, 3.12.8, 3.18, 4.2.3, 8.3.1, 9.5.1, 10.2.5, 10.2.8, 13.3.2, 14.1, 15.1.2, 15.2
Addenda
1.1.1
Additional Costs, Claims for
3.7.4, 3.7.5, 10.3.2, 15.1.5
Additional Inspections and Testing
9.4.2, 9.8.3, 12.2.1, 13.4
Additional Time, Claims for
3.2.4, 3.7.4, 3.7.5, 3.10.2, 8.3.2, 15.1.6
Administration of the Contract
3.1.3, 4.2, 9.4, 9.5
Advertisement or Invitation to Bid
1.1.1
Aesthetic Effect
4.2.13
Allowances
3.8
Applications for Payment
4.2.5, 7.3.9, 9.2, 9.3, 9.4, 9.5.1, 9.5.4, 9.6.3, 9.7, 9.10
Approvals
2.1.1, 2.3.1, 2.5, 3.1.3, 3.10.2, 3.12.8, 3.12.9, 3.12.10.1, 4.2.7, 9.3.2, 13.4.1
Arbitration
8.3.1, 15.3.2, 15.4
ARCHITECT
4
Architect, Definition of
4.1.1
Architect, Extent of Authority
2.5, 3.12.7, 4.1.2, 4.2, 5.2, 6.3, 7.1.2, 7.3.4, 7.4, 9.2, 9.3.1, 9.4, 9.5, 9.6.3, 9.8, 9.10.1, 9.10.3, 12.1, 12.2.1, 13.4.1, 13.4.2, 14.2.2, 14.2.4, 15.1.4, 15.2.1
Architect, Limitations of Authority and Responsibility
2.1.1, 3.12.4, 3.12.8, 3.12.10, 4.1.2, 4.2.1, 4.2.2, 4.2.3, 4.2.6, 4.2.7, 4.2.10, 4.2.12, 4.2.13, 5.2.1, 7.4, 9.4.2, 9.5.4, 9.6.4, 15.1.4, 15.2
Architect's Additional Services and Expenses
2.5, 12.2.1, 13.4.2, 13.4.3, 14.2.4
Architect's Administration of the Contract
3.1.3, 3.7.4, 15.2, 9.4.1, 9.5
Architect's Approvals
2.5, 3.1.3, 3.5, 3.10.2, 4.2.7
Architect's Authority to Reject Work
3.5, 4.2.6, 12.1.2, 12.2.1
Architect's Copyright
1.1.7, 1.5
Architect's Decisions
3.7.4, 4.2.6, 4.2.7, 4.2.11, 4.2.12, 4.2.13, 4.2.14, 6.3, 7.3.4, 7.3.9, 8.1.3, 8.3.1, 9.2, 9.4.1, 9.5, 9.8.4, 9.9.1, 13.4.2, 15.2
Architect's Inspections
3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.8.3, 9.9.2, 9.10.1, 13.4
Architect's Instructions
3.2.4, 3.3.1, 4.2.6, 4.2.7, 13.4.2
Architect's Interpretations
4.2.11, 4.2.12
Architect's Project Representative
4.2.10
Architect's Relationship with Contractor
1.1.2, 1.5, 2.3.3, 3.1.3, 3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.4.2, 3.5, 3.7.4, 3.7.5, 3.9.2, 3.9.3, 3.10, 3.11, 3.12, 3.16, 3.18, 4.1.2, 4.2, 5.2, 6.2.2, 7, 8.3.1, 9.2, 9.3, 9.4, 9.5, 9.7, 9.8, 9.9, 10.2.6, 10.3, 11.3, 12, 13.3.2, 13.4, 15.2
Architect's Relationship with Subcontractors
1.1.2, 4.2.3, 4.2.4, 4.2.6, 9.6.3, 9.6.4, 11.3
Architect's Representations
9.4.2, 9.5.1, 9.10.1
Architect's Site Visits
3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.5.1, 9.9.2, 9.10.1, 13.4
Asbestos
10.3.1
Attorneys' Fees
3.18.1, 9.6.8, 9.10.2, 10.3.3
Award of Separate Contracts
6.1.1, 6.1.2
Award of Subcontracts and Other Contracts for Portions of the Work
5.2
Basic Definitions
1.1
Bidding Requirements
1.1.1
Binding Dispute Resolution
8.3.1, 9.7, 11.5, 13.1, 15.1.2, 15.1.3, 15.2.1, 15.2.5, 15.2.6.1, 15.3.1, 15.3.2, 15.3.3, 15.4.1
Bonds, Lien
7.3.4.4, 9.6.8, 9.10.2, 9.10.3
Bonds, Performance, and Payment
7.3.4.4, 9.6.7, 9.10.3, 11.1.2, 11.1.3, 11.5
Building Information Models Use and Reliance
1.8
Building Permit
3.7.1
Capitalization
1.3
Certificate of Substantial Completion
9.8.3, 9.8.4, 9.8.5

Init.
/

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes:
(3B9ADA53)

Certificates for Payment
4.2.1, 4.2.5, 4.2.9, 9.3.3, 9.4, 9.5, 9.6.1, 9.6.6, 9.7, 9.10.1, 9.10.3, 14.1.1.3, 14.2.4, 15.1.4
Certificates of Inspection, Testing or Approval
13.4.4
Certificates of Insurance
9.10.2
Change Orders
1.1.1, 3.4.2, 3.7.4, 3.8.2.3, 3.11, 3.12.8, 4.2.8, 5.2.3, 7.1.2, 7.1.3, 7.2, 7.3.2, 7.3.7, 7.3.9, 7.3.10, 8.3.1, 9.3.1.1, 9.10.3, 10.3.2, 11.2, 11.5, 12.1.2
Change Orders, Definition of
7.2.1
CHANGES IN THE WORK
2.2.2, 3.11, 4.2.8, 7, 7.2.1, 7.3.1, 7.4, 8.3.1, 9.3.1.1, 11.5
Claims, Definition of
15.1.1
Claims, Notice of
1.6.2, 15.1.3
CLAIMS AND DISPUTES
3.2.4, 6.1.1, 6.3, 7.3.9, 9.3.3, 9.10.4, 10.3.3, 15, 15.4
Claims and Timely Assertion of Claims
15.4.1
Claims for Additional Cost
3.2.4, 3.3.1, 3.7.4, 7.3.9, 9.5.2, 10.2.5, 10.3.2, 15.1.5
Claims for Additional Time
3.2.4, 3.3.1, 3.7.4, 6.1.1, 8.3.2, 9.5.2, 10.3.2, 15.1.6
Concealed or Unknown Conditions, Claims for
3.7.4
Claims for Damages
3.2.4, 3.18, 8.3.3, 9.5.1, 9.6.7, 10.2.5, 10.3.3, 11.3, 11.3.2, 14.2.4, 15.1.7
Claims Subject to Arbitration
15.4.1
Cleaning Up
3.15, 6.3
Commencement of the Work, Conditions Relating to
2.2.1, 3.2.2, 3.4.1, 3.7.1, 3.10.1, 3.12.6, 5.2.1, 5.2.3, 6.2.2, 8.1.2, 8.2.2, 8.3.1, 11.1, 11.2, 15.1.5
Commencement of the Work, Definition of
8.1.2
Communications
3.9.1, 4.2.4
Completion, Conditions Relating to
3.4.1, 3.11, 3.15, 4.2.2, 4.2.9, 8.2, 9.4.2, 9.8, 9.9.1, 9.10, 12.2, 14.1.2, 15.1.2
COMPLETION, PAYMENTS AND
9
Completion, Substantial
3.10.1, 4.2.9, 8.1.1, 8.1.3, 8.2.3, 9.4.2, 9.8, 9.9.1, 9.10.3, 12.2, 15.1.2
Compliance with Laws
2.3.2, 3.2.3, 3.6, 3.7, 3.12.10, 3.13, 9.6.4, 10.2.2, 13.1, 13.3, 13.4.1, 13.4.2, 13.5, 14.1.1, 14.2.1.3, 15.2.8, 15.4.2, 15.4.3
Concealed or Unknown Conditions
3.7.4, 4.2.8, 8.3.1, 10.3
Conditions of the Contract
1.1.1, 6.1.1, 6.1.4
Consent, Written
3.4.2, 3.14.2, 4.1.2, 9.8.5, 9.9.1, 9.10.2, 9.10.3, 13.2, 15.4.4.2
Consolidation or Joinder
15.4.4
CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS
1.1.4, 6
Construction Change Directive, Definition of
7.3.1
Construction Change Directives
1.1.1, 3.4.2, 3.11, 3.12.8, 4.2.8, 7.1.1, 7.1.2, 7.1.3, 7.3, 9.3.1.1
Construction Schedules, Contractor's
3.10, 3.11, 3.12.1, 3.12.2, 6.1.3, 15.1.6.2
Contingent Assignment of Subcontracts
5.4, 14.2.2.2
Continuing Contract Performance
15.1.4
Contract, Definition of
1.1.2
CONTRACT, TERMINATION OR SUSPENSION OF THE
5.4.1.1, 5.4.2, 11.5, 14
Contract Administration
3.1.3, 4, 9.4, 9.5
Contract Award and Execution, Conditions Relating to
3.7.1, 3.10, 5.2, 6.1
Contract Documents, Copies Furnished and Use of
1.5.2, 2.3.6, 5.3
Contract Documents, Definition of
1.1.1
Contract Sum
2.2.2, 2.2.4, 3.7.4, 3.7.5, 3.8, 3.10.2, 5.2.3, 7.3, 7.4, 9.1, 9.2, 9.4.2, 9.5.1.4, 9.6.7, 9.7, 10.3.2, 11.5, 12.1.2, 12.3, 14.2.4, 14.3.2, 15.1.4.2, 15.1.5, 15.2.5
Contract Sum, Definition of
9.1
Contract Time
1.1.4, 2.2.1, 2.2.2, 3.7.4, 3.7.5, 3.10.2, 5.2.3, 6.1.5, 7.2.1.3, 7.3.1, 7.3.5, 7.3.6, 7, 7, 7.3.10, 7.4, 8.1.1, 8.2.1, 8.2.3, 8.3.1, 9.5.1, 9.7, 10.3.2, 12.1.1, 12.1.2, 14.3.2, 15.1.4.2, 15.1.6.1, 15.2.5
Contract Time, Definition of
8.1.1
CONTRACTOR
3
Contractor, Definition of
3.1, 6.1.2
Contractor's Construction and Submittal Schedules
3.10, 3.12.1, 3.12.2, 4.2.3, 6.1.3, 15.1.6.2
Contractor's Employees

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes:
(3B9ADA53)

2.2.4, 3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.2, 4.2.3, 4.2.6, 10.2, 10.3, 11.3, 14.1, 14.2.1.1
Contractor's Liability Insurance
11.1
Contractor's Relationship with Separate Contractors and Owner's Forces
3.12.5, 3.14.2, 4.2.4, 6, 11.3, 12.2.4
Contractor's Relationship with Subcontractors
1.2.2, 2.2.4, 3.3.2, 3.18.1, 3.18.2, 4.2.4, 5, 9.6.2, 9.6.7, 9.10.2, 11.2, 11.3, 11.4
Contractor's Relationship with the Architect
1.1.2, 1.5, 2.3.3, 3.1.3, 3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.4.2, 3.5.1, 3.7.4, 3.10, 3.11, 3.12, 3.16, 3.18, 4.2, 5.2, 6.2.2, 7, 8.3.1, 9.2, 9.3, 9.4, 9.5, 9.7, 9.8, 9.9, 10.2.6, 10.3, 11.3, 12, 13.4, 15.1.3, 15.2.1
Contractor's Representations
3.2.1, 3.2.2, 3.5, 3.12.6, 6.2.2, 8.2.1, 9.3.3, 9.8.2
Contractor's Responsibility for Those Performing the Work
3.3.2, 3.18, 5.3, 6.1.3, 6.2, 9.5.1, 10.2.8
Contractor's Review of Contract Documents
3.2
Contractor's Right to Stop the Work
2.2.2, 9.7
Contractor's Right to Terminate the Contract
14.1
Contractor's Submittals
3.10, 3.11, 3.12, 4.2.7, 5.2.1, 5.2.3, 9.2, 9.3, 9.8.2, 9.8.3, 9.9.1, 9.10.2, 9.10.3
Contractor's Superintendent
3.9, 10.2.6
Contractor's Supervision and Construction Procedures
1.2.2, 3.3, 3.4, 3.12.10, 4.2.2, 4.2.7, 6.1.3, 6.2.4, 7.1.3, 7.3.4, 7.3.6, 8.2, 10, 12, 14, 15.1.4
Coordination and Correlation
1.2, 3.2.1, 3.3.1, 3.10, 3.12.6, 6.1.3, 6.2.1
Copies Furnished of Drawings and Specifications
1.5, 2.3.6, 3.11
Copyrights
1.5, 3.17
Correction of Work
2.5, 3.7.3, 9.4.2, 9.8.2, 9.8.3, 9.9.1, 12.1.2, 12.2, 12.3, 15.1.3.1, 15.1.3.2, 15.2.1
Correlation and Intent of the Contract Documents
1.2
Cost, Definition of
7.3.4
Costs
2.5, 3.2.4, 3.7.3, 3.8.2, 3.15.2, 5.4.2, 6.1.1, 6.2.3, 7.3.3.3, 7.3.4, 7.3.8, 7.3.9, 9.10.2, 10.3.2, 10.3.6, 11.2, 12.1.2, 12.2.1, 12.2.4, 13.4, 14
Cutting and Patching
3.14, 6.2.5
Damage to Construction of Owner or Separate Contractors
3.14.2, 6.2.4, 10.2.1.2, 10.2.5, 10.4, 12.2.4
Damage to the Work
3.14.2, 9.9.1, 10.2.1.2, 10.2.5, 10.4, 12.2.4
Damages, Claims for
3.2.4, 3.18, 6.1.1, 8.3.3, 9.5.1, 9.6.7, 10.3.3, 11.3.2, 11.3, 14.2.4, 15.1.7
Damages for Delay
6.2.3, 8.3.3, 9.5.1.6, 9.7, 10.3.2, 14.3.2
Date of Commencement of the Work, Definition of
8.1.2
Date of Substantial Completion, Definition of
8.1.3
Day, Definition of
8.1.4
Decisions of the Architect
3.7.4, 4.2.6, 4.2.7, 4.2.11, 4.2.12, 4.2.13, 6.3, 7.3.4, 7.3.9, 8.1.3, 8.3.1, 9.2, 9.4, 9.5.1, 9.8.4, 9.9.1, 13.4.2, 14.2.2, 14.2.4, 15.1, 15.2
Decisions to Withhold Certification
9.4.1, 9.5, 9.7, 14.1.1.3
Defective or Nonconforming Work, Acceptance, Rejection and Correction of
2.5, 3.5, 4.2.6, 6.2.3, 9.5.1, 9.5.3, 9.6.6, 9.8.2, 9.9.3, 9.10.4, 12.2.1
Definitions
1.1, 2.1.1, 3.1.1, 3.5, 3.12.1, 3.12.2, 3.12.3, 4.1.1, 5.1, 6.1.2, 7.2.1, 7.3.1, 8.1, 9.1, 9.8.1, 15.1.1
Delays and Extensions of Time
3.2, 3.7.4, 5.2.3, 7.2.1, 7.3.1, 7.4, 8.3, 9.5.1, 9.7, 10.3.2, 10.4, 14.3.2, 15.1.6, 15.2.5
Digital Data Use and Transmission
1.7
Disputes
6.3, 7.3.9, 15.1, 15.2
Documents and Samples at the Site
3.11
Drawings, Definition of
1.1.5
Drawings and Specifications, Use and Ownership of
3.11
Effective Date of Insurance
8.2.2
Emergencies
10.4, 14.1.1.2, 15.1.5
Employees, Contractor's
3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.2, 4.2.3, 4.2.6, 10.2, 10.3.3, 11.3, 14.1, 14.2.1.1
Equipment, Labor, or Materials
1.1.3, 1.1.6, 3.4, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1, 4.2.6, 4.2.7, 5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2, 10.2.1, 10.2.4, 14.2.1.1, 14.2.1.2
Execution and Progress of the Work
1.1.3, 1.2.1, 1.2.2, 2.3.4, 2.3.6, 3.1, 3.3.1, 3.4.1, 3.7.1, 3.10.1, 3.12, 3.14, 4.2, 6.2.2, 7.1.3, 7.3.6, 8.2, 9.5.1, 9.9.1, 10.2, 10.3, 12.1, 12.2, 14.2, 14.3.1, 15.1.4
Extensions of Time
3.2.4, 3.7.4, 5.2.3, 7.2.1, 7.3, 7.4, 9.5.1, 9.7, 10.3.2, 10.4, 14.3, 15.1.6, 15.2.5

Init.
/
AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes:
(3B9ADA53)

Failure of Payment
9.5.1.3, 9.7, 9.10.2, 13.5, 14.1.1.3, 14.2.1.2
Faulty Work
(See Defective or Nonconforming Work)
Final Completion and Final Payment
4.2.1, 4.2.9, 9.8.2, 9.10, 12.3, 14.2.4, 14.4.3
Financial Arrangements, Owner's
2.2.1, 13.2.2, 14.1.1.4
GENERAL PROVISIONS
1
Governing Law
13.1
Guarantees (See Warranty)
Hazardous Materials and Substances
10.2.4, 10.3
Identification of Subcontractors and Suppliers
5.2.1
Indemnification
3.17, 3.18, 9.6.8, 9.10.2, 10.3.3, 11.3
Information and Services Required of the Owner
2.1.2, 2.2, 2.3, 3.2.2, 3.12.10.1, 6.1.3, 6.1.4, 6.2.5, 9.6.1, 9.9.2, 9.10.3, 10.3.3, 11.2, 13.4.1, 13.4.2, 14.1.1.4, 14.1.4, 15.1.4
Initial Decision
15.2
Initial Decision Maker, Definition of
1.1.8
Initial Decision Maker, Decisions
14.2.4, 15.1.4.2, 15.2.1, 15.2.2, 15.2.3, 15.2.4, 15.2.5
Initial Decision Maker, Extent of Authority
14.2.4, 15.1.4.2, 15.2.1, 15.2.2, 15.2.3, 15.2.4, 15.2.5
Injury or Damage to Person or Property
10.2.8, 10.4
Inspections
3.1.3, 3.3.3, 3.7.1, 4.2.2, 4.2.6, 4.2.9, 9.4.2, 9.8.3, 9.9.2, 9.10.1, 12.2.1, 13.4
Instructions to Bidders
1.1.1
Instructions to the Contractor
3.2.4, 3.3.1, 3.8.1, 5.2.1, 7, 8.2.2, 12, 13.4.2
Instruments of Service, Definition of
1.1.7
Insurance
6.1.1, 7.3.4, 8.2.2, 9.3.2, 9.8.4, 9.9.1, 9.10.2, 10.2.5, 11
Insurance, Notice of Cancellation or Expiration
11.1.4, 11.2.3
Insurance, Contractor's Liability
11.1
Insurance, Effective Date of
8.2.2, 14.4.2
Insurance, Owner's Liability
11.2
Insurance, Property
10.2.5, 11.2, 11.4, 11.5
Insurance, Stored Materials
9.3.2
INSURANCE AND BONDS
11
Insurance Companies, Consent to Partial Occupancy
9.9.1
Insured loss, Adjustment and Settlement of
11.5
Intent of the Contract Documents
1.2.1, 4.2.7, 4.2.12, 4.2.13
Interest
13.5
Interpretation
1.1.8, 1.2.3, 1.4, 4.1.1, 5.1, 6.1.2, 15.1.1
Interpretations, Written
4.2.11, 4.2.12
Judgment on Final Award
15.4.2
Labor and Materials, Equipment
1.1.3, 1.1.6, 3.4, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1, 5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2, 10.2.1, 10.2.4, 14.2.1.1, 14.2.1.2
Labor Disputes
8.3.1
Laws and Regulations
1.5, 2.3.2, 3.2.3, 3.2.4, 3.6, 3.7, 3.12.10, 3.13, 9.6.4, 9.9.1, 10.2.2, 13.1, 13.3.1, 13.4.2, 13.5, 14, 15.2.8, 15.4
Liens
2.1.2, 9.3.1, 9.3.3, 9.6.8, 9.10.2, 9.10.4, 15.2.8
Limitations, Statutes of
12.2.5, 15.1.2, 15.4.1.1
Limitations of Liability
3.2.2, 3.5, 3.12.10, 3.12.10.1, 3.17, 3.18.1, 4.2.6, 4.2.7, 6.2.2, 9.4.2, 9.6.4, 9.6.7, 9.6.8, 10.2.5, 10.3.3, 11.3, 12.2.5, 13.3.1
Limitations of Time
2.1.2, 2.2, 2.5, 3.2.2, 3.10, 3.11, 3.12.5, 3.15.1, 4.2.7, 5.2, 5.3, 5.4.1, 6.2.4, 7.3, 7.4, 8.2, 9.2, 9.3.1, 9.3.3, 9.4.1, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10, 12.2, 13.4, 14, 15, 15.1.2, 15.1.3, 15.1.5
Materials, Hazardous
10.2.4, 10.3
Materials, Labor, Equipment and
1.1.3, 1.1.6, 3.4.1, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1, 5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2, 10.2.1.2, 10.2.4, 14.2.1.1, 14.2.1.2
Means, Methods, Techniques, Sequences and Procedures of Construction
3.3.1, 3.12.10, 4.2.2, 4.2.7, 9.4.2
Mechanic's Lien
2.1.2, 9.3.1, 9.3.3, 9.6.8, 9.10.2, 9.10.4, 15.2.8
Mediation
8.3.1, 15.1.3.2, 15.2.1, 15.2.5, 15.2.6, 15.3, 15.4.1, 15.4.1.1
Minor Changes in the Work
1.1.1, 3.4.2, 3.12.8, 4.2.8, 7.1, 7.4
MISCELLANEOUS PROVISIONS
13

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved.** **WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes:
(3B9ADA53)

Modifications, Definition of
1.1.1
Modifications to the Contract
1.1.1, 1.1.2, 2.5, 3.11, 4.1.2, 4.2.1, 5.2.3, 7, 8.3.1, 9.7, 10.3.2
Mutual Responsibility
6.2
Nonconforming Work, Acceptance of
9.6.6, 9.9.3, 12.3
Nonconforming Work, Rejection and Correction of
2.4, 2.5, 3.5, 4.2.6, 6.2.4, 9.5.1, 9.8.2, 9.9.3, 9.10.4, 12.2
Notice
1.6, 1.6.1, 1.6.2, 2.1.2, 2.2.2., 2.2.3, 2.2.4, 2.5, 3.2.4, 3.3.1, 3.7.4, 3.7.5, 3.9.2, 3.12.9, 3.12.10, 5.2.1, 7.4, 8.2.2 9.6.8, 9.7, 9.10.1, 10.2.8, 10.3.2, 11.5, 12.2.2.1, 13.4.1, 13.4.2, 14.1, 14.2.2, 14.4.2, 15.1.3, 15.1.5, 15.1.6, 15.4.1
Notice of Cancellation or Expiration of Insurance
11.1.4, 11.2.3
Notice of Claims
1.6.2, 2.1.2, 3.7.4, 9.6.8, 10.2.8, 15.1.3, 15.1.5, 15.1.6, 15.2.8, 15.3.2, 15.4.1
Notice of Testing and Inspections
13.4.1, 13.4.2
Observations, Contractor's
3.2, 3.7.4
Occupancy
2.3.1, 9.6.6, 9.8
Orders, Written
1.1.1, 2.4, 3.9.2, 7, 8.2.2, 11.5, 12.1, 12.2.2.1, 13.4.2, 14.3.1
OWNER
2
Owner, Definition of
2.1.1
Owner, Evidence of Financial Arrangements
2.2, 13.2.2, 14.1.1.4
Owner, Information and Services Required of the
2.1.2, 2.2, 2.3, 3.2.2, 3.12.10, 6.1.3, 6.1.4, 6.2.5, 9.3.2, 9.6.1, 9.6.4, 9.9.2, 9.10.3, 10.3.3, 11.2, 13.4.1, 13.4.2, 14.1.1.4, 14.1.4, 15.1.4
Owner's Authority
1.5, 2.1.1, 2.3.32.4, 2.5, 3.4.2, 3.8.1, 3.12.10, 3.14.2, 4.1.2, 4.2.4, 4.2.9, 5.2.1, 5.2.4, 5.4.1, 6.1, 6.3, 7.2.1, 7.3.1, 8.2.2, 8.3.1, 9.3.2, 9.5.1, 9.6.4, 9.9.1, 9.10.2, 10.3.2, 11.4, 11.5, 12.2.2, 12.3, 13.2.2, 14.3, 14.4, 15.2.7
Owner's Insurance
11.2
Owner's Relationship with Subcontractors
1.1.2, 5.2, 5.3, 5.4, 9.6.4, 9.10.2, 14.2.2
Owner's Right to Carry Out the Work
2.5, 14.2.2
Owner's Right to Clean Up
6.3
Owner's Right to Perform Construction and to Award Separate Contracts
6.1
Owner's Right to Stop the Work
2.4
Owner's Right to Suspend the Work
14.3
Owner's Right to Terminate the Contract
14.2, 14.4
Ownership and Use of Drawings, Specifications and Other Instruments of Service
1.1.1, 1.1.6, 1.1.7, 1.5, 2.3.6, 3.2.2, 3.11, 3.17, 4.2.12, 5.3
Partial Occupancy or Use
9.6.6, 9.9
Patching, Cutting and
3.14, 6.2.5
Patents
3.17
Payment, Applications for
4.2.5, 7.3.9, 9.2, 9.3, 9.4, 9.5, 9.6.3, 9.7, 9.8.5, 9.10.1, 14.2.3, 14.2.4, 14.4.3
Payment, Certificates for
4.2.5, 4.2.9, 9.3.3, 9.4, 9.5, 9.6.1, 9.6.6, 9.7, 9.10.1, 9.10.3, 14.1.1.3, 14.2.4
Payment, Failure of
9.5.1.3, 9.7, 9.10.2, 13.5, 14.1.1.3, 14.2.1.2
Payment, Final
4.2.1, 4.2.9, 9.10, 12.3, 14.2.4, 14.4.3
Payment Bond, Performance Bond and
7.3.4.4, 9.6.7, 9.10.3, 11.1.2
Payments, Progress
9.3, 9.6, 9.8.5, 9.10.3, 14.2.3, 15.1.4
PAYMENTS AND COMPLETION
9
Payments to Subcontractors
5.4.2, 9.5.1.3, 9.6.2, 9.6.3, 9.6.4, 9.6.7, 14.2.1.2
PCB
10.3.1
Performance Bond and Payment Bond
7.3.4.4, 9.6.7, 9.10.3, 11.1.2
Permits, Fees, Notices and Compliance with Laws
2.3.1, 3.7, 3.13, 7.3.4.4, 10.2.2
PERSONS AND PROPERTY, PROTECTION OF
10
Polychlorinated Biphenyl
10.3.1
Product Data, Definition of
3.12.2
Product Data and Samples, Shop Drawings
3.11, 3.12, 4.2.7
Progress and Completion
4.2.2, 8.2, 9.8, 9.9.1, 14.1.4, 15.1.4
Progress Payments
9.3, 9.6, 9.8.5, 9.10.3, 14.2.3, 15.1.4
Project, Definition of
1.1.4
Project Representatives

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes:
(3B9ADA53)

4.2.10
Property Insurance
10.2.5, 11.2
Proposal Requirements
1.1.1
PROTECTION OF PERSONS AND PROPERTY
10
Regulations and Laws
1.5, 2.3.2, 3.2.3, 3.6, 3.7, 3.12.10, 3.13, 9.6.4, 9.9.1, 10.2.2, 13.1, 13.3, 13.4.1, 13.4.2, 13.5, 14, 15.2.8, 15.4
Rejection of Work
4.2.6, 12.2.1
Releases and Waivers of Liens
9.3.1, 9.10.2
Representations
3.2.1, 3.5, 3.12.6, 8.2.1, 9.3.3, 9.4.2, 9.5.1, 9.10.1
Representatives
2.1.1, 3.1.1, 3.9, 4.1.1, 4.2.10, 13.2.1
Responsibility for Those Performing the Work
3.3.2, 3.18, 4.2.2, 4.2.3, 5.3, 6.1.3, 6.2, 6.3, 9.5.1, 10
Retainage
9.3.1, 9.6.2, 9.8.5, 9.9.1, 9.10.2, 9.10.3
Review of Contract Documents and Field Conditions by Contractor
3.2, 3.12.7, 6.1.3
Review of Contractor's Submittals by Owner and Architect
3.10.1, 3.10.2, 3.11, 3.12, 4.2, 5.2, 6.1.3, 9.2, 9.8.2
Review of Shop Drawings, Product Data and Samples by Contractor
3.12
Rights and Remedies
1.1.2, 2.4, 2.5, 3.5, 3.7.4, 3.15.2, 4.2.6, 5.3, 5.4, 6.1, 6.3, 7.3.1, 8.3, 9.5.1, 9.7, 10.2.5, 10.3, 12.2.1, 12.2.2, 12.2.4, 13.3, 14, 15.4
Royalties, Patents and Copyrights
3.17
Rules and Notices for Arbitration
15.4.1
Safety of Persons and Property
10.2, 10.4
Safety Precautions and Programs
3.3.1, 4.2.2, 4.2.7, 5.3, 10.1, 10.2, 10.4
Samples, Definition of
3.12.3
Samples, Shop Drawings, Product Data and
3.11, 3.12, 4.2.7
Samples at the Site, Documents and
3.11
Schedule of Values
9.2, 9.3.1
Schedules, Construction
3.10, 3.12.1, 3.12.2, 6.1.3, 15.1.6.2
Separate Contracts and Contractors
1.1.4, 3.12.5, 3.14.2, 4.2.4, 4.2.7, 6, 8.3.1, 12.1.2
Separate Contractors, Definition of
6.1.1
Shop Drawings, Definition of
3.12.1
Shop Drawings, Product Data and Samples
3.11, 3.12, 4.2.7
Site, Use of
3.13, 6.1.1, 6.2.1
Site Inspections
3.2.2, 3.3.3, 3.7.1, 3.7.4, 4.2, 9.9.2, 9.4.2, 9.10.1, 13.4
Site Visits, Architect's
3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.5.1, 9.9.2, 9.10.1, 13.4
Special Inspections and Testing
4.2.6, 12.2.1, 13.4
Specifications, Definition of
1.1.6
Specifications
1.1.1, 1.1.6, 1.2.2, 1.5, 3.12.10, 3.17, 4.2.14
Statute of Limitations
15.1.2, 15.4.1.1
Stopping the Work
2.2.2, 2.4, 9.7, 10.3, 14.1
Stored Materials
6.2.1, 9.3.2, 10.2.1.2, 10.2.4
Subcontractor, Definition of
5.1.1
SUBCONTRACTORS
5
Subcontractors, Work by
1.2.2, 3.3.2, 3.12.1, 3.18, 4.2.3, 5.2.3, 5.3, 5.4, 9.3.1.2, 9.6.7
Subcontractual Relations
5.3, 5.4, 9.3.1.2, 9.6, 9.10, 10.2.1, 14.1, 14.2.1
Submittals
3.10, 3.11, 3.12, 4.2.7, 5.2.1, 5.2.3, 7.3.4, 9.2, 9.3, 9.8, 9.9.1, 9.10.2, 9.10.3
Submittal Schedule
3.10.2, 3.12.5, 4.2.7
Subrogation, Waivers of
6.1.1, 11.3
Substances, Hazardous
10.3
Substantial Completion
4.2.9, 8.1.1, 8.1.3, 8.2.3, 9.4.2, 9.8, 9.9.1, 9.10.3, 12.2, 15.1.2
Substantial Completion, Definition of
9.8.1
Substitution of Subcontractors
5.2.3, 5.2.4
Substitution of Architect
2.3.3
Substitutions of Materials
3.4.2, 3.5, 7.3.8
Sub-subcontractor, Definition of
5.1.2
Subsurface Conditions
3.7.4
Successors and Assigns

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA53)

13.2
Superintendent
3.9, 10.2.6
Supervision and Construction Procedures
1.2.2, 3.3, 3.4, 3.12.10, 4.2.2, 4.2.7, 6.1.3, 6.2.4, 7.1.3, 7.3.4, 8.2, 8.3.1, 9.4.2, 10, 12, 14, 15.1.4
Suppliers
1.5, 3.12.1, 4.2.4, 4.2.6, 5.2.1, 9.3, 9.4.2, 9.5.4, 9.6, 9.10.5, 14.2.1
Surety
5.4.1.2, 9.6.8, 9.8.5, 9.10.2, 9.10.3, 11.1.2, 14.2.2, 15.2.7
Surety, Consent of
9.8.5, 9.10.2, 9.10.3
Surveys
1.1.7, 2.3.4
Suspension by the Owner for Convenience
14.3
Suspension of the Work
3.7.5, 5.4.2, 14.3
Suspension or Termination of the Contract
5.4.1.1, 14
Taxes
3.6, 3.8.2.1, 7.3.4.4
Termination by the Contractor
14.1, 15.1.7
Termination by the Owner for Cause
5.4.1.1, 14.2, 15.1.7
Termination by the Owner for Convenience
14.4
Termination of the Architect
2.3.3
Termination of the Contractor Employment
14.2.2

TERMINATION OR SUSPENSION OF THE CONTRACT
14
Tests and Inspections
3.1.3, 3.3.3, 3.7.1, 4.2.2, 4.2.6, 4.2.9, 9.4.2, 9.8.3, 9.9.2, 9.10.1, 10.3.2, 12.2.1, 13.4
TIME
8
Time, Delays and Extensions of
3.2.4, 3.7.4, 5.2.3, 7.2.1, 7.3.1, 7.4, 8.3, 9.5.1, 9.7, 10.3.2, 10.4, 14.3.2, 15.1.6, 15.2.5
Time Limits
2.1.2, 2.2, 2.5, 3.2.2, 3.10, 3.11, 3.12.5, 3.15.1, 4.2, 5.2, 5.3, 5.4, 6.2.4, 7.3, 7.4, 8.2, 9.2, 9.3.1, 9.3.3, 9.4.1, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10, 12.2, 13.4, 14, 15.1.2, 15.1.3, 15.4
Time Limits on Claims
3.7.4, 10.2.8, 15.1.2, 15.1.3
Title to Work
9.3.2, 9.3.3
UNCOVERING AND CORRECTION OF WORK
12
Uncovering of Work
12.1
Unforeseen Conditions, Concealed or Unknown
3.7.4, 8.3.1, 10.3
Unit Prices
7.3.3.2, 9.1.2
Use of Documents
1.1.1, 1.5, 2.3.6, 3.12.6, 5.3
Use of Site
3.13, 6.1.1, 6.2.1
Values, Schedule of
9.2, 9.3.1
Waiver of Claims by the Architect
13.3.2
Waiver of Claims by the Contractor
9.10.5, 13.3.2, 15.1.7
Waiver of Claims by the Owner
9.9.3, 9.10.3, 9.10.4, 12.2.2.1, 13.3.2, 14.2.4, 15.1.7
Waiver of Consequential Damages
14.2.4, 15.1.7
Waiver of Liens
9.3, 9.10.2, 9.10.4
Waivers of Subrogation
6.1.1, 11.3
Warranty
3.5, 4.2.9, 9.3.3, 9.8.4, 9.9.1, 9.10.2, 9.10.4, 12.2.2, 15.1.2
Weather Delays
8.3, 15.1.6.2
Work, Definition of
1.1.3
Written Consent
1.5.2, 3.4.2, 3.7.4, 3.12.8, 3.14.2, 4.1.2, 9.3.2, 9.10.3, 13.2, 13.3.2, 15.4.4.2
Written Interpretations
4.2.11, 4.2.12
Written Orders
1.1.1, 2.4, 3.9, 7, 8.2.2, 12.1, 12.2, 13.4.2, 14.3.1

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes:
(3B9ADA53)

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

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

§ 1.1.2 The Contract

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

§ 1.1.3 The Work

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

§ 1.1.4 The Project

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

§ 1.1.5 The Drawings

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

§ 1.1.6 The Specifications

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

§ 1.1.7 Instruments of Service

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

§ 1.1.8 Initial Decision Maker

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

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA53)

consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

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

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

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

§ 1.3 Capitalization

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

§ 1.4 Interpretation

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

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

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

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

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

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

§ 1.7 Digital Data Use and Transmission

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

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes:

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

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

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

§ 2.2 Evidence of the Owner's Financial Arrangements

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

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

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

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

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements,

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA53)

assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

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

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

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

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

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

§ 2.4 Owner's Right to Stop the Work

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

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

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

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

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

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA53)

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

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

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

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

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

§ 3.3 Supervision and Construction Procedures

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

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

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

§ 3.4 Labor and Materials

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

Init.
/
AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes:
(3B9ADA53)

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

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

§ 3.5 Warranty

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

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

§ 3.6 Taxes

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

§ 3.7 Permits, Fees, Notices and Compliance with Laws

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

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

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

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA53)

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

§ 3.8 Allowances

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

§ 3.8.2 Unless otherwise provided in the Contract Documents,

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

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

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

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

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

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

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

Init.
/
AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes:
(3B9ADA53)

Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

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

§ 3.11 Documents and Samples at the Site

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

§ 3.12 Shop Drawings, Product Data and Samples

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

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

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

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

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

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

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

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

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA53)

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

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

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

§ 3.13 Use of Site

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

§ 3.14 Cutting and Patching

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

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

§ 3.15 Cleaning Up

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

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

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA53)

§ 3.16 Access to Work

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

§ 3.17 Royalties, Patents and Copyrights

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

§ 3.18 Indemnification

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

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

ARTICLE 4 ARCHITECT

§ 4.1 General

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

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

§ 4.2 Administration of the Contract

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

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes:
(3B9ADA53)

Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

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

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

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

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

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

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

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA53)

and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

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

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

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

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

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

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

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

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

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

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

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor,

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA53)

prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

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

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

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

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

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

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

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

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

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

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

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

§ 6.2 Mutual Responsibility

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

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work,

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA53)

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

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

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

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

§ 6.3 Owner's Right to Clean Up

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

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

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

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

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

§ 7.2 Change Orders

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

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

§ 7.3 Construction Change Directives

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

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

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

Init.
/
AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA53)

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

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

.1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
.2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
.5 Costs of supervision and field office personnel directly attributable to the change.

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

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

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

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

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

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

§ 7.4 Minor Changes in the Work

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

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA53)

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

ARTICLE 8 TIME

§ 8.1 Definitions

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

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

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

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

§ 8.2 Progress and Completion

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

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

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

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

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

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

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

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

§ 9.2 Schedule of Values

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

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes:
(3B9ADA53)

unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

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

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

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

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

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

§ 9.4 Certificates for Payment

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

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

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA53)

§ 9.5 Decisions to Withhold Certification

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

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

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

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

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

§ 9.6 Progress Payments

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

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

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

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

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

Init.
/

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes:
(3B9ADA53)

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

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

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

§ 9.7 Failure of Payment

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

§ 9.8 Substantial Completion

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

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

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

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

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

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA53)

§ 9.9 Partial Occupancy or Use

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

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

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

§ 9.10 Final Completion and Final Payment

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

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

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

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes:
(3B9ADA53)

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

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

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

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

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

§ 10.2 Safety of Persons and Property

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

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

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

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

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

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

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

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

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA53)

§ 10.2.8 Injury or Damage to Person or Property

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

§ 10.3 Hazardous Materials and Substances

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

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

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

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

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

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

§ 10.4 Emergencies

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

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes:
(3B9ADA53)

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

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

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

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

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

§ 11.2 Owner's Insurance

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

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

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

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA53)

§ 11.3 Waivers of Subrogation

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

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

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

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

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

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

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes:
(3B9ADA53)

the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

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

§ 12.2.2 After Substantial Completion

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

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

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

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

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

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

§ 12.3 Acceptance of Nonconforming Work

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

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

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

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA53)

§ 13.2 Successors and Assigns

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

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

§ 13.3 Rights and Remedies

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

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

§ 13.4 Tests and Inspections

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

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

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

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

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

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

§ 13.5 Interest

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

Init.
/

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes:

(3B9ADA53)

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

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

- **.1** Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- **.2** An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- **.3** Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- **.4** The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

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

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

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

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

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

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

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

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

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance,

Init.
/
AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes:
(3B9ADA53)

the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

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

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

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

§ 14.4 Termination by the Owner for Convenience

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

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

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

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

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

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

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA53)

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

§ 15.1.4 Continuing Contract Performance

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

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

§ 15.1.5 Claims for Additional Cost

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

§ 15.1.6 Claims for Additional Time

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

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

§ 15.1.7 Waiver of Claims for Consequential Damages

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

.1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

.2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

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

§ 15.2 Initial Decision

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

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

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA53)

Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

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

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

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

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

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

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

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

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

Init.
/

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA53)

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

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

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

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

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

§ 15.4.4 Consolidation or Joinder

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

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

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

AIA Document A201™ – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. **All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.** This document was produced by AIA software at 09:57:10 ET on 08/15/2019 under Order No. 3260845935 which expires on 01/25/2020, and is not for resale.
User Notes: (3B9ADA53)

SECTION 00 73 13

SUPPLEMENTARY GENERAL CONDITIONS A201-2017

The following supplements modify the "General Conditions of the Contract for Construction," AIA Document A201-2017. Where a portion of the General Conditions is modified or deleted by the Supplementary Conditions, the unaltered portions of the General Conditions shall remain in effect.

TABLE OF ARTICLES

1. GENERAL PROVISIONS
2. OWNER
3. CONTRACTOR
4. ADMINISTRATION OF THE CONTRACT
5. SUBCONTRACTORS
6. CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS
7. CHANGES IN THE WORK
8. TIME
9. PAYMENTS AND COMPLETION
10. PROTECTION OF PERSONS AND PROPERTY
11. INSURANCE AND BONDS
12. UNCOVERING AND CORRECTION OF WORK
13. MISCELLANEOUS PROVISIONS
14. TERMINATION OR SUSPENSION OF THE CONTRACT
15. CLAIMS AND DISPUTES

ARTICLE 1: GENERAL PROVISIONS

1.1 BASIC DEFINITIONS

1.1.1 THE CONTRACT DOCUMENTS

Strike the last sentence of Section 1.1.1 in its entirety and replace with the following:

"The Contract Documents also include Advertisement for Bid, Instructions to Bidder, sample forms, the Bid Form, the Contractor's completed Bid and the Award Letter."

Add the following Section:

"1.1.1.1 In the event of conflict or discrepancies among the Contract Documents, the Documents prepared by the State of Delaware, Division of Facilities Management shall take precedence over all other documents."

1.1.8 INITIAL DECISION MAKER

Strike the last sentence of Section 1.1.8 in its entirety and add the following to the end of the remaining sentence:

" and certify termination of the Agreement under Section 14.2.2."

1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

1.2.1.1 Insert "if possible" at the end of the second sentence.

Add the following Sections:

"1.2.4 In the case of an inconsistency between the Drawings and the Specifications, or within either document not clarified by addendum, the better quality or greater quantity of work shall be provided in accordance with the Architect's interpretation."

"1.2.5The word "PROVIDE" as used in the Contract Documents shall mean "FURNISH AND INSTALL" and shall include, without limitation, all labor, materials, equipment, transportation, services and other items required to complete the Work."

"1.2.6The word "PRODUCT" as used in the Contract Documents means all materials, systems and equipment."

1.5 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE

Strike Section 1.5.1 in its entirety and replace with the following:

"All pre-design studies, drawings, specifications and other documents, including those in electronic form, prepared by the Architect under this Agreement are, and shall remain, the property of the Owner whether the Project for which they are made is executed or not.

Such documents may be used by the Owner to construct one or more like Projects without the approval of, or additional compensation to, the Architect. The Contractor, Subcontractors, Sub-subcontractors, and Material or Equipment Suppliers are authorized to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by the Architect and the Architect's consultants appropriate to and for use in the execution of their Work under the Contract Documents. They are not to be used by the Contractor or any Subcontractor, Sub-subcontractor or Material and Equipment Supplier on other Projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and Architect's consultants.

The Architect shall not be liable for injury or damage resulting from the re-use of drawings and specifications if the Architect is not involved in the re-use Project. Prior to re-use of construction documents for a Project in which the Architect is not also involved, the Owner will remove from such documents all identification of the original Architect, including name, address and professional seal or stamp."

Strike Section 1.5.2 in its entirety.

1.7 DIGITAL DATA USE AND TRANSMISSION

Strike Section 1.7 in its entirety and replace with the following:

"The parties shall agree upon protocols governing transmission and use of Instruments of Service or any other information or documentation in digital form."

1.8 BUILDING INFORMATION MODELS USE AND RELIANCE

Strike Section 1.8 in its entirety.

ARTICLE 2: OWNER

2.2 EVIDENCE OF THE OWNERS FINANCIAL ARRANGEMENTS

Strike Section 2.2 in its entirety.

2.3 INFORMATION AND SERVICES REQUIRED OF THE OWNER

2.3.3 Strike 2.3.3 in its entirety.

2.3.4 Add the following sentence at the end of the paragraph:

"The Contractor, at their expense shall bear the costs to accurately identify the location of all underground utilities in the area of their excavation and shall bear all cost for any repairs required, out of failure to accurately identify said utilities."

Strike Section 2.3.6 in its entirety and replace with the following:

"2.3.6 The Contractor shall be furnished free of charge (1) electronic set of the Drawings and Project Manuals. Additional sets will be furnished at the cost of reproduction, postage and handling."

2.5 OWNER'S RIGHT TO CARRY OUT THE WORK

Add ", except as outlined in Section 3.15" after the reference to "Article 15" at the end of the last sentence of the Section.

ARTICLE 3: CONTRACTOR

3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

3.2.2 Add "and Owner" after "report to the Architect" in the second sentence.

3.2.4 Strike "subject to Section 15.1.7" in the second sentence.

3.2.4 Strike the third sentence.

3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

Add the following Sections:

"3.3.2.1 The Contractor shall immediately remove from the Work, whenever requested to do so by the Owner, any person who is considered by the Owner or Architect to be incompetent or disposed to be so disorderly, or who for any reason is not satisfactory to the Owner, and that person shall not again be employed on the Work without the consent of the Owner or the Architect."

"3.3.4 The Contractor must provide suitable storage facilities at the Site for the proper protection and safe storage of their materials, or as otherwise identified by the specifications. Consult the Owner and the Architect before storing any materials."

"3.3.5 When any room is used as a shop, storeroom, office, etc., by the Contractor or Subcontractor(s) during the construction of the Work, the Contractor making use of these areas will be held responsible for any repairs, patching or cleaning arising from such use."

3.4 LABOR AND MATERIALS

Add the Following Sections:

"3.4.4 Before starting the Work, each Contractor shall carefully examine all preparatory Work that has been executed to receive their Work. Check carefully, by whatever means are required, to insure that its Work and adjacent, related Work, will finish to proper contours, planes and levels. Promptly notify the Architect & Owner of any defects or imperfections in preparatory Work which will in any way affect satisfactory completion of its Work. Absence of such notification will be construed as an acceptance of preparatory Work and later claims of defects will not be recognized."

"3.4.5 Under no circumstances shall the Contractor's Work proceed prior to preparatory Work having been completely cured, dried and/or otherwise made satisfactory to receive this Work. Responsibility for timely installation of all materials rests solely with the Contractor responsible for that Work, who shall maintain coordination at all times."

3.5 WARRANTY

Add the following Sections:

"3.5.3 The Contractor will guarantee all materials and workmanship against original defects, except injury from proper and usual wear when used for the purpose intended, for two years after Acceptance by the Owner, and will maintain all items in perfect condition during the period of warranty."

"3.5.4 Defects appearing during the period of warranty will be made good by the Contractor at his expense upon demand of the Owner, it being required that all work will be in perfect condition when the period of warranty will have elapsed."

"3.5.5 Upon notification by the Owner of a defect covered by the Contractor's warranty, the Contractor shall respond within 4 hours of the notification."

"3.5.6 In addition to the General Warranty there are other warranties required for certain items for different periods of time than the two years as above, and are particularly so stated in that part of the specifications referring to same. The said warranties will commence at the same time as the General Warranty."

"3.5.7 If the Contractor fails to remedy any failure, defect or damage within a reasonable time after receipt of notice, the Owner will have the right to replace, repair, or otherwise remedy the failure, defect or damage at the Contractor's expense."

3.8 ALLOWANCES

Add the following Section:

"3.8.1.1 For costs to be covered under a project allowance, (included in the schedule of values) the Contractor shall submit a summary of those costs anticipated and an Allowance Access Authorization Form to the Architect and Owner, reflecting the projected costs. The Allowance Access Authorization Form must be signed by the Owner prior to initiating any work associated with the allowance."

3.10 CONTRACTOR'S CONSTRUCTION AND SUBMITTAL SCHEDULES

3.10.1 Add "estimated" after "and the" and before "date of" in the second sentence.

3.10.2 Strike "and thereafter as necessary to maintain a current submittal schedule" in the first sentence.

3.11 DOCUMENTS AND SAMPLES AT THE SITE

Add the following Sections:

"3.11.1 During the course of the Work, the Contractor shall maintain a record set of drawings on which the Contractor shall mark the actual physical location of all piping, valves, equipment, conduit, outlets, access panels, controls, actuators, including all appurtenances that will be concealed once construction is complete, etc., including all invert elevations."

"3.11.2 At the completion of the project, the Contractor shall obtain a set of the conformed contract drawings from the Architect, and neatly transfer all information outlined in 3.11.1 to provide a complete record of the as-built conditions."

"3.11.3 Upon completion of the work noted in 3.11.2 the contractor shall schedule a meeting with the Architect/Engineer and Owner to review the final record drawings and closeout documents prior to submission. After this meeting the Contractor shall make adjustments per the review, and submit one (1) original markup and (2) copies of the red line drawings (as-built conditions, to the Owner and one (1) print to the Architect. In addition, attach one complete set of the as-built documents to each of the Operating and Maintenance Instructions/Manuals. The Contractor will include (2) USB drives, each containing all "red line drawings (as-built) and Closeout Documents properly tabbed in accordance with closeout requirements as defined elsewhere in the contract documents."

3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

3.12.10.2 Strike "If the Contract Documents require" from the beginning of the sentence.

3.12.10.2 Strike "to" between "professional" and certify" and replace with "shall".

3.17 Insert "indemnify and" between "shall" and "hold" in the second sentence.

ARTICLE 4: ADMINISTRATION OF THE CONTRACT

4.2 ADMINISTRATION OF THE CONTRACT

4.2.7 Strike the first sentence and replace with the following:

"The Architect will review and approve or take other appropriate action upon the Contractor's submittals such as Shop Drawings, Product Data and Samples for the purpose of checking for conformance with the Contract Documents."

4.2.7 Strike the second sentence and replace with the following:

"The Architect's action will be taken with such reasonable promptness as to cause no delay in the Work in the activities of the Owner, Contractor or separate Contractors, while allowing sufficient time in the Owner's professional judgment to permit adequate review."

Add the following Section:

"4.2.10.1 There will be no full-time Project Representative provided by the Owner or Architect on this project."

"4.2.13 Add "and in compliance with all local requirements." to the end of the sentence."

ARTICLE 5: SUBCONTRACTORS

5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

5.2.3 Strike Section 5.2.3 in its entirety and replace with the following:

"If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection, subject to the statutory requirements of 29 Delaware Code § 6962(d)(10)b.3 and 4."

5.2.4 Strike Section 5.2.4 in its entirety and replace with the following:

"The Contractor may not substitute any Subcontractor listed in its Bid unless the Contractor complies with the requirements of 29 Delaware Code § 6962(d)(10)b.3 and 4. Failure to comply with this requirement shall subject the Contractor to a penalty as outlined in Section 5.2 of the Owner's General Requirements."

Add the following Section:

"5.2.5 The Contractor shall comply and shall ensure all Subcontractors comply with all requirements for drug testing as set forth in TITLE 19 LABOR DELAWARE ADMINISTRATIVE CODE 4000 Office of Management and Budget 4100 Division of Facilities Management **4104 Regulations for the Drug Testing of Contractor and Subcontractor Employees Working on Large Public Works Projects."**

ARTICLE 6: CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

6.1.1 Strike "and waiver of subrogation" from the end of the second sentence.

6.1.4 Strike Section 6.1.4 in its entirety.

6.2 MUTUAL RESPONSIBILITY

6.2.3 Strike "shall" and replace with "may" in the second sentence.

ARTICLE 7: CHANGES IN THE WORK

(SEE ARTICLE 7: CHANGES IN WORK IN THE STATE OF DELAWARE DIVISION OF FACILITIES MANAGEMENT GENERAL REQUIREMENTS)

7.2 CHANGE ORDERS

Add the following Sections:

"7.2.2 In addition to the above:

7.2.2.1 The General Contractor is allowed a fifteen percent (15%) markup for overhead and profit for additional work performed by the General Contractor's own forces.

7.2.2.2 For additional subcontractor work, the Subcontractor is allowed a fifteen (15) percent overhead and profit on change order work above and beyond the direct costs stated previously. To this amount, the General Contractor will be allowed a mark-up not exceeding seven- and one-half percent (7.5%) on the subcontractor's work.

7.2.2.3 Where the Third Tier Contractor is going to be completing the additional work, the Third-Tier contractor will be allowed a markup of fifteen percent (15%) overhead and profit on changes order work above and beyond the direct costs stated previously. To this amount, the Subcontractor will be allowed a markup not to exceed seven and one-half percent (7.5%) on the Third-Tier Contractor's work and the General Contractor will be allowed a markup not to exceed seven and one-half percent (7.5%) of the amount of the Subcontractor's markup.

7.2.2.4 No additional costs shall be allowed for changes related to the Contractor's onsite superintendent/staff, or project manager, unless a change in the work changes the project duration and is identified by the CPM schedule. There will be no other costs associated with the change order.

7.2.2.5 These markups shall include all costs including, but not limited to: overhead, profit, bonds, insurance, supervision, etc."

7.3.4.1 Strike "and other employee costs approved by the Architect" after "worker's compensation insurance,"

7.3.4.4 Add "work attributable to the" before "change" at the end of the sentence.

7.4 MINOR CHANGES IN THE WORK
Add "unless such changes are approved" at the end of the third sentence.

ARTICLE 8: TIME

8.2 PROGRESS AND COMPLETION

8.2.1 Add the following Section:

"8.2.1.1 Refer to Project Specifications Section SUMMARY OF WORK for Contract time requirements."

8.2.2 After "by the Contractor" strike "and" and insert "to".

8.2.4 Add the following Section:

"8.2.4 If the Work falls behind the Progress Schedule as submitted by the Contractor, the Contractor shall employ additional labor and/or equipment necessary to bring the Work into compliance with the Progress Schedule at no additional cost to the Owner."

8.3 DELAYS AND EXTENSION OF TIME

8.3.1 Strike "binding dispute resolution" and insert "any and all remedies at law or in equity".

Add the following Section:

"8.3.2.1 The Contractor shall update the status of the suspension, delay, or interruption of the Work with each Application for Payment. (The Contractor shall report the termination of such cause immediately upon the termination thereof.) Failure to comply with this procedure shall constitute a waiver for any claim for adjustment of time or price based upon said cause."

Strike Section 8.3.3 in its entirety and replace with the following:

8.3.3 "Except in the case of a suspension of the Work directed by the Owner, an extension of time under the provisions of Section 8.3.1 shall be the Contractor's sole remedy in the progress of the Work and there shall be no payment or compensation to the Contractor for any expense or damage resulting from the delay."

Add the following Section:

"8.3.4 By permitting the Contractor to work after the expired time for completion of the project, the Owner does not waive their rights under the Contract."

ARTICLE 9: PAYMENTS AND COMPLETION

9.2 SCHEDULE OF VALUES

Add the following Sections:

"9.2.1 The Schedule of Values shall be submitted using AIA Document G703, Continuation Sheet to G702."

"9.2.2 The Schedule of Values is to include a line item for Project Closeout Document Submittal. The value of this item is to be no less than 1.5% of the initial contract amount."

9.3 APPLICATIONS FOR PAYMENT

9.3.1 Strike Section 9.3.1 in its entirety and replace with the following:

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

Add the following Sections:

"9.3.1.3 Application for Payment shall be submitted on AIA Document G702 "Application and Certificate for Payment", supported by AIA Document G703 "Continuation Sheet". Said Applications shall be fully executed and notarized."

"9.3.4 Until Closeout Documents have been received and outstanding items completed the Owner will pay 95% (ninety-five percent) of the amount due the Contractor on account of progress payments."

"9.3.5 The Contractor shall provide a current and updated Progress Schedule to the Architect with each Application for Payment. Failure to provide Schedule will be just cause for rejection of Application for Payment."

9.5 DECISIONS TO WITHHOLD CERTIFICATION

Add the following Subsections to 9.5.1:

.8 failure to provide a current Progress Schedule;
.9 a lien or attachment is filed;
.10 failure to comply with mandatory requirements for maintaining Record Documents.

9.6 PROGRESS PAYMENTS

9.6.1 Strike Section 9.6.1 in its entirety and replace with the following:

"9.6.1 After the Architect has approved and issued a Certificate for Payment, payment shall be made by the Owner within 30 days after Owner's receipt of the Certificate for Payment."

9.6.8 Strike "Provided the Owner has fulfilled its payment obligations under the Contract Documents," in the first sentence.

9.7 FAILURE OF PAYMENT

Strike Section 9.7 in its entirety and replace with the following:

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

9.8 SUBSTANTIAL COMPLETION

9.8.3 At the end of Section 9.8.3, add the following sentence:

"If the Architect is required to make more than 2 inspections of the same portion of work, the Contractor shall be responsible for all costs associated with subsequent inspections including but not limited to any Architect's fees."

9.8.5 Strike "shall" and insert "may" in the second sentence.

9.8.5 Insert "1/2 of the" after "make payment of" in the second sentence.

9.9 PARTIAL OCCUPANCY OR USE

9.9.1 Strike the the first sentence and replace with the following (the remainder of the Section remains as written):
"The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use authorized by public authorities having jurisdiction over the Project."

9.10.2 Strike "to remain in force after final payment is currently in effect" after "required by the Contract Documents" and replace with "shall remain in force until final payment is completed" in the first sentence.

9.10.4.4 Strike "if permitted by the Contract Documents,"

ARTICLE 10: PROTECTION OF PERSONS AND PROPERTY

10.1 SAFETY PRECAUTIONS AND PROGRAMS

Add the following Sections:

10.1.1 Each Contractor shall develop a safety program in accordance with the Occupational Safety and Health Act of 1970. A copy of said plan shall be furnished to the Owner and Architect prior to the commencement of that Contractor's Work.

10.1.2 Each Contractor shall appoint a Safety Representative. Safety Representatives shall be someone who is on site on a full time basis. If deemed necessary by the Owner or Architect, Contractor Safety meetings will be scheduled. The attendance of all Safety Representatives will be required. Minutes will be recorded of said meetings by the Contractor and will be distributed to all parties as well as posted in all job offices/trailers etc.

10.2 SAFETY OF PERSONS AND PROPERTY

Add the following Section:

10.2.4.1 As required in the Hazardous Chemical Act of June 1984, all vendors supplying any material that may be defined as hazardous must provide Material Safety Data Sheets for those products. Any chemical product should be considered hazardous if it has a caution warning on the label relating to a potential physical or health hazard, if it is known to be present in the work place, and if employees may be exposed under normal conditions or in foreseeable emergency situations. Material Safety Data Sheets shall be provided directly to the Owner, along with the shipping slips that include those products.

10.2.5 Strike the second sentence in its entirety.

10.3 HAZARDOUS MATERIALS AND SUBSTANCES

10.3.3 Strike Section 10.3.3 in its entirety.

10.3.4 Insert “hazardous” in the last sentence after “handling of such” .

10.3.6 Strike Section 10.3.6 in its entirety.

ARTICLE 11: INSURANCE AND BONDS

11.1 CONTRACTOR’S INSURANCE AND BONDS

11.1.1 Strike “Owner” from the third sentence.

11.2 OWNER’S LIABILITY INSURANCE

Strike 11.2 in its entirety, except that in the case of school projects in which case Section 11.2 shall remain.

11.3 WAIVERS OF SUBROGATION

Delete Section 11.3 in its entirety

11.4 LOSS OF USE, BUSINESS INTERRUPTION, AND DELAY IN COMPLETION INSURANCE

Delete Section 11.4 in its entirety

ARTICLE 12: UNCOVERING AND CORRECTION OF WORK

12.2.2 AFTER SUBSTANTIAL COMPLETION

Add the following Section:

“12.2.2.1.1 At any time during the progress of the Work, or in any case where the nature of the defects will be such that it is not expedient to have corrected, the Owner, at its option, will have the right to deduct such sum, or sums, of money from the amount of the Contract as it considers justified to adjust the difference in value between the non-conforming work and that required under contract including any damage to the structure.”

12.2.2.1 Strike all references to “one year” or “one-year” and replace with “two years”.

12.2.2.2 Strike “one-year” and replace with “two years”.

12.2.2.3 Strike “one-year” and replace with “two years”.

12.2.5 Strike “one-year” and replaced with “two years”.

ARTICLE 13: MISCELLANEOUS PROVISIONS

13.1 GOVERNING LAW

Strike the last sentence.

13.4 TESTS AND INSPECTIONS

13.4.1 Strike the last sentence and replace with the following:

"The Owner shall pay for tests, inspections, or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor."

13.5 INTEREST

Strike "the date payment is due at such rate as the parties may agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located" and replace with "30 days of presentment of the authorized Certificate of Payment at the annual rate of 12% or 1% per month."

Insert the following Section:

"13.6 CONFLICTS WITH FEDERAL STATUTES OR REGULATIONS

13.6.1 If any provision, specifications or requirement of the Contract Documents conflict or is inconsistent with any statute, law or regulation of the government of the United State of America, the Contractor shall notify the Architect and Owner immediately upon discovery."

ARTICLE 14: TERMINATION OR SUSPENSION OF THE CONTRACT

14.1 TERMINATION BY THE CONTRACTOR

14.1.1.4 Insert ", upon the Contractors' request," after "furnish to the Contractor".

14.1.3 Strike "and profit on Work not executed, and" after "as well as reasonable overhead" and replace with ", profit, and reasonable"

14.3 SUSPENSION BY OWNER FOR CONVENIENCE

14.3.2 Strike "Adjustment of the Contract Sum shall include profit".

14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

14.4.3 Strike Section 14.4.3 in its entirety and replace with the following:

"In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and reasonable costs incurred by reason of such termination along with reasonable overhead."

ARTICLE 15: CLAIMS AND DISPUTES

15.1 CLAIMS

15.1.2 TIME LIMITS ON CLAIMS

Strike the last sentence.

15.1.3 NOTICE OF CLAIM

Strike all references to "21" and replace with "45".

15.1.5 CLAIMS FOR ADDITIONAL COSTS

Strike the first sentence and replace with the following:

"Contractor shall not proceed to execute any portion of the Work that is subject to the Claim without prior approval of the costs or method of payment for the costs associated with the Claim as determined by the Architect and approved by the Owner."

15.1.7 WAIVER OF CLAIMS FOR CONSEQUENTIAL DAMAGES

Strike Section 15.1.7 in its entirety.

15.2 INITIAL DECISION

15.2.1 Strike "and binding dispute resolution" in the fourth sentence and replace with "or any and all remedies at law or in equity".

15.2.5 Strike Section 15.2.5 in its entirety and replace with the following:

"The Architect will approve or reject Claims by written decision, which shall state the reasons therefore and shall notify the parties of any change in the Contract Sum or Contract Time or both. The approval or rejection of a Claim by the Architect shall be subject to mediation and any or all remedies at law or in equity."

15.2.6 Strike Section 15.2.6 and its sub-Sections in their entirety.

15.3 MEDIATION

15.3.1 Strike "binding dispute resolution" and replace with "any or all remedies at law or in equity".

15.3.2 Strike ", shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedure in effect on the date of the Agreement," in the first sentence.

15.3.2 Strike all references to "binding dispute resolution" and replace with "any or all remedies at law and in equity".

15.3.3 Strike Section 15.3.3 in its entirety.

15.4 ARBITRATION

Strike Section 15.4 and its Subsections in their entirety.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 00 73 43

DELAWARE DEPARTMENT OF LABOR PREVAILING WAGE RATES

STATE OF DELAWARE
DEPARTMENT OF LABOR
DIVISION OF INDUSTRIAL AFFAIRS
OFFICE OF LABOR LAW ENFORCEMENT
PHONE: (302) 318-2769

Mailing Address:
252 Chapman Road
Suite 210
Newark, DE 19702

Located at:
252 Chapman Road
Suite 210
Newark, DE 19702

PREVAILING WAGES FOR **BUILDING CONSTRUCTION** EFFECTIVE MARCH 13, 2026

CLASSIFICATION	NEW CASTLE	KENT	SUSSEX
ASBESTOS WORKERS	30.70	37.78	55.01
BOILERMAKERS	91.87	46.61	68.52
BRICKLAYERS	68.29	68.29	68.29
CARPENTERS	64.06	64.06	52.30
CEMENT FINISHERS	96.91	68.92	53.44
ELECTRICAL LINE WORKERS	61.02	52.34	39.90
ELECTRICIANS	86.87	86.87	86.87
ELEVATOR CONSTRUCTORS	121.73	86.57	109.37
GLAZIERS	88.42	88.42	76.04
INSULATORS	71.54	71.54	71.54
IRON WORKERS	79.33	79.33	79.33
LABORERS	59.65	59.65	59.65
MILLWRIGHTS	91.00	91.00	73.10
PAINTERS	61.53	61.53	61.53
PILEDRIVERS	93.37	52.83	42.72
PLASTERERS	40.06	40.06	29.69
PLUMBERS/PIPEFITTERS/STEAMFITTERS	82.05	85.29	78.26
POWER EQUIPMENT OPERATORS	85.29	85.29	85.29
ROOFERS-COMPOSITION	36.41	31.28	33.64
ROOFERS-SHINGLE/SLATE/TILE	24.68	29.36	23.08
SHEET METAL WORKERS	87.84	87.84	87.84
SOFT FLOOR LAYERS	63.69	63.69	50.43
SPRINKLER FITTERS	77.63	77.63	77.63
TERRAZZO/MARBLE/TILE FNRS	73.75	73.75	84.10
TERRAZZO/MARBLE/TILE STRS	81.93	81.93	93.27
TRUCK DRIVERS	58.41	36.83	28.66

CERTIFIED: 4-6-2026 BY: Salina Chrostek/kc
ADMINISTRATOR, OFFICE OF LABOR LAW ENFORCEMENT

NOTE: THESE RATES ARE PROMULGATED AND ENFORCED PURSUANT TO THE PREVAILING WAGE REGULATIONS ADOPTED BY THE DEPARTMENT OF LABOR ON APRIL 3, 1992.

CLASSIFICATIONS OF WORKERS ARE DETERMINED BY THE DEPARTMENT OF LABOR. FOR ASSISTANCE IN CLASSIFYING WORKERS, OR FOR A COPY OF THE REGULATIONS OR CLASSIFICATIONS, PHONE (302) 318-2769.

NON-REGISTERED APPRENTICES MUST BE PAID THE MECHANIC'S RATE.

PROJECT: White Clay Creek State Park Proposed Nature Center, New Castle County

(THIS PAGE INTENTIONALLY LEFT BLANK)

SECTION 00 81 13

GENERAL REQUIREMENTS

TABLE OF ARTICLES

1. GENERAL

2. OWNER

3. CONTRACTOR

4. ADMINISTRATION OF THE CONTRACT

5. SUBCONTRACTORS

6. CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

7. CHANGES IN THE WORK

8. TIME

9. PAYMENTS AND COMPLETION

10. PROTECTION OF PERSONS AND PROPERTY

11. INSURANCE AND BONDS

12. UNCOVERING AND CORRECTION OF WORK

13. MISCELLANEOUS PROVISIONS

14. TERMINATION OR SUSPENSION OF THE CONTRACT

ARTICLE 1: GENERAL

1.1 CONTRACT DOCUMENTS

1.1.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary and what is required by one shall be as binding as if required by all. Performance by the Contractor shall be required to an extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the intended results.

1.1.2 Work including material purchases shall not begin until the Contractor is in receipt of a bonafide State of Delaware Purchase Order. Any work performed or material purchases prior to the issuance of the Purchase Order is done at the Contractor's own risk and cost.

1.2 EQUALITY OF EMPLOYMENT OPPORTUNITY ON PUBLIC WORKS

1.2.1 For Public Works Projects financed in whole or in part by state appropriation the Contractor agrees that during the performance of this contract:

1. The Contractor will not discriminate against any employee or applicant for employment because of race, creed, sex, color, sexual orientation, gender identity or national origin. The Contractor will take positive steps to ensure that applicants are employed and that employees are treated during employment without regard to their race, creed, sex, color, sexual orientation, gender identity or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places available to employees and applicants for employment notices to be provided by the contracting agency setting forth this nondiscrimination clause.

2. The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, creed, sex, color, sexual orientation, gender identity or national origin."

ARTICLE 2: OWNER

(NO ADDITIONAL GENERAL REQUIREMENTS – SEE SUPPLEMENTARY GENERAL CONDITIONS)

ARTICLE 3: CONTRACTOR

3.1 Schedule of Values: The successful Bidder shall within twenty (20) days after receiving notice to proceed with the work, furnish to the Owner a complete schedule of values on the various items comprising the work.

3.2 Subcontracts: Upon approval of Subcontractors, the Contractor shall award their Subcontracts as soon as possible after the signing of their own contract and see that all material, their own and those of their Subcontractors, are promptly ordered so that the work will not be delayed by failure of materials to arrive on time.

3.3 Before commencing any work or construction, the General Contractor is to consult with the Owner as to matters in connection with access to the site and the allocation of Ground Areas for the various features of hauling, storage, etc.

3.4 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions.

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

3.6 The Contractor warrants to the Owner that materials and equipment furnished will be new and of good quality, unless otherwise permitted, and that the work will be free from defects and in conformance with the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved, may be considered defective. If required by the Owner, the Contractor shall furnish evidence as to the kind and quality of materials and equipment provided.

3.7 Unless otherwise provided, the Contractor shall pay all sales, consumer, use and other similar taxes, and shall secure and pay for required permits, fees, licenses, and inspections necessary for proper execution of the Work.

3.8 The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations, and lawful orders of public authorities bearing on performance of the Work. The Contractor shall promptly notify the Owner if the Drawings and Specifications are observed to be at variance therewith.

3.9 The Contractor shall be responsible to the Owner for the acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons performing portions of the Work under contract with the Contractor.

3.10 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work the Contractor shall remove from and about the Project all waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials. The Contractor shall be responsible for returning all damaged areas to their original conditions.

3.11 STATE LICENSE AND TAX REQUIREMENTS

3.11.1 Each Contractor and Subcontractor shall be licensed to do business in the State of Delaware and shall pay all fees and taxes due under State laws. In conformance with Section 2503, Chapter 25, Title 30, Delaware Code, "the Contractor shall furnish the Delaware Department of Finance within ten (10) days after entering into any contract

with a contractor or subcontractor not a resident of this State, a statement of total value of such contract or contracts together with the names and addresses of the contracting parties."

3.12 The Contractor shall comply with all requirements set forth in Section 6962, Chapter 69, Title 29 of the Delaware Code.

3.13 During the contract Work, the Contractor and each Subcontractor, shall implement an Employee Drug Testing Program in accordance with OMB Regulation 4104 - "Regulations for the Drug Testing of Contractor and Subcontractor Employees Working on "Large Public Works Projects". "Large Public Works" is based upon the current threshold required for bidding Public Works as set by the Purchasing and Contracting Advisory Council.

ARTICLE 4: ADMINISTRATION OF THE CONTRACT

4.1 CONTRACT SURETY

4.1.1 PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND

4.1.2 All bonds will be required as follows unless specifically waived elsewhere in the Bidding Documents.

4.1.3 Contents of Performance Bonds – The bond shall be in the form approved by the Office of Management and Budget. The bond shall be conditioned upon the faithful compliance and performance by the successful bidder of each and every term and condition of the contract and the proposal, plans, specifications, and bid documents thereof. Each term and condition shall be met at the time and in the manner prescribed by the Contract, Bid documents and the specifications, including the payment in full to every person furnishing materiel or performing labor in the performance of the Contract, of all sums of money due the person for such labor and materiel. (The bond shall also contain the successful bidder's guarantee to indemnify and save harmless the State and the agency from all costs, damages and expenses growing out of or by reason of the Contract in accordance with the Contract.)

4.1.4 Invoking a Performance Bond – The agency may, when it considers that the interest of the State so requires, cause judgement to be confessed upon the bond.

4.1.5 Within twenty (20) days after the date of notice of award of contract, the Bidder to whom the award is made shall furnish a Performance Bond and Labor and Material Payment Bond, each equal to the full amount of the Contract price to guarantee the faithful performance of all terms, covenants and conditions of the same. The bonds are to be issued by an acceptable Bonding Company licensed to do business in the State of Delaware and shall be issued in duplicate.

4.1.6 Performance and Payment Bonds shall be maintained in full force (warranty bond) for a period of two (2) years after the date of the Certificate for Final Payment. The Performance Bond shall guarantee the satisfactory completion of the Project and that the Contractor will make good any faults or defects in his work which may develop during the period of said guarantees as a result of improper or defective workmanship, material or apparatus, whether

furnished by themselves or their Sub-Contractors. The Payment Bond shall guarantee that the Contractor shall pay in full all persons, firms or corporations who furnish labor or material or both labor and material for, or on account of, the work included herein. The bonds shall be paid for by this Contractor. The Owner shall have the right to demand that the proof parties signing the bonds are duly authorized to do so.

4.2 FAILURE TO COMPLY WITH CONTRACT

4.2.1 If any firm entering into a contract with the State, or Agency that neglects or refuses to perform or fails to comply with the terms thereof, the Agency which signed the Contract may terminate the Contract and proceed to award a new contract in accordance with this Chapter 69, Title 29 of the Delaware Code or may require the Surety on the Performance Bond to complete the Contract in accordance with the terms of the Performance Bond. Nothing herein shall preclude the Agency from pursing additional remedies as otherwise provided by law.

4.3 CONTRACT INSURANCE AND CONTRACT LIABILITY

4.3.1 In addition to the bond requirements stated in the Bid Documents, each successful Bidder shall purchase adequate insurance for the performance of the Contract and, by submission of a Bid, agrees to indemnify and save harmless and to defend all legal or equitable actions brought against the State, any Agency, officer and/or employee of the State, for and from all claims of liability which is or may be the result of the successful Bidder's actions during the performance of the Contract.

4.3.2 The purchase or nonpurchase of such insurance or the involvement of the successful Bidder in any legal or equitable defense of any action brought against the successful Bidder based upon work performed pursuant to the Contract will not waive any defense which the State, its agencies and their respective officers, employees and agents might otherwise have against such claims, specifically including the defense of sovereign immunity, where applicable, and by the terms of this section, the State and all agencies, officers and employees thereof shall not be financially responsible for the consequences of work performed, pursuant to said contract.

4.4 RIGHT TO AUDIT RECORDS

4.4.1 The Owner shall have the right to audit the books and records of a Contractor or any Subcontractor under any Contract or Subcontract to the extent that the books and records relate to the performance of the Contract or Subcontract.

4.4.2 Said books and records shall be maintained by the Contractor for a period of seven (7) years from the date of final payment under the Prime Contract and by the Subcontractor for a period of seven (7) years from the date of final payment under the Subcontract.

ARTICLE 5: SUBCONTRACTORS

5.1 SUBCONTRACTING REQUIREMENTS

5.1.1 All contracts for the construction, reconstruction, alteration or repair of any public building (not a road, street or highway) shall be subject to the following provisions:

1. A contract shall be awarded only to a Bidder whose Bid is accompanied by a statement containing, for each Subcontractor category, the name and address (city or town and State only – street number and P.O. Box addresses not required) of the subcontractor whose services the Bidder intends to use in performing the Work and providing the material for such Subcontractor category.

2. A Bid will not be accepted nor will an award of any Contract be made to any Bidder which, as the Prime Contractor, has listed itself as the Subcontractor for any Subcontractor unless:

   A. It has been established to the satisfaction of the awarding Agency that the Bidder has customarily performed the specialty work of such Subcontractor category by artisans regularly employed by the Bidder's firm;

   B. That the Bidder is duly licensed by the State to engage in such specialty work, if the State requires licenses; and

   C. That the Bidder is recognized in the industry as a bona fide Subcontractor or Contractor in such specialty work and Subcontractor category.

5.1.2 The decision of the awarding Agency as to whether a Bidder who list itself as the Subcontractor for a Subcontractor category shall be final and binding upon all Bidders, and no action of any nature shall lie against any awarding agency or its employees or officers because of its decision in this regard.

5.1.3 After such a Contract has been awarded, the successful Bidder shall not substitute another Subcontractor for any Subcontractor whose name was set forth in the statement which accompanied the Bid without the written consent of the awarding Agency.

5.1.4 No Agency shall consent to any substitution of Subcontractors unless the Agency is satisfied that the Subcontractor whose name is on the Bidders accompanying statement:

   A. Is unqualified to perform the work required;

   B. Has failed to execute a timely reasonable Subcontract;

   C. Has defaulted in the performance on the portion of the work covered by the Subcontract; or

   D. Is no longer engaged in such business.

5.1.5 Should a Bidder be awarded a contract, such successful Bidder shall provide to the agency the taxpayer identification license numbers of such subcontractors. Such numbers shall be provided on the later of the date on which such subcontractor is required to be identified or the time the contract is executed. The successful Bidder shall provide to the agency to which it is contracting, within 30 days of entering into such public works contract, copies of all Delaware Business licenses of subcontractors and/or independent contractors that will

perform work for such public works contract. However, if a subcontractor or independent contractor is hired or contracted more than 20 days after the Bidder entered the public works contract the Delaware Business license of such subcontractor or independent contractor shall be provided to the agency within 10 days of being contracted or hired.

5.1.6 The Contractor may employ additional Subcontractors on the jobsite only after submitting a copy of the Subcontractor's Employee Drug Testing Program to the Owner for approval. A Contractor or Subcontractor shall not commence work until the Owner has concluded its review and determined that the submitted Employee Drug Testing Program complies with OMB Regulation 4104.

5.2 PENALTY FOR SUBSTITUTION OF SUBCONTRACTORS

5.2.1 Should the Contractor fail to utilize any or all of the Subcontractors in the Contractor's Bid statement in the performance of the Work on the public bidding, the Contractor shall be penalized in the amount of (project specific amount*). The Agency may determine to deduct payments of the penalty from the Contractor or have the amount paid directly to the Agency. Any penalty amount assessed against the Contractor may be remitted or refunded, in whole or in part, by the Agency awarding the Contract, only if it is established to the satisfaction of the Agency that the Subcontractor in question has defaulted or is no longer engaged in such business. No claim for the remission or refund of any penalty shall be granted unless an application is filed within one year after the liability of the successful Bidder accrues. All penalty amounts assessed and not refunded or remitted to the contractor shall be reverted to the State.

*one (1) percent of contract amount not to exceed $10,000

5.3 ASBESTOS ABATEMENT

5.3.1 The selection of any Contractor to perform asbestos abatement for State-funded projects shall be approved by the Office of Management and Budget, Division of Facilities Management pursuant to Chapter 78 of Title 16.

5.4 STANDARDS OF CONSTRUCTION FOR THE PROTECTION OF THE PHYSICALLY HANDICAPPED

5.4.1 All Contracts shall conform with the standard established by the Delaware Architectural Accessibility Board unless otherwise exempted by the Board.

5.5 CONTRACT PERFORMANCE

5.5.1 Any firm entering into a Public Works Contract that neglects or refuses to perform or fails to comply with its terms, the Agency may terminate the Contract and proceed to award a new Contract or may require the Surety on the Performance Bond to complete the Contract in accordance with the terms of the Performance Bond.

ARTICLE 6: CONSTRUCTION BY OWNER OR SEPARATE CONTRACTORS

6.1 The Owner reserves the right to simultaneously perform other construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other Projects at the same site.

6.2 The Contractor shall afford the Owner and other Contractors reasonable opportunity for access and storage of materials and equipment, and for the performance of their activities, and shall connect and coordinate their activities with other forces as required by the Contract Documents.

ARTICLE 7: CHANGES IN THE WORK

7.1 The Owner, without invalidating the Contract, may order changes in the Work consisting of Additions, Deletions, Modifications or Substitutions, with the Contract Sum and Contract completion date being adjusted accordingly. Such changes in the Work shall be authorized by written Change Order signed by the Professional, as the duly authorized agent, the Contractor and the Owner.

7.2 The Contract Sum and Contract Completion Date shall be adjusted only by a fully executed Change Order.

7.3 The additional cost, or credit to the Owner resulting from a change in the Work shall be by mutual agreement of the Owner, Contractor and the Architect. In all cases, this cost or credit shall be based on the 'DPE' wages required and the "invoice price" of the materials/equipment needed.

7.3.1 "DPE" shall be defined to mean "direct personnel expense". Direct payroll expense includes prevailing wage rates plus a maximum multiplier of 1.35 times DPE. For example, if the prevailing wage rate is $50/hour, the DPE would be $67.50/hour (50 x 1.35).

7.3.2 "Invoice price" of materials/equipment shall be defined to mean the actual cost of materials and/or equipment that is paid by the Contractor, (or subcontractor), to a material distributor, direct factory vendor, store, material provider, or equipment leasing entity. Rates for equipment that is leased and/or owned by the Contractor or subcontractor(s) shall not exceed those listed in the latest version of the "Means Building Construction Cost Data" publication.

7.3.3 In addition to the above:

7.3.3.1 The General Contractor is allowed a fifteen percent (15%) markup for overhead and profit for additional work performed by the General Contractor's own forces.

7.3.3.2 For additional subcontractor work, the Subcontractor is allowed a fifteen (15) percent overhead and profit on change order work above and beyond the direct costs stated previously. To this amount, the General Contractor will be allowed a mark-up not exceeding seven- and one-half percent (7.5%) on the subcontractor's work.

7.3.3.3 Where the Third Tier Contractor is going to be completing the additional work, the Third-Tier contractor will be allowed a markup of fifteen percent (15%) overhead and

profit on changes order work above and beyond the direct costs stated previously. To this amount, the Subcontractor will be allowed a markup not to exceed seven and one-half percent (7.5%) on the Third-Tier Contractor's work and the General Contractor will be allowed a markup not to exceed seven and one-half percent (7.5%) of the amount of the Subcontractor's markup.

7.3.3.4 No additional costs shall be allowed for changes related to the Contractor's onsite superintendent/staff, or project manager, unless a change in the work changes the project duration and is identified by the CPM schedule. There will be no other costs associated with the change order.

7.3.3.5 These markups shall include all costs including, but not limited to: overhead, profit, bonds, insurance, supervision, etc.

ARTICLE 8: TIME

8.1 Time limits, if any, are as stated in the Project Manual. By executing the Agreement, the Contractor confirms that the stipulated limits are reasonable, and that the Work will be completed within the anticipated time frame.

8.2 If progress of the Work is delayed at any time by changes ordered by the Owner, by labor disputes, fire, unusual delay in deliveries, abnormal adverse weather conditions, unavoidable casualties or other causes beyond the Contractor's control, the Contract Time shall be extended for such reasonable time as the Owner may determine.

8.3 Any extension of time beyond the date fixed for completion of the construction and acceptance of any part of the Work called for by the Contract, or the occupancy of the building by the Owner, in whole or in part, previous to the completion shall not be deemed a waiver by the Owner of his right to annul or terminate the Contract for abandonment or delay in the matter provided for, nor relieve the Contractor of full responsibility

8.4 SUSPENSION AND DEBARMENT

8.4.1 Per Section 6962(d)(14), Title 29, Delaware Code, "Any Contractor who fails to perform a public works contract or complete a public works project within the time schedule established by the Agency in the Invitation To Bid, may be subject to Suspension or Debarment for one or more of the following reasons: a) failure to supply the adequate labor supply ratio for the project; b) inadequate financial resources; or, c) poor performance on the Project."

8.4.2 "Upon such failure for any of the above stated reasons, the Agency that contracted for the public works project may petition the Director of the Office of Management and Budget for Suspension or Debarment of the Contractor. The Agency shall send a copy of the petition to the Contractor within three (3) working days of filing with the Director. If the Director concludes that the petition has merit, the Director shall schedule and hold a hearing to determine whether to suspend the Contractor, debar the Contractor or deny the petition. The Agency shall have the burden of proving, by a preponderance of the evidence, that the Contractor failed to perform or complete the public works project within the time schedule established by the Agency and failed to do so for one or more of

the following reasons: a) failure to supply the adequate labor supply ratio for the project; b) inadequate financial resources; or, c) poor performance on the project. Upon a finding in favor of the Agency, the Director may suspend a Contractor from Bidding on any project funded, in whole or in part, with public funds for up to 1 year for a first offense, up to 3 years for a second offense and permanently debar the Contractor for a third offense. The Director shall issue a written decision and shall send a copy to the Contractor and the Agency. Such decision may be appealed to the Superior Court within thirty (30) days for a review on the record."

8.5 RETAINAGE

8.5.1 Per Section 6962(d)(5) a.3, Title 29, Delaware Code: The Agency may at the beginning of each public works project establish a time schedule for the completion of the project. If the project is delayed beyond the completion date due to the Contractor's failure to meet their responsibilities, the Agency may forfeit, at its discretion, all or part of the Contractor's retainage.

8.5.2 This forfeiture of retainage also applies to the timely completion of the punchlist. A punchlist will only be prepared upon the mutual agreement of the Owner, Architect and Contractor. Once the punchlist is prepared, all three parties will by mutual agreement, establish a schedule for its completion. Should completion of the punchlist be delayed beyond the established date due to the Contractor's failure to meet their responsibilities, the Agency may hold permanently, at its discretion, all or part of the Contractor's retainage.

ARTICLE 9: PAYMENTS AND COMPLETION

9.1 APPLICATION FOR PAYMENT

9.1.1 Applications for payment shall be made upon AIA Document G702. There will be a five percent (5%) retainage on all Contractor's monthly invoices until completion of the project. This retainage may become payable upon receipt of all required closeout documentation, provided all other requirements of the Contract Documents have been met.

9.1.2 A date will be fixed for the taking of the monthly account of work done. Upon receipt of Contractor's itemized application for payment, such application will be audited, modified, if found necessary, and approved for the amount. Statement shall be submitted to the Owner.

9.1.3 Section 6516, Title 29 of the Delaware Code annualized interest is not to exceed 12% per annum beginning thirty (30) days after the "presentment" (as opposed to the date) of the invoice.

9.2 PARTIAL PAYMENTS

9.2.1 Any public works Contract executed by any Agency may provide for partial payments at the option of the Owner with respect to materials placed along or upon the sites or stored at secured locations, which are suitable for use in the performance of the contract.

9.2.2 When approved by the agency, partial payment may include the values of tested and acceptable materials of a nonperishable or noncontaminative nature which have been

produced or furnished for incorporation as a permanent part of the work yet to be completed, provided acceptable provisions have been made for storage.

9.2.2.1 Any allowance made for materials on hand will not exceed the delivered cost of the materials as verified by invoices furnished by the Contractor, nor will it exceed the contract bid price for the material complete in place.

9.2.3 If requested by the Agency, receipted bills from all Contractors, Subcontractors, and material, men, etc., for the previous payment must accompany each application for payment. Following such a request, no payment will be made until these receipted bills have been received by the Owner.

9.3 SUBSTANTIAL COMPLETION

9.3.1 When the building has been made suitable for occupancy, but still requires small items of miscellaneous work, the Owner will determine the date when the project has been substantially completed.

9.3.2 If, after the Work has been substantially completed, full completion thereof is materially delayed through no fault of the Contractor, and without terminating the Contract, the Owner may make payment of the balance due for the portion of the Work fully completed and accepted. Such payment shall be made under the terms and conditions governing final payment that it shall not constitute a waiver of claims.

9.3.3 On projects where commissioning is included, the commissioning work as defined in the specifications must be complete prior to the issuance of substantial completion.

9.4 FINAL PAYMENT

9.4.1 Final payment, including the five percent (5%) retainage if determined appropriate, shall be made within thirty (30) days after the Work is fully completed and the Contract fully performed and provided that the Contractor has submitted the following closeout documentation (in addition to any other documentation required elsewhere in the Contract Documents):

9.4.1.1 Evidence satisfactory to the Owner that all payrolls, material bills, and other indebtedness connected with the work have been paid,

9.4.1.2 An acceptable RELEASE OF LIENS,

9.4.1.3 Copies of all applicable warranties,

9.4.1.4 As-built drawings,

9.4.1.5 Operations and Maintenance Manuals,

9.4.1.6 Instruction Manuals,

9.4.1.7 Consent of Surety to final payment.

9.4.1.8 The Owner reserves the right to retain payments, or parts thereof, for its protection until the foregoing conditions have been complied with, defective work corrected and all unsatisfactory conditions remedied.

ARTICLE 10: PROTECTION OF PERSONS AND PROPERTY

10.1 The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract. The Contractor shall take all reasonable precautions to prevent damage, injury or loss to: workers, persons nearby who may be affected, the Work, materials and equipment to be incorporated, and existing property at the site or adjacent thereto. The Contractor shall give notices and comply with applicable laws ordinances, rules regulations, and lawful orders of public authorities bearing on the safety of persons and property and their protection from injury, damage, or loss. The Contractor shall promptly remedy damage and loss to property at the site caused in whole or in part by the Contractor, a Subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable.

10.2 The Contractor shall notify the Owner in the event any existing hazardous material such as lead, PCBs, asbestos, etc. is encountered on the project. The Owner will arrange with a qualified specialist for the identification, testing, removal, handling and protection against exposure or environmental pollution, to comply with applicable regulation laws and ordinances. The Contractor and Architect will not be required to participate in or to perform this operation. Upon completion of this work, the Owner will notify the Contractor and Architect in writing the area has been cleared and approved by the authorities in order for the work to proceed. The Contractor shall attach documentation from the authorities of said approval.

10.3 As required in the Hazardous Chemical Information Act of June 1984, all vendors supplying any materials that may be defined as hazardous, must provide Material Safety Data Sheets for those products. Any chemical product should be considered hazardous if it has a warning caution on the label relating to a potential physical or health hazard, if it is known to be present in the work place, and if employees may be exposed under normal conditions or in any foreseeable emergency situation. Material Safety Data Sheets must be provided directly to the Owner along with the shipping slips that include those products.

10.4 The Contractor shall certify to the Owner that materials incorporated into the Work are free of all asbestos. This certification may be in the form of Material Safety Data Sheet (MSDS) provided by the product manufacturer for the materials used in construction, as specified or as provided by the Contractor.

ARTICLE 11: INSURANCE AND BONDS

11.1 The Contractor shall carry all insurance required by law, such as Unemployment Insurance, etc. The Contractor shall carry such insurance coverage as they desire on their own property such as a field office, storage sheds or other structures erected upon the project site that belong to them and for their own use. The Subcontractors involved with this project shall carry whatever insurance protection they consider necessary to cover the loss of any of their personal property, etc.

11.2 Upon being awarded the Contract, the Contractor shall obtain a minimum of two (2) copies of all required insurance certificates called for herein, and submit one (1) copy of each certificate, to the Owner, within 20 days of contract award.

11.3 Bodily Injury Liability and Property Damage Liability Insurance shall, in addition to the coverage included herein, include coverage for injury to or destruction of any property arising out of the collapse of or structural injury to any building or structure due to demolition work and evidence of these coverages shall be filed with and approved by the Owner.

11.4 The Contractor's Property Damage Liability Insurance shall, in addition to the coverage noted herein, include coverage on all real and personal property in their care, custody and control damaged in any way by the Contractor or their Subcontractors during the entire construction period on this project.

11.5 Builders Risk (including Standard Extended Coverage Insurance) on the existing building during the entire construction period, may be provided by the Contractor under this contract. The Owner shall insure the existing building and all of its contents and all this new alteration work under this contract during entire construction period for the full insurable value of the entire work at the site. Note, however, that the Contractor and their Subcontractors shall be responsible for insuring building materials (installed and stored) and their tools and equipment whenever in use on the project, against fire damage, theft, vandalism, etc.

11.6 Certificates of the insurance company or companies stating the amount and type of coverage, terms of policies, etc., shall be furnished to the Owner, within 20 days of contract award.

11.7 The Contractor shall, at their own expense, (in addition to the above) carry the following forms of insurance:

11.7.1 Contractor's Contractual Liability Insurance

Minimum coverage to be:

Bodily Injury		
	$1,000,000	for each occurrence
	$3,000,000	aggregate
Property Damage	$1,000,000	for each occurrence
	$3,000,000	aggregate

11.7.2 Contractor's Protective Liability Insurance

Minimum coverage to be:

Bodily Injury		
	$1,000,000	for each occurrence
	$3,000,000	aggregate

Property Damage	$1,000,000	for each occurrence
	$3,000,000	aggregate

11.7.3 Automobile Liability Insurance

Minimum coverage to be:

Bodily Injury	$1,000,000	for each person
	$1,000,000	for each occurrence
Property Damage	$500,000	per accident

11.7.4 Prime Contractor's and Subcontractors' policies shall include contingent and contractual liability coverage in the same minimum amounts as 11.7.1 above.

11.7.5 Workmen's Compensation (including Employer's Liability):

11.7.5.1 Minimum Limit on employer's liability to be as required by law.

11.7.5.2 Minimum Limit for all employees working at one site.

11.7.6 Certificates of Insurance must be filed with the Owner guaranteeing fifteen (15) days prior notice of cancellation, non-renewal, or any change in coverages and limits of liability shown as included on certificates.

11.7.7 Social Security Liability

11.7.7.1 With respect to all persons at any time employed by or on the payroll of the Contractor or performing any work for or on their behalf, or in connection with or arising out of the Contractor's business, the Contractor shall accept full and exclusive liability for the payment of any and all contributions or taxes or unemployment insurance, or old age retirement benefits, pensions or annuities now or hereafter imposed by the Government of the United States and the State or political subdivision thereof, whether the same be measured by wages, salaries or other remuneration paid to such persons or otherwise.

11.7.7.2 Upon request, the Contractor shall furnish Owner such information on payrolls or employment records as may be necessary to enable it to fully comply with the law imposing the aforesaid contributions or taxes.

11.7.7.3 If the Owner is required by law to and does pay any and/or all of the aforesaid contributions or taxes, the Contractor shall forthwith reimburse the Owner for the entire amount so paid by the Owner.

ARTICLE 12: UNCOVERING AND CORRECTION OF WORK

12.1 The Contractor shall promptly correct Work rejected by the Owner or failing to conform to the requirements of the Contract Documents, whether observed before or after Substantial Completion and whether or not fabricated, installed or completed, and shall correct any Work found to be not in accordance with the requirements of the Contract Documents within a period of two years from the date of Substantial Completion, or by terms of an applicable special warranty required by the Contract Documents. The provisions of this Article apply

to work done by Subcontractors as well as to Work done by direct employees of the Contractor.

12.2 At any time during the progress of the work, or in any case where the nature of the defects shall be such that it is not expedient to have them corrected, the Owner, at their option, shall have the right to deduct such sum, or sums, of money from the amount of the contract as they consider justified to adjust the difference in value between the defective work and that required under contract including any damage to the structure.

ARTICLE 13: MISCELLANEOUS PROVISIONS

13.1 CUTTING AND PATCHING

13.1.1 The Contractor shall be responsible for all cutting and patching. The Contractor shall coordinate the work of the various trades involved.

13.2 DIMENSIONS

13.2.1 All dimensions shown shall be verified by the Contractor by actual measurements at the project site. Any discrepancies between the drawings and specifications and the existing conditions shall be referred to the Owner for adjustment before any work affected thereby has been performed.

13.3 LABORATORY TESTS

13.3.1 Any specified laboratory tests of material and finished articles to be incorporated in the work shall be made by bureaus, laboratories or agencies approved by the Owner and reports of such tests shall be submitted to the Owner. The cost of the testing shall be paid for by the Contractor.

13.3.2 The Contractor shall furnish all sample materials required for these tests and shall deliver same without charge to the testing laboratory or other designated agency when and where directed by the Owner.

13.4 ARCHAEOLOGICAL EVIDENCE

13.4.1 Whenever, in the course of construction, any archaeological evidence is encountered on the surface or below the surface of the ground, the Contractor shall notify the authorities of the State Historic Preservation Office and suspend work in the immediate area for a reasonable time to permit those authorities, or persons designated by them, to examine the area and ensure the proper removal of the archaeological evidence for suitable preservation by the Division of Historical and Cultural Affairs.

13.5 GLASS REPLACEMENT AND CLEANING

13.5.1 The General Contractor shall replace without expense to the Owner all glass broken during the construction of the project. If job conditions warrant, at completion of the job the General Contractor shall have all glass cleaned and polished.

13.6 WARRANTY

13.6.1 For a period of two (2) years from the date of substantial completion, as evidenced by the date of final acceptance of the work, the contractor warrants that work performed under this contract conforms to the contract requirements and is free of any defect of equipment, material or workmanship performed by the contractor or any of his subcontractors or suppliers. However, manufacturer's warranties and guarantees, if for a period longer than two (2) years, shall take precedence over the above warranties. The contractor shall remedy, at his own expense, any such failure to conform or any such defect. The protection of this warranty shall be included in the Contractor's Performance Bond.

ARTICLE 14: TERMINATION OR SUSPENSION OF THE CONTRACT

14.1 If the Contractor defaults or persistently fails or neglects to carry out the Work in accordance with the Contract Documents or fails to perform a provision of the Contract, the Owner, after seven days written notice to the Contractor, may make good such deficiencies and may deduct the cost thereof from the payment then or thereafter due the Contractor. Alternatively, at the Owner's option, and the Owner may terminate the Contract and take possession of the site and of all materials, equipment, tools, and machinery thereon owned by the Contractor and may finish the Work by whatever method the Owner may deem expedient. If the costs of finishing the Work exceed any unpaid compensation due the Contractor, the Contractor shall pay the difference to the Owner.

14.2 “If the continuation of this Agreement is contingent upon the appropriation of adequate state, or federal funds, this Agreement may be terminated on the date beginning on the first fiscal year for which funds are not appropriated or at the exhaustion of the appropriation. The Owner may terminate this Agreement by providing written notice to the parties of such non-appropriation. All payment obligations of the Owner will cease upon the date of termination. Notwithstanding the foregoing, the Owner agrees that it will use its best efforts to obtain approval of necessary funds to continue the Agreement by taking appropriate action to request adequate funds to continue the Agreement.”

END OF SECTION

SECTION 00 81 14

DRUG TESTING FORMS

(THIS PAGE INTENTIONALLY LEFT BLANK)

EMPLOYEE DRUG TESTING REPORT FORM
Period Ending:_____

4104 Regulations for the Drug Testing of Contractor and Subcontractor Employees Working on Large Public Works Projects requires that Contractors and Subcontractors who work on Large Public Works Contracts funded all or in part with public funds maintain testing data that includes but is not limited to the data elements below.

Project Number: _____

Project Name: _____

Contractor/Subcontractor Name: _____

Contractor/Subcontractor Address: _____
_____
_____

Number of employees who worked on the jobsite during the report period:_____

Number of employees subject to random testing during the report period:_____

Number of Negative Results _____ Number of Positive Results _____

Action taken on employee(s) in response to a failed or positive random test:
_____
_____
_____

Date: _____

This form is not required to be submitted to the Owner. Included as a reference to show information required to be maintained by the Contractor. The Owner shall have the right to periodically audit all Contractor and Subcontractor test results at the Contractor's or Subcontractor's offices (or by other means to make the data available for inspection by the Owner).

EMPLOYEE DRUG TESTING
REPORT OF POSITIVE RESULTS

4104 Regulations for the Drug Testing of Contractor and Subcontractor Employees Working on Large Public Works Projects requires that Contractors and Subcontractors who work on Large Public Works Contracts funded all or in part with public funds to notify the Owner in writing of a positive random drug test.

Project Number: _____

Project Name: _____

Contractor/Subcontractor Name: _____

Contractor/Subcontractor Address: _____
_____
_____

Name of employee with positive test result: _____

Last 4 digits of employee SSN: _____

Date test results received: _____

Action taken on employee in response to a positive test result:
_____
_____
_____

Authorized Representative of Contractor/Subcontractor: _____
(typed or printed)

Authorized Representative of Contractor/Subcontractor: _____
(signature)

Date: _____

This form shall be sent by mail to the Owner within 24 hours of receipt of test results.

Enclose this test results form in a sealed envelope with the notation "Drug Testing Form – DO NOT OPEN" on the face thereof and place in a separate mailing envelope.

EMPLOYEE DRUG TESTING REPORT FORM
Period Ending:_____

4104 Regulations for the Drug Testing of Contractor and Subcontractor Employees Working on Large Public Works Projects requires that Contractors and Subcontractors who work on Large Public Works Contracts funded all or in part with public funds submit Testing Report Forms to the Owner no less than quarterly.

Project Number: _____

Project Name: _____

Contractor/Subcontractor Name: _____

Contractor/Subcontractor Address: _____
_____
_____

Number of employees who worked on the jobsite during the report period:_____

Number of employees subject to random testing during the report period:_____

Number of Negative Results _____ Number of Positive Results _____

Action taken on employee(s) in response to a failed or positive random test:
_____
_____
_____

Authorized Representative of Contractor/Subcontractor: _____
(typed or printed)

Authorized Representative of Contractor/Subcontractor: _____
(signature)

Date: _____

EMPLOYEE DRUG TESTING
REPORT OF POSITIVE RESULTS

4104 Regulations for the Drug Testing of Contractor and Subcontractor Employees Working on Large Public Works Projects requires that Contractors and Subcontractors who work on Large Public Works Contracts funded all or in part with public funds to notify the Owner in writing of a positive random drug test.

Project Number: _____

Project Name: _____

Contractor/Subcontractor Name: _____

Contractor/Subcontractor Address: _____
_____
_____

Name of employee with positive test result: _____

Last 4 digits of employee SSN: _____

Date test results received: _____

Action taken on employee in response to a positive test result:
_____
_____
_____

Authorized Representative of Contractor/Subcontractor: _____
(typed or printed)

Authorized Representative of Contractor/Subcontractor: _____
(signature)

Date: _____

This form shall be sent by mail to the Owner within 24 hours of receipt of test results.

Enclose this test results form in a sealed envelope with the notation "Drug Testing Form – DO NOT OPEN" on the face thereof and place in a separate mailing envelope.

AFFIDAVIT
OF
EMPLOYEE DRUG TESTING PROGRAM

4104 Regulations for the Drug Testing of Contractor and Subcontractor Employees Working on Large Public Works Projects requires that Contractors and Subcontractors implement a program of mandatory drug testing for Employees who work on Large Public Works Contracts funded all or in part with public funds.

We hereby certify that we have in place or will implement during the entire term of the contract a Mandatory Drug Testing Program for our employees on the jobsite that complies with this regulation:

Contractor/Subcontractor Name: _____

Contractor/Subcontractor Address: _____

_____

_____

Authorized Representative (typed or printed): _____

Authorized Representative (signature): _____

Title: _____

Sworn to and Subscribed before me this _____day of _____ 20____.

My Commission expires _____. NOTARY PUBLIC _____.

THIS PAGE MUST BE SIGNED AND NOTARIZED FOR YOUR BID TO BE CONSIDERED.

(THIS PAGE INTENTIONALLY LEFT BLANK)

WHITE CLAY CREEK STATE PARK NATURE CENTER
WHITE CLAY CREEK STATE PARK
1475 CREEK ROAD, NEWARK, DE 19711
DIVISION OF PARKS AND RECREATION CONTRACT No. NAT25805-NATCTR

AFFIDAVIT OF CRAFT TRAINING COMPLIANCE

We, the contractor, hereby certify that we and all applicable subcontractors will abide by the contractor and subcontractor craft training requirements outlined below for the duration of the contract. Craft training must be provided by a contractor and/or subcontractor for each craft on a project for which there are Delaware Department of Labor approved and registered training programs or, if the contractor and/or subcontractor meets the requirements under Title 29, Chapter 69, Section 6960A.(b)(1)c.1.-3., payment may be made in accordance with Title 29, Chapter 69, Section 6960A.(b)(1)d. A list of crafts for which there are approved and registered training programs is maintained by the Delaware Department of Labor and can be found at: https://laborfiles.delaware.gov/main/det/apprenticeship/DE%20Craft%20Training%20Occupation%20List%20Effective%20March%201%202022.pdf. If you have questions regarding craft training programs, please submit all questions in writing to the Delaware Department of Labor at: apprenticeship@delaware.gov. ***This Affidavit of Craft Training Compliance must be submitted prior to contract execution***.

In accordance with Title 29, Chapter 69, Section 6960A.(a)(1), a contract relating to a public works project under § 6962 of Title 29 must include a craft training program for each craft in the project if at the time the contractor executes a public works contract, all of the following apply:

a. A project meets the prevailing wage requirement under Section 6960 of Title 29.
b. The contractor employs 10 or more total employees.
c. The project is not a federal highway project, except for the project under Section 6962(c)(11) of Title 29.
d. There is an apprenticeship program for a craft in the project on the list of crafts under Section 204(b)(2) of Title 19.

Pursuant to Title 29, Chapter 69, Section 6960A.(a)(2), ***a contractor must commit that all subcontractors provide craft training*** if paragraph (a)(1) of this section applies to the subcontractor. Failure to provide required craft training or payment on the project may subject the successful contractor and/or subcontractor(s) to penalties as outlined in Title 29, Chapter 69, Section 6960A.(d)(1)-(3).

Craft(s): _____

Contractor Name: _____

Contractor Address: _____

_____

_____

Contractor Program Registration Number(s) _____
On this line also indicate whether DE, Other State (identify) or US Registration Number

Or

☐ **A payment has been made in the amount established under Section 204(b)(2)b.2. of Title 19, for the craft into the Delaware Department of Labor's Apprenticeship and Training Fund.**

Or

☐ **Craft Training requirements are not applicable because:**

_____

Authorized Representative (typed or printed): _____

Authorized Representative (signature): _____

Title: _____

State of Delaware)
) ss:
County of _____)

Before me, a notary public, in and for said county and state, personally appeared, _____, who acknowledged to me that she/he did execute the foregoing instrument on behalf of _____.

IN TESTIMONY WHEREOF, I have subscribed my name and affixed my official seal this ____ day of _____ 20___.

_____
Notary Public
Commission Expires _____

THIS PAGE MUST BE SIGNED AND NOTARIZED TO BE CONSIDERED.

APPENDIX "A"

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

April 18, 2022

M-22-11

MEMORANDUM FOR HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES

FROM: Shalanda D. Young
Director

SUBJECT: Initial Implementation Guidance on Application of Buy America Preference in Federal Financial Assistance Programs for Infrastructure

On November 15, 2021, President Biden signed into law the Infrastructure Investment and Jobs Act ("IIJA"), Pub. L. No. 117-58, which includes the Build America, Buy America Act ("the Act"). Pub. L. No. 117-58, §§ 70901-52. The Act strengthens Made in America Laws[1] and will bolster America's industrial base, protect national security, and support high-paying jobs. The Act requires that no later than May 14, 2022—180 days after the enactment of the IIJA—the head of each covered Federal agency[2] shall ensure that "none of the funds made available for a Federal financial assistance program for infrastructure, including each deficient program, may be obligated for a project unless all of the iron, steel, manufactured products, and construction materials used in the project are produced in the United States."[3]

The Act affirms, consistent with Executive Order 14005, *Ensuring the Future Is Made in All of America by All of America's Workers* ("the Executive Order"), this Administration's priority to "use terms and conditions of Federal financial assistance awards to maximize the use of goods, products, and materials produced in, and services offered in, the United States."[4]

The Act provides statutory authorities for the Made in America Office ("MIAO") in the Office of Management and Budget ("OMB") to maximize and enforce compliance with Made in

[1] "Made in America Laws" means all statutes, regulations, rules, and Executive Orders relating to Federal financial assistance awards or Federal procurement, including those that refer to "Buy America" or "Buy American," that require, or provide a preference for, the purchase or acquisition of goods, products, or materials produced in the United States, including iron, steel, and manufactured products offered in the United States. Made in America Laws include laws requiring domestic preference for maritime transport, including the Merchant Marine Act of 1920 (Pub. L. No. 66-261), also known as the Jones Act. Exec. Order No. 14,005, 86 Fed. Reg. 7475, § 2(b) (Jan. 28, 2021), *available at* https://www.federalregister.gov/documents/2021/01/28/2021-02038/ensuring-the-future-is-made-in-all-of-america-by-all-of-americas-workers. Made in America Laws also include laws that give preference to Indian-owned and -controlled businesses, such as the Buy Indian Act (25 U.S.C. 47), that produce items in the United States.

[2] For the purposes of this guidance, the terms "Federal agency" and "agency" mean any authority of the United States that is an "agency" (as defined in section 3502 of title 44, United States Code), other than an independent regulatory agency (as defined in that section). IIJA, § 70912(3).

[3] IIJA, § 70914(a).

[4] Exec. Order No. 14,005 (see footnote 1).

America Laws.[5] MIAO aims to increase reliance on domestic supply chains and reduce the need for waivers through a strategic process aimed at: achieving consistency across agencies; gathering data to support decision-making to make U.S. supply chains more resilient; bringing increased transparency to waivers in order to send clear demand signals to domestic producers; and concentrating efforts on changes that will have the greatest impact.[6]

This memorandum provides implementation guidance to Federal agencies on the application of: (1) a "Buy America" preference[7] to Federal financial assistance programs for infrastructure; and (2) a transparent process to waive such a preference, when necessary. A Federal financial assistance program for infrastructure is any program under which an award may be issued for an infrastructure project, regardless of whether infrastructure is the primary purpose of the award. The term "project" means any activity related to the construction, alteration, maintenance, or repair of infrastructure in the United States.[8]

Agencies should determine how this guidance is best applied to their infrastructure programs and processes, and consult with OMB, as needed, on establishing criteria, processes, and procedures for applying a Buy America preference and issuing waivers. OMB may update or provide additional guidance, as appropriate, to further assist agencies in the implementation of a Buy America preference.

I. Application of a Buy America Preference

By May 14, 2022, agencies must ensure that all applicable programs comply with section 70914 of the Act, including by the incorporation of a Buy America preference in the terms and conditions of each award with an infrastructure project.[9] The Act requires the following Buy America preference:

(1) All iron and steel used in the project are produced in the United States. This means all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States.

(2) All manufactured products used in the project are produced in the United States. This means the manufactured product was manufactured in the United States, and the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 55 percent of the total cost of all components of the manufactured product, unless another standard for determining the minimum amount of domestic content of the manufactured product has been established under applicable law or regulation.

[5] IIJA, § 70923(a) & (b)(1).
[6] OMB Memorandum M-21-26, Increasing Opportunities for Domestic Sourcing and Reducing the Need for Waivers from Made in America Laws available at: https://www.whitehouse.gov/wp-content/uploads/2020/11/M-21-06.pdf
[7] For the purposes of this guidance, a "Buy America" preference is a domestic content procurement preference as defined in IIJA, § 70912(2).
[8] IIJA, § 70912 (5) & (7).
[9] See Appendix I: Example of Award Term - Required Use of American Iron, Steel, Manufactured Products, and Construction Materials.

(3) All construction materials are manufactured in the United States. This means that all manufacturing processes for the construction material occurred in the United States.[10, 11]

II. Applicability to Federal Financial Assistance Programs

This guidance applies to all Federal financial assistance as defined in section 200.1 of title 2, Code of Federal Regulations[12]—whether or not funded through IIJA—where funds are appropriated or otherwise made available and used for a project for infrastructure. Federal financial assistance means assistance that non-Federal entities receive or administer in the form of grants, cooperative agreements, non-cash contributions or donations of property, direct assistance, loans, loan guarantees, and other types of financial assistance. The term "non-Federal entity" includes States, local governments, territories, Indian tribes, Institutions of Higher Education (IHE), and nonprofit organizations.[13]

For purposes of this guidance, for-profit organizations are not considered non-Federal entities. However, this guidance does not alter independent statutory authorities that agencies may have to include domestic content requirements in awards of Federal financial assistance issued to for-profit organizations.

Federal agencies are encouraged to consult with OMB if they are uncertain about the applicability of this guidance to any particular infrastructure program.

Before applying a Buy America preference to a covered program that will affect Tribal communities, Federal agencies should follow the consultation policies established through Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments*, and consistent with policies set forth in the Presidential Memorandum of January 26, 2021, on Tribal Consultation and Strengthening Nation-Nation Relationships. Federal agencies should commence consultation promptly.

This guidance does not apply to "expenditures for assistance authorized under section 402, 403, 404, 406, 408, or 502 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. 5170a, 5170b, 16 5170c, 5172, 5174, or 5192) relating to a major disaster or emergency declared by the President under section 401 or 501, respectively, of such Act (42 U.S.C. 5170, 5191) or pre and post disaster or emergency response expenditures."[14] "[P]re and post disaster or emergency response expenditures" consist of expenditures for financial assistance that are (1) authorized by statutes other than the Stafford Act, 42 U.S.C. §§ 5121 et seq., and (2) made in anticipation of or response to an event or events that qualify as an "emergency" or "major disaster" within the meaning of the Stafford Act, *id.* § 5122(1), (2). Awards made to support the construction or improvement of infrastructure to mitigate the damage that may be caused by a non-imminent future emergency or disaster, such as awards

[10] IIJA, § 70912 (2) & (6)(B)(ii).
[11] See Section VIII. of this guidance for more information on construction materials.
[12] IIJA § 70912(4)(A)
[13] *See* 2 C.F.R. § 200.1.
[14] IIJA § 70912(4)(B)

made under FEMA's Flood Mitigation Assistance program,[15] do not qualify as "pre and post disaster or emergency response expenditures."

Subawards should conform to the terms and conditions of the Federal award from which they flow.[16]

The IIJA's definition of "infrastructure" encompasses public infrastructure projects. Thus, the term "infrastructure" includes, at a minimum, the structures, facilities, and equipment for, in the United States, roads, highways, and bridges; public transportation; dams, ports, harbors, and other maritime facilities; intercity passenger and freight railroads; freight and intermodal facilities; airports; water systems, including drinking water and wastewater systems; electrical transmission facilities and systems; utilities; broadband infrastructure; and buildings and real property.[17] Agencies should treat structures, facilities, and equipment that generate, transport, and distribute energy - including electric vehicle (EV) charging - as infrastructure.

When determining if a program has infrastructure expenditures, Federal agencies should interpret the term "infrastructure" broadly and consider the definition provided above as illustrative and not exhaustive. When determining if a particular construction project of a type not listed in the definition above constitutes "infrastructure," agencies should consider whether the project will serve a public function, including whether the project is publicly owned and operated, privately operated on behalf of the public, or is a place of public accommodation, as opposed to a project that is privately owned and not open to the public. Projects with the former qualities have greater indicia of infrastructure, while projects with the latter quality have fewer. Projects consisting solely of the purchase, construction, or improvement of a private home for personal use, for example, would not constitute an infrastructure project. Federal agencies are strongly encouraged to consult with OMB when making such determinations.

Agencies should consult with MIAO regarding their readiness to apply the requirements of the Act to covered programs. Agencies with questions regarding the application of a Buy America preference to agency-specific programs, including questions about the possible use of waivers during adjustment periods as agencies work to implement the Act, are advised to reach out to MIAO for technical assistance and advice.

III. Consistency with International Agreements

Pursuant to section 70914(e) of the Act, this guidance must be applied in a manner consistent with the obligations of the United States under international agreements.

IV. Avoid Unnecessary Disruption

The Act makes clear that its preferences apply to a Federal financial assistance program for infrastructure only to the extent that a domestic content procurement preference as described

[15] *See* 42 U.S.C. § 4104c.
[16] 2 CFR 200.101 (b) (2)
[17] IIJA, § 70912(5).

in section 70914 of the Act does not already apply to iron, steel, manufactured products, and construction materials.[18] Agencies should consider whether existing domestic content requirements meet the standards in the Act, as described in this memorandum. Agencies must make necessary changes to come into compliance with the Act's requirements, while preserving policies and provisions that already meet or exceed the standards required by the Act. For example, a program in which the standards for iron and steel already meet the standards in the Act may nevertheless be required to adopt new standards for manufactured products and construction materials. Maintaining current policies where appropriate avoids unnecessary disruption to programs, or elements of programs, that already meet or exceed Build America, Buy America requirements.

V. Effective Date for Awards

Agencies must ensure that, starting on May 14, 2022, all Federal financial assistance programs for infrastructure comply with the requirements of section 70914 of the Act. Therefore, new awards made on or after May 14, 2022, must take appropriate steps to ensure financial assistance awards comply with these requirements, which may include appropriate terms and conditions[19] incorporating a Buy America preference. Renewal awards and amendments obligating additional funds to existing awards that are executed on or after May 14, 2022, must also include a Buy America preference. This means that agencies must include a Buy America preference in awards issued on or after May 14, 2022, even if Notices of Funding Opportunities for those awards did not include a Buy America preference. In these cases, agencies may consider whether public interest waivers may be needed to avoid undue increases in the time and cost of a project. Similarly, public interest waivers may be needed for awards and amendments made on or after May 14, 2022, where budgets for purchase of covered materials have already been agreed upon (including if materials have been ordered and construction has begun). Consistent with the guidance provided below, agencies should issue waivers judiciously and clearly communicate to recipients the limitations and conditions of any such waivers.

VI. Articles, Materials, and Supplies for Infrastructure

A Buy America preference, as defined in section I of this guidance, only applies to the iron and steel, manufactured products, and construction materials used for the infrastructure project under an award. If an agency has determined that no funds from a particular award under a covered program will be used for infrastructure, a Buy America preference does not apply to that award. Similarly, for a covered program, a Buy America preference does not apply to non-infrastructure spending under an award that also includes a covered project. A Buy America preference applies to *an entire infrastructure project*, even if it is funded by both Federal and non-Federal funds under one or more awards.

A Buy America preference only applies to articles, materials, and supplies that are consumed in, incorporated into, or affixed to an infrastructure project. As such, it does not apply

[18] IIJA, § 70917(a) &(b).
[19] See Appendix I: Example of Award Term - Required Use of American Iron, Steel, Manufactured Products, and Construction Materials for exemplary language.

to tools, equipment, and supplies, such as temporary scaffolding, brought to the construction site and removed at or before the completion of the infrastructure project. Nor does a Buy America preference apply to equipment and furnishings, such as movable chairs, desks, and portable computer equipment, that are used at or within the finished infrastructure project, but are not an integral part of or permanently affixed to the structure.

For the purposes of this guidance, an article, material, or supply should only be classified into *one* of the following categories: (1) iron or steel; (2) a manufactured product; or (3) a construction material. For ease of administration, an article, material, or supply should not be considered to fall into multiple categories. Agencies should apply the iron and steel test to items that are predominantly iron or steel, unless another standard applies under law or regulation.

Any waivers from these requirements must be in writing and meet the requirements of section 70914(b).

VII. Issuing Buy America Waivers

Pursuant to Section 70914(c) of the Act, the head of a Federal agency may waive the application of a Buy America preference under an infrastructure program in any case in which the head of the Federal agency finds that—

(1) applying the domestic content procurement preference would be inconsistent with the public interest (a "public interest waiver");
(2) types of iron, steel, manufactured products, or construction materials are not produced in the United States in sufficient and reasonably available quantities or of a satisfactory quality (a "nonavailability waiver"); or
(3) the inclusion of iron, steel, manufactured products, or construction materials produced in the United States will increase the cost of the overall project by more than 25 percent (an "unreasonable cost waiver").

Federal agencies are responsible for processing and approving all waivers, including waivers requested by recipients and on behalf of subrecipients. To the greatest extent practicable, waivers should be targeted to specific products and projects.[20]

Before issuing a waiver, the head of the Federal agency must make publicly available on the agency's website a detailed written explanation for the proposed determination to issue the waiver and provide at least 15 days for public comment on the proposed waiver.[21] General applicability waivers are subject to a minimum 30-day public comment period.[22] By April 29, 2022, agencies should provide the website address where they will be posting proposed waivers for public comment to MBX.OMB.MadeInAmerica@omb.eop.gov. Pursuant to sections 70914(c) and 70937 of the Act, the waiver must be cross-posted to a centralized waiver transparency website managed by GSA, BuyAmerican.gov,[23] no later than November 15, 2022.

[20] See Section VII of this guidance for information on waiver principles and criteria.
[21] Executive Order, § 4(b)(i)(2); IIJA, § 70914(c); IIJA, § 70937 (note that "Buy American" as used in this section also refers to Buy America preferences, per IIJA, § 70932(1)).
[22] IIJA § 70914(d)(2)(A)(ii). See Section VII of this guidance for information on general applicability waivers.
[23] BuyAmerican.gov redirects to MadeInAmerica.gov.

To minimize duplication and promote efficiency, MIAO and GSA will coordinate with agencies on the expansion of the existing website's functionality to display waivers for Federal financial assistance and provide further instructions to agencies as necessary.

Federal agencies are responsible for performing due diligence and approving or rejecting waivers consistent with the Act, this guidance, and any other applicable Buy America laws. Federal agencies should notify MIAO in advance of posting an award- or project-level proposed waiver for public comment. However, Federal agencies must consult with MIAO for proposed waivers with broader applicability (such as a general applicability waiver) before posting them for public comment. The purpose of the consultation is to identify any opportunities to structure the waiver in order to maximize the use of goods, products, and materials produced in the United States to the greatest extent possible consistent with law. Federal agencies should send proposed waivers for review to MBX.OMB.MIAwaivers@omb.eop.gov.

Federal agencies must submit to MIAO a proposed waiver for review after the public comment period has concluded. MIAO will review the proposed waiver to determine if it is consistent with applicable law and policy,[24] and will notify the Federal agency of its determination.

All waiver requests must include a detailed justification for the use of goods, products, or materials mined, produced, or manufactured outside the United States[25] and a certification that there was a good faith effort to solicit bids for domestic products supported by terms included in requests for proposals, contracts, and nonproprietary communications with potential suppliers.[26] In addition, at a minimum and to the greatest extent practicable, each proposed waiver submitted to MIAO should include the following information, as applicable:

- Waiver type (nonavailability, unreasonable cost, or public interest)
- Recipient name and Unique Entity Identifier (UEI)
- Federal awarding agency organizational information (e.g., Common Government-wide Accounting Classification (CGAC) Agency Code)
- Financial assistance listing name and number
- Federal financial assistance program name
- Federal Award Identification Number (FAIN) (if available)
- Federal financial assistance funding amount
- Total cost of infrastructure expenditures, including all Federal and non-Federal funds (to the extent known)
- Infrastructure project description and location (to the extent known)
- List of iron or steel item(s), manufactured products, and construction material(s) proposed to be excepted from Buy America requirements, including name, cost, country(ies) of origin (if known), and relevant PSC and NAICS code for each.
- A certification that the Federal official or assistance recipient made a good faith effort to solicit bids for domestic products supported by terms included in requests for proposals, contracts, and nonproprietary communications with the prime contractor.

[24] Executive Order, § 4(c).
[25] IIJA, § 70937(c)(2)(A).
[26] IIJA, § 70937(c)(2)(D).

- A statement of waiver justification, including a description of efforts made (e.g., market research, industry outreach), by the Federal awarding agency and, and in the case of a project or award specific waiver, by the recipient, in an attempt to avoid the need for a waiver. Such a justification may cite, if applicable, the absence of any Buy America-compliant bids received in response to a solicitation.
- Anticipated impact if no waiver is issued.
- Any relevant comments received through the public comment period.

The purpose of the information is to ensure that the agency has adequate information to perform due diligence, that MIAO has sufficient information to determine whether the proposed waiver is consistent with law and policy, and that sufficient information is available for public review. Information provided for public review should help interested manufacturers gauge the demand for products for which agencies are considering waiving a Buy America preference.

To avoid a need for duplicative waiver requests from entities that receive funding for one infrastructure project through multiple Federal agencies, the Federal agency contributing the greatest amount of Federal funds for the project should be considered the "Cognizant Agency for Made in America" and should take responsibility for coordinating with the other Federal awarding agencies. Such coordination will provide uniform waiver criteria and adjudication processes, minimize duplicative efforts among Federal agencies, and reduce burdens on recipients. The Cognizant Agency for Made in America shall be responsible for consulting with the other Federal awarding agencies, publicizing the proposed joint waiver, and submitting the proposed joint waiver for review to MIAO.

a. Exceptions for Unforeseen and Exigent Circumstances

In limited situations where there is an urgent need in an unforeseen and exigent circumstance, agencies have the authority to waive the application of Buy America preferences without submitting the waiver for public comment and MIAO determination.[27] As an exception to the public transparency requirements of the Act, agencies should exercise that authority only when necessary. Further, to ensure MIAO can fulfill its role as a central and transparent source of Made in America waivers, an agency that issues a waiver without first seeking public comment and MIAO approval must, within 30 days of the waiver's issuance, submit a report to MIAO explaining its reliance upon the "unforeseen and exigent circumstance" exception.[28] MIAO will provide further instructions to agencies on how to submit those reports. Although public posting and MIAO review may be waived in exigent circumstances, agencies remain responsible for performing due diligence appropriate to the circumstances, consistent with the principles and criteria in paragraphs VII(b) and (c) below.

[27] IIJA, § 70937(b)(2).
[28] This reporting process was established pursuant to Executive Order 14,005, § 4(d) and OMB Guidance on Improving the Transparency of Made in America Waivers available at: https://www.whitehouse.gov/wp-content/uploads/2021/10/Guidance-Memo-Improving-the-Transparency-of-Made-in-America-Waivers.pdf.

b. Waiver Principles and Criteria

To ensure they are scrupulously monitoring, enforcing, and complying with applicable Buy America Laws and minimizing the use of waivers,[29] agencies must apply standard criteria to determine whether to grant a waiver in a given circumstance. Agencies with existing criteria must review it for consistency with this guidance and update it as appropriate. All other agencies must establish criteria.

Agencies may reject or grant waivers in whole or in part. To the greatest extent practicable, waivers should be issued at the project level and be product-specific. Overly broad waivers undermine market signals designed to boost domestic supply chains, particularly for key articles, materials and supplies in critical supply chains (i.e., critical supply chains identified in Executive Order 14017, *America's Supply Chains*). When necessary, agencies may consider issuing a waiver that has applicability beyond a single project; however, agencies should always issue, construe, and apply waivers to ensure the maximum utilization of goods, products, and materials produced in the United States, consistent with applicable law. Federal agencies may consult with MIAO when establishing or modifying criteria for granting waivers. They may also work within the Made in America Council, a practice that will help to foster consistency across agencies to the greatest extent practical and appropriate, given agency and program missions.

Federal agencies should use the following principles before issuing a waiver of any type:

- **Time-limited**: In certain limited circumstances, a Federal agency may determine that a waiver should be constrained principally by a length of time, rather than by the specific projects to which it applies. Waivers of this type may be appropriate, for example, when an item that is "nonavailable" is widely used in projects funded by a particular program's awards. When issuing such a waiver, the agency should identify a short, definite time frame (e.g., no more than one to two years) designed to ensure that, as domestic supply becomes available, domestic producers will have prompt access to the market created by the program.
- **Targeted**: Waivers that are not limited to particular projects should apply only to the item(s), product(s), or material(s) or category(ies) of item(s), product(s), or material(s) necessary. Waivers that are overly broad will tend to undermine domestic preference policies. Broader waivers will receive greater scrutiny from MIAO.
- **Conditional**: Federal agencies are encouraged to issue waivers with specific conditions that support the policies of the Act and the Executive Order.

These principles and criteria should be viewed as minimum requirements for the use of waivers by Federal agencies.[30]

<u>Nonavailability Waivers</u>

Before granting a nonavailability waiver, agencies should consider whether the recipient has performed thorough market research, which may be accomplished with assistance from the agency, and adequately considered, where appropriate, qualifying alternate items, products, or

[29] IIJA § 70933(2).
[30] See Section IV. of this guidance for agencies that have existing regulations or guidance.

materials. Waivers should describe the market research activities and methods to identify domestically manufactured items capable of satisfying the requirement, including the timing of the research and conclusions reached on the availability of sources. Agencies are encouraged to engage with the Made in America Council to develop resource lists for common items, goods, or materials.

Unreasonable Cost Waivers

An unreasonable cost waiver is available if the inclusion of iron, steel, manufactured products, or construction materials produced in the United States will increase the cost of the overall project by more than 25 percent. Before granting an unreasonable-cost waiver, to the extent permitted by law, agencies should ensure the recipient has provided adequate documentation that no domestic alternatives are available within this cost parameter. Agencies may assist recipients in gathering documentation.

For requests citing unreasonable cost as the statutory basis of the waiver, the waiver justification must include, as applicable, a comparison of the cost of the domestic product to the cost of the foreign product or a comparison of the overall cost of the project with domestic products to the overall cost of the project with foreign-origin products, pursuant to the requirements of the applicable Made in America law.[31] Publicly available cost comparison data may be provided in lieu of proprietary pricing information.[32] Unreasonable-cost waivers should be no broader than necessary.

Public Interest Waivers

A waiver in the public interest may be appropriate where an agency determines that other important policy goals cannot be achieved consistent with the Buy America requirements established by the Act and the proposed waiver would not meet the requirements for a nonavailability or unreasonable cost waiver. Such waivers shall be used judiciously and construed to ensure the maximum utilization of goods, products, and materials produced in the United States.[33] To the extent permitted by law, determination of public interest waivers shall be made by the head of the agency with the authority over the Federal financial assistance award.[34]

Public interest waivers may have a variety of bases. As with other waivers, they should be project-specific whenever possible, as what is in the public interest may vary depending upon the circumstances of the project, recipient, and specific items, products, or materials in question.

Federal agencies may wish to consider issuing a limited number of general applicability public interest waivers in the interest of efficiency and to ease burdens for recipients. The agency remains responsible for determining whether such a waiver is appropriate to apply to any

[31] IIJA, § 70937(c)(2)(B).
[32] IIJA, § 70937(c)(2)(B).
[33] IIJA, § 70935(a).
[34] IIJA, § 70935(b).

given project; the Made in America Office will not review each application of such a waiver. The following are examples of types of public interest waivers an agency may consider issuing.[35]

- **De Minimis**: Ease of administration is important to reduce burden for recipients and agencies. Federal agencies may consider whether a general applicability public interest waiver should apply to infrastructure project purchases below a de minimis threshold. An agency may consider whether a public interest waiver should apply when necessary to ensure that recipients and Federal agencies make efficient use of limited resources, especially if the cost of processing the individualized waiver(s) would risk exceeding the value of the items waived. Agencies may consider adopting an agency-wide public interest waiver that sets a de minimis threshold, for example, of 5 percent of project costs up to a maximum of $1,000,000.
- **Small Grants**: Agencies may wish to consider whether it is in the public interest to waive application of a Buy America preference to awards below the Simplified Acquisition Threshold. This type of waiver may be particularly relevant in the initial years after enactment of IIJA, and may be phased out over time as agencies develop efficient waiver review capabilities.
- **Minor Components**: Agencies may wish to consider whether it is in the public interest to allow minor deviations for miscellaneous minor components within iron and steel products. A minor components waiver in the public interest may allow non-domestically produced miscellaneous minor components comprising no more than 5 percent of the total material cost of an otherwise domestically produced iron and steel product to be used. It would not be in the public interest to use a minor components waiver to exempt a whole product from the iron and steel requirements, or to allow the primary iron or steel components of the product to be produced other than domestically.
- **Adjustment Period**: Agencies should consider whether brief, time limited waivers to allow recipients and agencies to transition to new rules and processes may be in the public interest.
- **International Trade Obligations**: If a recipient is a State that has assumed procurement obligations pursuant to the Government Procurement Agreement or any other trade agreement, a waiver of a Made in America condition to ensure compliance with such obligations may be in the public interest.
- **Other Considerations**: A waiver may be in the public interest in one circumstance, but not in another, and considerations will depend upon the nature and amount of resources available to the recipient, the value of the items, goods, or materials in question, the potential domestic job impacts, and other policy considerations, including sustainability, equity, accessibility, performance standards, and the domestic content (if any) of and conditions under which the non-qualifying good was produced.

All proposed waivers citing the public interest as the statutory basis must include a detailed written statement, which shall address all appropriate factors, such as potential

[35] The list is not exhaustive and no agency is required to issue the types of waivers noted as examples. As with other general applicability waivers, generally applicable public interest waivers must be reviewed at least every five years and more often as appropriate.

obligations under international agreements, justifying why the requested waiver is in the public interest.[36]

Before granting a waiver in the public interest, to the extent permitted by law, agencies shall assess whether a significant portion of any cost advantage of a foreign-sourced product is the result of the use of dumped steel, iron, or manufactured products or the use of injuriously subsidized steel, iron, or manufactured products.[37] Agencies may consult with the International Trade Administration (ITA) in making this assessment if the granting agency deems such consultation to be helpful. The agency shall integrate any findings from the assessment into its waiver determination as appropriate.[38] MIAO will work with ITA and agencies to develop standard processes to expedite this required assessment, such as by ensuring agencies know how to easily access lists of dumped or injuriously subsidized products.

c. General Applicability Waivers

The term "general applicability waiver" refers to a waiver that applies generally across multiple awards. A general applicability waiver can be "product-specific" (e.g., applies only to a product or category of products) or "non-product specific" (e.g., applies to all "manufactured products").

General applicability waivers should be issued only when necessary to advance an agency's missions and goals, consistent with IIJA, the Executive Order, and this guidance. For example, an agency might issue a general waiver for a product for which there are well-established domestic sourcing challenges. General applicability waivers will require appropriate justification from the Federal agency.

Federal agencies with one or more existing general applicability waivers, including public interest waivers, must review such waivers within five years of the date on which the waiver was issued. Agencies issuing new general applicability waivers must review such waivers at least every five years from the date of issuance. Agencies are encouraged to review general applicability waivers more frequently, when appropriate. In conducting a review of any general applicability waiver, the head of a Federal agency shall—

(A) publish in the *Federal Register* a notice that—
    (i) describes the justification for a general applicability waiver; and
    (ii) requests public comments for a period of not less than 30 days on the continued need for a general applicability waiver; and

(B) publish in the *Federal Register* a determination on whether to continue or discontinue the general applicability waiver, considering the comments received in response to the notice published under paragraph (A).[39]

[36] IIJA, § 70937(c)(2)(C).
[37] Executive Order, § 5.
[38] Executive Order, § 5.
[39] IIJA, § 70914(d)(1) & (2).

For a period of five years beginning on the date of enactment of the Act, paragraphs (A) and (B) above shall not apply to any product-specific general applicability waiver that was issued more than 180 days before November 15, 2021.[40]

By no later than November 15, 2022, agencies with existing, non-product specific general applicability waivers that were issued more than five years before November 15, 2021 should promptly commence review of each such waiver by publishing a *Federal Register* notice as required in section 70914(d)(2)(A) of the IIJA. Should the review justify retaining the waiver, agencies should consider narrowing the waiver in a manner that would support supply chain resilience and boost incentives to manufacture key products domestically, as appropriate.

To ensure prompt commencement of projects funded by IIJA, MIAO plans to work with agencies to expedite consideration of general applicability waivers for products or categories of products for which domestic sourcing challenges have been well documented. Agencies should align such waivers with complementary policies, such as work to boost supply chain resiliency and domestic employment. General applicability waivers should include appropriate expiration dates designed to ensure that, once available, Buy America qualifying products receive appropriate consideration.

VIII. Preliminary Guidance for Construction Materials

For construction materials, the Act requires that, not later than 180 days after November 15, 2021, OMB must issue standards that define the term "all manufacturing processes" in the case of construction materials. These standards must require that each manufacturing process required for the manufacture of the construction material and the inputs of the construction material occurs in the United States. They must also reflect efforts to maximize the direct and indirect jobs benefited or created in the production of the construction material.[41]

Although the deadline to issue such guidance has not yet passed, OMB is providing preliminary and non-binding guidance to assist agencies in determining which materials are construction materials so that agencies can begin applying Buy America requirements to those materials. This preliminary guidance addresses the requirements as set forth in section 70915(b) of the IIJA while providing sufficient time for OMB to receive additional stakeholder input.

The IIJA finds that "construction materials" includes an article, material, or supply—other than an item of primarily iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives[42]—that is or consists primarily of:

- non-ferrous metals;
- plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables);
- glass (including optic glass);

[40] IIJA, § 70914(d)(3).
[41] IIJA, § 70915(b).
[42] IIJA, § 70917(c)(1).

- lumber; or
- drywall.[43]

To provide clarity to item, product, and material manufacturers and processers, we note that items that consist of two or more of the listed materials that have been combined together through a manufacturing process, and items that include at least one of the listed materials combined with a material that is not listed through a manufacturing process, should be treated as manufactured products, rather than as construction materials. For example, a plastic framed sliding window should be treated as a manufactured product while plate glass should be treated as a construction material.

Pending OMB's issuance of final standards on construction materials, and absent any existing applicable standard in law or regulation that meets or exceeds these preliminary standards, agencies should consider "all manufacturing processes" for construction materials to include at least the final manufacturing process and the immediately preceding manufacturing stage for the construction material. OMB is seeking additional stakeholder input before issuing further guidance identifying initial manufacturing processes for construction materials that should be considered as part of "all manufacturing processes."

Agencies should consult with MIAO, as needed, to ensure that any waiver issued for construction materials is explicitly targeted and time-limited, in order to send a clear market signal that additional standards for "all manufacturing processes" in the case of construction materials will be forthcoming.

[43] See IIJA, § 70911(5).

Appendix I: Example of Award Term - Required Use of American Iron, Steel, Manufactured Products, and Construction Materials

Where applicable, the Federal agency must include appropriate terms and conditions in all awards, in accordance with applicable legal requirements and its established procedures, in order to effectuate the requirements of the Act and this guidance. The following is sample language.

To achieve the greatest possible consistency across agencies and programs, agencies should send their proposed terms and conditions to MIAO for review prior to incorporating them into applicable awards. Agencies should begin including appropriate language in NOFOs published *before* May 14, 2022 to provide applicants fair notice of the Buy America conditions that will apply to funds obligated on or after that date.

** ** **

Recipients of an award of Federal financial assistance from a program for infrastructure are hereby notified that none of the funds provided under this award may be used for a project for infrastructure unless:

(1) all iron and steel used in the project are produced in the United States--this means all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States;

(2) all manufactured products used in the project are produced in the United States—this means the manufactured product was manufactured in the United States; and the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 55 percent of the total cost of all components of the manufactured product, unless another standard for determining the minimum amount of domestic content of the manufactured product has been established under applicable law or regulation; and

(3) all construction materials[44] are manufactured in the United States—this means that all manufacturing processes for the construction material occurred in the United States.

The Buy America preference only applies to articles, materials, and supplies that are consumed in, incorporated into, or affixed to an infrastructure project. As such, it does not apply to tools, equipment, and supplies, such as temporary scaffolding, brought to the construction site and removed at or before the completion of the infrastructure project. Nor does a Buy America preference apply to equipment and furnishings, such as movable chairs, desks, and portable computer equipment, that are used at or within the finished infrastructure project, but are not an integral part of the structure or permanently affixed to the infrastructure project.

[44] Excludes cement and cementitious materials, aggregates such as stone, sand, or gravel, or aggregate binding agents or additives.

Waivers

When necessary, recipients may apply for, and the agency may grant, a waiver from these requirements. The agency should notify the recipient for information on the process for requesting a waiver from these requirements.

(a) When the Federal agency has made a determination that one of the following exceptions applies, the awarding official may waive the application of the domestic content procurement preference in any case in which the agency determines that:

(1) applying the domestic content procurement preference would be inconsistent with the public interest;

(2) the types of iron, steel, manufactured products, or construction materials are not produced in the United States in sufficient and reasonably available quantities or of a satisfactory quality; or

(3) the inclusion of iron, steel, manufactured products, or construction materials produced in the United States will increase the cost of the overall project by more than 25 percent.

A request to waive the application of the domestic content procurement preference must be in writing. The agency will provide instructions on the format, contents, and supporting materials required for any waiver request. Waiver requests are subject to public comment periods of no less than 15 days and must be reviewed by the Made in America Office.

There may be instances where an award qualifies, in whole or in part, for an existing waiver described at [link to awarding agency web site with information on currently applicable general applicability waivers].

Definitions[45]

"Construction materials" includes an article, material, or supply—other than an item of primarily iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives[46]—that is or consists primarily of:

- non-ferrous metals;
- plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables);
- glass (including optic glass);
- lumber; or
- drywall.

[45] Federal agencies may choose to provide definitions on a public-facing website and reference that website in the terms and conditions, rather than including all definitions in the terms and conditions itself. If an agency chooses to do provide definitions on a public-facing website, it is not considered a deviation from the terms and conditions provided and does not need to be reviewed by OMB.

[46] IIJA, § 70917(c)(1).

“Domestic content procurement preference’’ means all iron and steel used in the project are produced in the United States; the manufactured products used in the project are produced in the United States; or the construction materials used in the project are produced in the United States.

“Infrastructure” includes, at a minimum, the structures, facilities, and equipment for, in the United States, roads, highways, and bridges; public transportation; dams, ports, harbors, and other maritime facilities; intercity passenger and freight railroads; freight and intermodal facilities; airports; water systems, including drinking water and wastewater systems; electrical transmission facilities and systems; utilities; broadband infrastructure; and buildings and real property. Infrastructure includes facilities that generate, transport, and distribute energy.

‘‘Project’’ means the construction, alteration, maintenance, or repair of infrastructure in the United States.

END OF APPENDIX "A"

(THIS PAGE INTENTIONALLY LEFT BLANK)

SECTION 01 10 00 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work under separate contract.
4. Allowances.
5. Alternates.
6. Unit Prices.
7. Applications for Payment.
8. Owner Supplied Construction Documents.
9. Coordination.
10. Phased construction.
11. Access to site.
12. Coordination with occupants.
13. Work restrictions.
14. Specification and drawing conventions.
15. Field Engineering.
16. References and Standards.
17. Miscellaneous provisions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

A. Project Identification: White Clay Creek State Park Nature Center

1. Project Location: 1475 Creek Road, Newark, DE 19711

B. Owner: State of Delaware, Division of Natural Resources and Environmental Control, Parks and Recreation, 89 Kings Highway, Dove DE 19901.

C. Architect/Engineer's Identification: The Contract Documents, dated March 20, 2026, were prepared for this Project by GWWO Inc., 1215 E. Fort Ave, Suite 24, Baltimore, MD 21230.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. New two-story nature center, parking lot, and accessible paths. Connect to existing septic system. Additional work within the adjacent historic Chambers House to provide pressure tanks. Removal of existing Comfort Station facility on site.

B. Type of Contract:

1. Project will be constructed under a single, lump sum prime contract.

1.5 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts as it will have an impact on the General Contractor's scope of work. The General Contractor shall allow the separate contractors access to scaffolding and/or high reaches.

1. Bridge Replacement Project

2. Exhibit Design Installation throughout the nature center

3. Exhibit Design Installation throughout Chambers House

4. Septic System demolition and installation

5. Items noted "NIC" (Not in Contract) will be furnished and installed by others.

1.6 ALLOWANCES

A. Schedule of Allowances: Refer to Section 012100 Allowances.

1.7 ALTERNATES

A. Alternates quoted in the Bid Form will be exercised as Owner option. Accepted alternates will be listed in the Owner-Contractor agreement.

B. Coordinate related work and modify surrounding work affected by accepted alternates as required to complete the Work.

C. Schedule of Alternates: Refer to Section 012300 Alternates.

1.8 UNIT PRICES

A. Unit Prices quoted on the Bid form will be exercised as Owner option.

B. Coordinate related work and modify surrounding work affected by accepted unit prices as required to complete the Work.

C. Schedule of Unit Prices: Refer to Section 012200 Unit Prices.

1.9 APLICATIONS FOR PAYMENT

A. Submit three (3) originals of each application under procedures of Section 012900 Payment Procedures.

B. Content and Format: Use the Project Manual table of contents to develop the Schedule of Values.

1.10 OWNER SUPPLIED CONSTRUCTION DOCUMENTS

A. The Contractor will be furnished, free of charge one electronic PDF file drawings and Project Manuals that are conformed to include all drawings and specification revised during the bid process. Paper sets will be furnished at the cost of reproduction, postage and handling.

1.11 COORDINATION

A. Coordinate Work of the various sections of Specifications to assure efficient and orderly sequence of installation of construction elements, with provisions for accommodating items installed later.

B. Verify characteristics of elements of interrelated operating equipment are compatible; coordinate Work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

C. Coordinate space requirements and installation of mechanical, electrical and plumbing work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduits, as closely as practicable; make runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

D. In finished areas (except as otherwise shown), conceal pipes, ducts, and wiring in the construction. Coordinate locations of fixtures and outlets with finish elements.

E. Execute cutting and patching to integrate elements of Work, uncover ill-timed defective and non-conforming work, provide openings for penetrations of existing surfaces, and provide samples for testing. Seal penetrations through floors, walls, and ceilings.

1.12 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Use of Site: Limit use of Project site to areas within the Contract limits. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Limits: Confine construction operations to the areas as indicated. The surrounding buildings (Chambers House and Robinson House) and site are occupied and the Owner's operations shall not be disturbed.
2. Driveways, Walkways and Entrances: Keep public roads, public parking, driveways and entrances outside of the work area serving premises clear and available to Owner, Owner's employees, emergency vehicles and general public at all times. Do not use these areas for parking or storage of materials.
    a. Maintain bike and hiking path for public use along Tweeds Mill Road/Creek Road on nights and weekends.
    b. Schedule deliveries to minimize use of driveways and entrances by construction operations.
    c. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

3. The adjacent building areas, site and properties are occupied and shall not be disturbed.

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

1.13 COORDINATION WITH OCCUPANTS

A. Full Owner Occupancy: Owner will occupy site and the Chambers House during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, entrances, corridors, stairs and other adjacent occupied or used facilities. Do not close or obstruct walkways, entrances, stairs, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction. Entrances shall be open for the Owner's use at all times.
2. Barricade work areas to keep the public from entering.
3. Notify Owner not less than one week in advance of activities that will affect Owner's operations.

1.14 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
2. Refer to Section 011400 “Work Restrictions” for additional requirements.

B. On-Site Work Hours: Limit work to the site and/or existing building to normal business working hours of 7:00 a.m. to 5:00 p.m., Monday through Friday, unless otherwise indicated.

1. Weekend Hours: Weekend work shall not be allowed unless preapproved by the Owner.
2. Early Morning Hours: Early morning hours are not allowed unless required for utility shut downs.

C. Noise, Vibration, and Odors: Coordinate operations that may result in any level of noise and vibration, odors, or other disruption to the occupancy or use of adjacent occupied areas, the buildings and adjacent properties with the Owner.

1. Notify Architect and Owner not less than seven (7) days in advance of proposed disruptive operations.
2. Obtain Architect's and/or Owner's written permission before proceeding with disruptive operations.

D. Nonsmoking Campus and Building: Smoking is prohibited within the boundaries of all state workplaces including all buildings, facilities, indoor and outdoor spaces and all the surrounding grounds owned by the State. This policy also includes but is not limited to parking lots, walkways, State vehicles and private vehicles parked or operated on State workplace property.

1.15 SPECIFICATION AND DRAWING CONVENTIONS

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

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

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

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

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.

3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

1.16 FIELD ENGINEERING

A. Provide field engineering services; establish grades, lines, and levels, by use of recognized engineering survey practices.

B. Control datum for survey is that shown on drawings. Locate and protect control and reference points.

1.17 REFERENCES AND STANDARDS

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

B. The date of the standard is that in effect as of the Bid date, except when a specific date is specified.

C. Obtain copies of standards when required by Contract Documents. Maintain copy at job site during progress of the specific work.

1.18 MISCELLANEOUS PROVISIONS

A. SCHEDULE

1. The following is the required schedule for this work:

a. Bids Due: June 2, 2026 at 1:00PM
b. Notice of Building Contract Award: Within thirty (30) days of receipt and acceptance of qualified low bid.
c. Purchase Order Issuance: The issuance of a State of Delaware purchase order is contingent upon the successful Contractor submitting bonds on State-approved forms, signed contracts and insurance certificates to the State of Delaware within 20 days of Notice of Award. A purchase order will be issued in approximately thirty days after these items have been submitted to the State of Delaware.
d. On-Site Mobilization: Upon receipt of State of Delaware purchase order.
e. Substantial Completion: It is the state of Delaware's preference that the work shall be completed 12 months from on-site start of work.
f. Completion of Punch List: 21 days from date of substantial completion.

1) Refer to the General Requirements for additional details.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

(THIS PAGE INTENTIONALLY LEFT BLANK)

SECTION 01 14 00 - WORK RESTRICTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 USE OF PREMISES

A. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of site beyond areas in which the Work is indicated.

1. Limits: Confine construction operations to the limits indicated on the drawings. Do not disturb areas to remain occupied during the renovations.
2. Owner Occupancy: The Chambers House and surrounding site is currently occupied and will be occupied during the new construction and renovation process. The surrounding occupied areas, site, buildings, roadways, access into the buildings, etc. beyond the work area shall remain accessible to the Owner.
3. Parking: Parking to be located within the Limit of Disturbance. Final location to be coordinated with the Owner.
4. Dumpster: Dumpster to be located within the Limit of Disturbance. Final location to be coordinated with the Owner. The dumpster shall be covered to avoid windblown debris. Debris shall be removed on a regular basis in order to avoid an overflowing dumpster. Restoration of grounds disturbed by the dumpster will be required upon completion of the Project. “No Trespassing” signs shall be placed on the dumpster.
5. Storage: No Storage is allowed within the Chambers House or the adjacent parking lot serving the Chambers House.
6. Public Roadways, Driveways, Entrances and Public Sidewalks: Keep public roadways, driveways, entrances and public sidewalks serving premises clear and available to the Owner, Owner's employees and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
    a. Maintain bike and hiking path for public use along Tweeds Mill Road/Creek Road on nights and weekends.
    b. Schedule deliveries to minimize use of roadways, driveways, sidewalks and entrances.
    c. The Owner will not sign for any deliveries at any time.
    d. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
7. Contractor and subcontractor promotional signage will not be allowed at the project site or within the Park unless approved by the Owner.

B. Use of Existing Building: Maintain the existing building in a weathertight condition throughout renovation period. Repair damage caused by construction operations. Protect building and its contents during construction period.

1. The Contractor shall be provided partial access to specific areas of the Chambers House as necessary to complete the work. Access to Chambers House will be coordinated with the Owner.
2. Use of the Owner's telephones will not be allowed.
3. Flammable materials shall not be stored in the Chambers House and surrounding site. Flammable materials shall be kept outside, away from all buildings, in a flammable liquid/material storage box.
4. Gas powered equipment will not be allowed in the buildings or near windows and intake louvers at any time.
5. Debris shall be removed from and around the Chambers House and site including the sidewalks, trails and parking areas on a daily basis.
6. At no times shall equipment be left operating in and around the Chambers House and site after hours or when no one is present in the building.
7. Noisy activities shall take place during the hours defined by New Castle County and prescheduled with the Owner to avoid disruption of their activities.
8. Access to water will be provided.
9. There will be no restroom facilities available during the construction of the White Clay Creek Nature Center. The Contractor shall provide a self-contained toilet unit securely attached to the ground and kept locked after hours.
10. Dogs or other animals shall not be brought onto the property at any time.
11. Children shall not be brought onto the site at any time.
12. The general surrounds of the site are open to the public and those working at the site shall not use abusive language.
13. Radios or other music-playing devices will not be allowed. Head phones and ear buds will not be allowed.
14. Fire extinguishers shall be kept in the areas under renovation at Chambers House and the surrounding site at all times.
15. All work taking place on the site shall be monitored by the contractor's project superintendent at all times even if the General Contractor's work forces are not working at the site.
16. The Project superintendant shall discuss weekly with the DNREC Project Manager to review the activities planned for that week to avoid miscommunication, facilitate the renovation process and to maintain the Owner's operations.
17. Walk off mats shall be provided at entrances to all construction areas from public ways.
18. Provide protective barriers and covers at entrances and public access areas where work is taking place overhead.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 14 00

SECTION 01 21 00 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

B. Selected materials and equipment are specified in the Contract Documents by Allowances. In some cases, these Allowances include installation. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Proposal Request.

C. Types of allowances include the following:

1. Lump-sum allowances.
2. Unit-cost Allowances.
3. Contingency Allowances.

D. Related Requirements:

1. Section 012200 "Unit Prices" for procedures for using unit prices.

1.3 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Owner of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Owner's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected in writing by Owner from the designated supplier.

1.4 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

1.5 INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.6 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.7 LUMP-SUM ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight**,** and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.8 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

1. Include installation costs in purchase amount only where indicated as part of the allowance.
2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.

4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.

1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

1.9 Contingency Allowances:

A. Use the Contingency Allowance only as directed for the Owner's purposes and only by Change Orders that indicate amounts to be charged to the Allowance.

B. Change Orders authorizing use of funds from the Contingency Allowance, for purchase of products and equipment, will include Contractor's related costs and reasonable overhead and profit margins. These related costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.

C. At Project Closeout, credit unused amounts remaining in the Contingency Allowance to the Owner by Change Order.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. Allowance No. 1 – Contingency Allowance: Include, in the Bid, a Contingency Allowance of the sum of $30,000 for use according to the Owner's instructions.

1. This allowance includes material cost, receiving, handling, installation and Contractor overhead and profit.

B. Allowance No. 2 - Contingency Allowance: Include, in the Bid, a Contingency Allowance of the sum of $30,000 for coordination for infrastructure to support the interpretive design within Exhibit 102.
1. This allowance includes material cost, receiving, handling, installation and Contractor overhead and profit.

END OF SECTION 01 21 00

SECTION 01 22 00 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for unit prices.

B. Related Sections include the following:

1. Division 1 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders.

1.3 DEFINITIONS

A. Unit price is an amount proposed by bidders, stated on the Bid Form, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A list of unit prices is included at the end of this Section. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 LIST OF UNIT PRICES

A. Unit Price No. 1 – Additional Excavation

1. Description: Provide cost per cubic yard for additional excavation (includes removal and hauling off site) beyond what is indicated in the construction documents.
2. Unit of Measurement: CU YD.

B. Unit Price No. 2 – Additional Tree & Brush Removal

1. Description: Provide cost per single tree for additional tree removal beyond what is indicated in the construction documents.
2. Unit of Measurement: Each

C. Unit Price No. 3 – Additional Installation of Asphalt Paving

1. Description: Provide cost per square yard to install additional Asphalt Paving per Asphalt Paving Section on sheet C.11 beyond what is indicated in the construction documents.
2. Unit of Measurement: SQ YD.

D. Unit Price No. 4 – Additional Installation of Concrete Paving
1. Description: Provide cost per square yard to install additional Concrete Paving beyond what is indicated in the construction documents.
2. Unit of Measurement: SQ YD.

E. Unit Price No. 5 – Removal of Unsatisfactory Soils
1. Description: Removal (includes hauling off site) of one cubic yard of unsatisfactory soil and replacement with satisfactory fill beyond what is indicated in the construction documents.
2. Unit of Measurement: CU YD.

F. Unit Price No. 6 – Excavation of Rock/Boulders
1. Description: Provide cost per cubic yard for excavation for rock/boulders one cubic yard and larger in volume, including all necessary equipment and relocation of rock/boulders.
2. Unit of Measurement: CU YD.

END OF SECTION 01 22 00

SECTION 01 23 00 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate 1: Shrubs

1. Remove shrubs from parking islands.
2. Base Bid includes shrubs in the parking islands.

B. Alternate 2: Seed Mix

1. Add seed mix in stormwater basin in lieu of plugs.
2. Base Bid includes plugs in stormwater basin.

C. Alternate 3: Railing Material

1. Remove exterior stainless-steel railings, add galvanized steel railings.
2. Base Bid includes exterior decorative stainless-steel railings.

D. Alternate 4: Railing Material

1. Remove exterior stainless-steel railings, add anodized aluminum railings.
2. Base Bid includes exterior stainless-steel railings.

E. Alternate 5: Green Roof

1. Remove green Roof Type R2, add PVC Roof Type R5.
2. Base Bid includes green roof.

F. Alternate 6: Stone Veneer

1. Remove stone veneer in certain locations, add fiber cement siding.
2. Base Bid includes stone veneer.

G. Alternate 7: Folding Glass Storefront

1. Remove folding glass storefront between the classroom and the outdoor covered area; add double door and fixed window.
2. Base Bid includes folding glass storefront between the classroom and the outdoor covered area.

END OF SECTION 01 23 00

SECTION 01 24 00 - PERMITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes permits that have been issued for this Project as well as permits-in-progress initiated by the Owner and those required Contractor application.

1.3 DEFINITIONS

A. Permits: A document issued by the Authorities having jurisdiction approving specific construction. Permits may approve the documents as submitted or contain caveats that are to be followed.

1. Preconstruction Permits: Permits issued prior to the bidding and award and which are required prior to proceeding to this stage.
2. Post Bid Permits: Permits required to by applied for by the successful contractor. These include demolition permits, building permits and sub-permits such as mechanical, electrical, fire suppression and plumbing.
3. Post Construction Permits: Permits issued by the authorities having jurisdiction stating that a structure or portion of the structure has been approved as complying with applicable laws, regulations and codes and may be occupied and put to its intended you.

1.4 RESPONSIBILITIES

A. The Contractor shall abide by the approved permits which are to include the notations provided by the entity/person approving the permit.

B. The Contractor is responsible for obtaining and paying for all construction permits unless stated otherwise in the construction documents.

1. The Contractor shall conform to all of the regulations and requirements, and shall be responsible for costs associated therewith, of all permits required of the Work.
2. The Contractor shall be responsible for scheduling all inspections as required by the permits.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ISSUED PERMITS

A. State of Delaware Architectural Accessibility Board.

B. Department of Natural Resources and Environmental Control (DNREC).

1. Sediment and Stormwater Plan Approval (02/27/2026)

2. Notice of Intent (NOI) Stormwater Discharge Permit (ID # 7774)

C. New Castle County Historic Review Board

D. DelDOT Letter of No Objection to Record (LONO) Approval

E. Site Fire Plan Approval

3.2 SCHEDULE OF PENDING PERMITS

A. New Castle County Grading Plan Approval

B. New Castle County Record Land Development Approval

C. State Fire Marshal

END OF SECTION 01 24 00

SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Sections include the following:

1. Division 1 Section “Submittal Procedures for” administrative procedures for handling requests for substitutions made after Contract award.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions.

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
c. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
5. Comply with requirements in Division 1 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

1.5 CHANGE ORDER PROCEDURES

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

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 26 00

SECTION 01 29 00 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Sections include the following:

1. Division 1 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
2. Division 1 Section "Construction Progress Documentation" for administrative requirements governing preparation and submittal of Contractor's Construction Schedule.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.

1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:

   a. Application for Payment forms with Continuation Sheets.

2. Submit the Schedule of Values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the Schedule of Values:

   a. Project name and location.
   b. Name of Architect.
   c. Architect's project number.
   d. Contractor's name and address.
   e. Date of submittal.

2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:

a. Related Specification Section or Division.
b. Description of the Work.
c. Change Orders (numbers) that affect value.
d. Dollar value.

1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

a. Differentiate between items stored on-site and items stored off-site. Include evidence of insurance or bonded warehousing if required.

6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.

8. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

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

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.

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

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.

1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
3. Submit one draft copy electronically for review and approval.

E. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

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

F. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of Values.
3. Contractor's Construction Schedule (preliminary if not final).
4. List of Contractor's staff assignments (Project Superintendent specifically).
5. Copies of building permits.
6. Certificates of insurance and insurance policies.
7. Performance and payment bonds.

G. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.

H. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Updated final statement, accounting for final changes to the Contract Sum.
2. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
3. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
4. AIA Document G707, "Consent of Surety to Final Payment."

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00

(THIS PAGE INTENTIONALLY LEFT BLANK)

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General project coordination procedures.
2. Administrative and supervisory personnel.
3. Project meetings.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Construction Progress Documentation" for preparing and submitting the Contractor's Construction Schedule.
2. Division 1 Section "Closeout Procedures" for coordinating Contract closeout.

1.3 COORDINATION

A. Coordination: Coordinate construction operations included in various Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with subcontractors to ensure maximum accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. If necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's Construction Schedule.

2. Preparation of the Schedule of Values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.

1.4 SUBMITTALS

A. Staff Names: Within 15 days of notice to proceed, submit a list of principal staff assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.

1.5 PROJECT MEETINGS

A. General: The Architect will schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting.
2. Minutes: The Architect will record significant discussions and agreements achieved. The minutes will be distributed to everyone concerned, including Owner, within 7 days of the meeting.

B. Preconstruction Conference: A preconstruction conference will be scheduled before the start of construction, at a time convenient to the Owner and Contractor, but no later than 15 days after execution of the Agreement. The conference will be held at the Project. The meeting will be conducted to review responsibilities and personnel assignments.

1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Items of significance that could affect progress will be discussed, including the following:

a. Tentative construction schedule.
b. Designation of responsible personnel.
c. Procedures for processing field decisions and Change Orders.
d. Procedures for processing Applications for Payment.
e. Submittal procedures.
f. Preparation of Record Documents.
g. Use of the premises.
h. Responsibility for temporary facilities and controls.
i. Parking availability.
j. Storage areas.
k. Equipment deliveries and priorities.
l. Progress cleaning.

m. Working hours.

C. Progress Meetings: Progress meetings will be conducted every two weeks. Coordinate dates of meetings with preparation of payment requests.

1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

    a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    b. Review present and future needs of each entity present, including the following:

        1) Deliveries.
        2) Off-site fabrication.
        3) Access.
        4) Site utilization.
        5) Temporary facilities and controls.
        6) Work hours.
        7) Progress cleaning.
        8) Quality and work standards.

3. Reporting: The Architect will distribute minutes of the meeting to each party present and to parties who should have been present. A brief summary, in narrative form, of progress since the previous meeting and report will be included.

    a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. The revised schedule will be issued concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

(THIS PAGE INTENTIONALLY LEFT BLANK)

SECTION 01 31 50 – FIELD ENGINEERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative provisions and procedural requirements for Field Engineering services, including, but not necessarily limited to the following:

1. Land Survey Work.
2. Engineering services.

1.3 SUBMITTALS

A. Certificates: Submit a certificate signed by the Land Surveyor certifying that the location and elevation of improvements comply with the Contract Documents.

B. Project Record Documents: Submit a record of Work performed and record survey data as required under provisions of Sections "Submittals" and "Project Closeout".

1.4 QUALITY ASSURANCE

A. Surveyor: Engage a Professional Land Surveyor, licensed in the State of Delaware, to perform required surveying services to ensure that grades, lines, levels, and locations of the Work are in compliance with the Contract Documents.

B. Engineer: Engage a Professional Engineer of the discipline required, registered in the State of Delaware, to perform required engineering services.

1.5 EXAMINATION

A. The Owner will identify existing control points and property line corner stakes.

B. Verify layout information shown on the Drawings, in relation to the property survey and existing benchmarks before proceeding to layout the Work. Locate and protect existing benchmarks and control points. Preserve permanent reference points during construction.

1. Do not change or relocate benchmarks or control points without prior written approval. Promptly report lost or destroyed reference points, or requirements to relocate reference points because of necessary changes in grades or locations.
2. Promptly replace lost or destroyed Project control points. Base replacements on the original survey control points.

C. Establish and maintain a minimum of two permanent benchmarks on the site, referenced to data established by survey control points.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

D. Existing utilities and equipment: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction.

1.6 PERFORMANCE

A. Working from lines and levels established by the property survey, establish benchmarks and markers to set lines and levels at each story of construction and elsewhere as needed to properly locate each element of the Project. Calculate and measure required dimensions within indicated or recognized tolerances. Do not scale Drawings to determine dimensions.

1. Advise entities engaged in construction activities, of marked lines and levels provided for their use.
2. As construction proceeds, check every major element for line, level and plumb.

B. Surveyor's Log: Maintain a surveyor's log of control and other survey Work. Make this log available for reference.

1. Record deviations from required lines and levels, and advise the Architect when deviations that exceed indicated or recognized tolerances are detected. On Project Record Drawings, record deviations that are accepted and not corrected.
2. On completion of foundation walls, major site improvements, and other Work requiring field engineering services, prepare a certified survey showing dimensions, locations, angles and elevations of construction and sitework.

C. Site Improvements: Locate and lay out site improvements, including pavements, stakes for grading, fill and topsoil placement, utility slopes and invert elevations by instrumentation and similar appropriate means.

D. Building Lines and Levels: Locate and lay out batter boards for structures, building foundations, column grids and locations, floor levels and control lines and levels required for mechanical and electrical work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 50

SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Contractor's Construction Schedule.
2. Field condition reports.
3. Special reports.

B. Related Sections include the following:

1. Division 1 Section "Payment Procedures" for submitting the Schedule of Values.
2. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.

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

C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

D. Event: The starting or ending point of an activity.

E. Major Area: A story of construction, a separate building, or a similar significant construction element.

F. Milestone: A key or critical point in time for reference or measurement.

1.4 SUBMITTALS

A. Preliminary Construction Schedule: Submit two opaque copies.

B. Contractor's Construction Schedule: Submit two opaque copies of initial schedule, large enough to show entire schedule for entire construction period.

C. Field Condition Reports: Submit two copies at time of discovery of differing conditions.

D. Special Reports: Submit two copies at time of unusual event.

1.5 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from parties involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."

B. Time Frame: Extend schedule from date established for commencement of the Work to date of Substantial Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each separate area as a separate numbered activity for each principal element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Submittal Review Time: Include review and resubmittal times indicated in Division 1 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.

3. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Work Restrictions: Show the effect of the following items on the schedule:

a. Coordination with existing construction.
b. Use of premises restrictions.
c. Provisions for future construction.
d. Seasonal variations.
e. Environmental control.

2. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

a. Mockups.
b. Fabrication.
c. Deliveries.
d. Installation.

E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion**.**

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

2.2 CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit horizontal bar-chart-type construction schedule within five days of date established for commencement of the Work.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities.

2.3 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.

5. Material deliveries.
6. High and low temperatures and general weather conditions.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (refer to special reports).
10. Stoppages, delays, shortages, and losses.
11. Emergency procedures.
12. Orders and requests of authorities having jurisdiction.
13. Change Orders received and implemented.
14. Construction Change Directives received and implemented.
15. Substantial Completions authorized.

B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.4 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At bi-weekly intervals, update schedule to reflect actual construction progress and activities. Issue schedule at each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. As the Work progresses, indicate Actual Completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, and other parties identified by Contractor with a need-to-know schedule responsibility.

END OF SECTION 01 32 00

SECTION 01 32 33 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Periodic construction photographs.
3. Final Completion construction photographs.

B. Related Sections include the following:

1. Division 01 Section "Submittal Procedures" for submitting photographic documentation.
2. Division 01 Section "Closeout Procedures" for submitting digital media as Project Record Documents at Project closeout.
3. Division 01 Section "Selective Demolition" for photographic documentation before selective demolition operations commence.

1.3 SUBMITTALS

A. Construction Digital Images: Submit a complete set of digital image electronic files as part of the Project closeout on CD-ROM, DVD or flash drive. Identify electronic media with date photographs were taken. Submit images that have same aspect ratio as the sensor, uncropped.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in uncompressed TIFF or JPEG format, produced by a digital camera with minimum sensor size of 12.0 megapixels, and at an image resolution of not less than 4000 by 3000 pixels.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

1. Photographs are to be taken weekly at a minimum during normal construction and daily during small duration projects or significant activities.
2. Photographs are to be taken prior to the start of the work to record existing conditions.
3. Photographs are to be taken when areas are opened prior to the start of the new work.
4. Photographs are to be taken during demolition operations.

5. Provide temporary lighting when required to produce clear, well-lit photographs without obscuring shadows.

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

1. Date and Time: Include date and time in filename for each image.
2. Field Office Images: Maintain one set of images on a thumb drive in the field office at Project site, available at all times for reference. Identify images same as for those submitted to Architect.

C. Preconstruction Photographs: Before commencement of excavation and/or demolition, and starting of construction take color, digital photographs of Project building interior and exterior, site and surrounding properties, including existing items to remain during construction, from different vantage points, or as directed by Architect.

1. Flag excavation areas and construction limits before taking construction photographs.
2. Take a minimum of eight photographs to show existing conditions adjacent to building before starting the Work.
3. Take a minimum of eight photographs of existing buildings adjacent to the building to accurately record physical conditions at start of construction.
4. Take a minimum of four photographs of each existing room even if renovations are not planned in that space.
5. Take as many photographs as necessary to document the exterior of the existing building.
6. Take additional photographs as required to record settlement or cracking of adjacent pavements, and other improvements.

D. Architect-Directed Construction Photographs: From time to time, Architect will instruct the Contractor about number and frequency of color, digital photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.

E. Final Completion Construction Photographs: Take a minimum of four-color photographs of each room and eight color photographs of the exterior after date of Substantial Completion for submission as Project Record Documents. Architect will direct photographer for desired vantage points.

1. Do not include date stamp.

END OF SECTION 01 32 33

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Sections include the following:

1. Division 1 Section "Payment Procedures" for submitting Applications for Payment and the Schedule of Values.
2. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes and for submitting Coordination Drawings.
3. Division 1 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule.
4. Division 1 Section "Quality Requirements" for submitting test and inspection reports and for mockup requirements.
5. Division 1 Section "Closeout Procedures" for submitting warranties.
6. Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
7. Division 1 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Architect's responsive action.

B. Informational Submittals: Written information that does not require Architect’s responsive action. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL PROCEDURES

A. General: Electronic copies of select CAD Drawing files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals. The Contractor will be responsible for field verifying existing conditions.

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

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

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

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

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.

D. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches (150 by 200 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information on label for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name and address of Architect.
    d. Name and address of Contractor.
    e. Name and address of subcontractor.
    f. Name and address of supplier.
    g. Name of manufacturer.
    h. Submittal number or other unique identifier, including revision identifier.

        1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).

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

E. Deviations: Highlight or otherwise specifically identify deviations from the Contract Documents on submittals.

F. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

G. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.

1. Transmittal Form: Provide locations on form for the following information:

a. Project name.
b. Date.
c. Destination (To:).
d. Source (From:).
e. Names of subcontractor, manufacturer, and supplier.
f. Category and type of submittal.
g. Submittal purpose and description.
h. Specification Section number and title.
i. Drawing number and detail references, as appropriate.
j. Submittal and transmittal distribution record.
k. Remarks.
l. Signature of transmitter.

2. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same label information as related submittal.

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

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked "Furnish as Submitted”.

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

J. Use for Construction: Use only final submittals with mark indicating "Furnish as Submitted" or “Revise as Noted & Furnish” taken by Architect.

1.5 CONTRACTOR'S USE OF ARCHITECT'S CAD FILES

A. General: At Contractor's written request, copies of Architect's CAD files will be provided to Contractor for Contractor's use in connection with Project, subject to the following conditions:

1. CADD files are limited to those that have been generated for this Project.
2. CADD files for the floor plans, reflected ceiling plans, and roof plans shall be provided. Files for details, etc. will not be provided.
3. Contractor will be asked to sign Architects waiver of release form before files will be delivered to the contractor.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

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

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

a. Manufacturer's written recommendations.
b. Manufacturer's product specifications.
c. Manufacturer's installation instructions.
d. Standard color charts.
e. Manufacturer's catalog cuts.
f. Wiring diagrams showing factory-installed wiring.
g. Printed performance curves.
h. Operational range diagrams.
i. Mill reports.
j. Standard product operation and maintenance manuals.
k. Compliance with specified referenced standards.
l. Testing by recognized testing agency.
m. Application of testing agency labels and seals.
n. Notation of coordination requirements.

4. Submit Product Data before or concurrent with Samples.
5. Submit electronic files of Product Data, unless otherwise indicated. Architect will return the reviewed files. Retain copy as a Project Record Document.

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

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

    a. Dimensions.
    b. Identification of products.
    c. Fabrication and installation drawings.
    d. Roughing-in and setting diagrams.
    e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
    f. Shopwork manufacturing instructions.
    g. Templates and patterns.
    h. Schedules.
    i. Design calculations.
    j. Compliance with specified standards.
    k. Notation of coordination requirements.
    l. Notation of dimensions established by field measurement.
    m. Relationship to adjoining construction clearly indicated.
    n. Seal and signature of professional engineer if specified.
    o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 24 by 36 inches.
3. Number of Copies: Submit electronic files of each submittal. Retain copies where copies are required for operation and maintenance manuals. The Architect will return the reviewed files.

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

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

    a. Generic description of Sample.
    b. Product name and name of manufacturer.
    c. Sample source.
    d. Number and title of appropriate Specification Section.

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

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

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

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

5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

   a. Number of Samples: Submit four sets of Samples. Architect will retain three Sample sets; remainder will be returned.

      1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least four sets of paired units that show approximate limits of variations.

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

1. Type of product. Include unique identifier for each product.
2. Number and name of room or space.
3. Location within room or space.
4. Number of Copies: Submit three copies of product schedule or list, unless otherwise indicated. Architect will return two copies.

   a. Mark up and retain one returned copy as a Project Record Document.

F. Contractor's Construction Schedule: Comply with requirements specified in Division 1 Section "Construction Progress Documentation" for Construction Manager's action.

G. Submittals Schedule: Comply with requirements specified in Division 1 Section "Construction Progress Documentation."

H. Application for Payment: Comply with requirements specified in Division 1 Section "Payment Procedures."

I. Schedule of Values: Comply with requirements specified in Division 1 Section "Payment Procedures."

J. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.
4. Number of Copies: Submit three copies of subcontractor list, unless otherwise indicated. Architect will return two copies.

    a. Mark up and retain one returned copy as a Project Record Document.

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

1. Number of Copies: Submit electronic files. Architect will not return copies.
2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
3. Test and Inspection Reports: Comply with requirements specified in Division 1 Section "Quality Requirements."

B. Coordination Drawings: Comply with requirements specified in Division 1 Section "Project Management and Coordination."

C. Contractor's Construction Schedule: Comply with requirements specified in Division 1 Section "Construction Progress Documentation."

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

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

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

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

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

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

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

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

L. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

M. Schedule of Tests and Inspections: Comply with requirements specified in Division 1 Section "Quality Requirements."

N. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

O. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

P. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

Q. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 1 Section "Operation and Maintenance Data."

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

S. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

T. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

U. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

V. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Architect.

1. Architect will not review submittals that include MSDSs and will return the entire submittal for resubmittal.

2.3 DELEGATED DESIGN SERVICES

1. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
   a. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to the architect.
2. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic files and three paper copies of certificates, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
   a. Indicate the products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

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

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:

1. No Exceptions Taken
2. Exceptions as Noted
3. Revise & Resubmit
4. Rejected
5. Reviewed for Information Only
6. Action Varies by Item

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

D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 01 33 00

THIS PAGE INTENTIONALLY LEFT BLANIK

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

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

C. Related Sections include but are not limited to the following:

1. Division 1 Section "Construction Progress Documentation" for developing a schedule of required tests and inspections.
2. Division 1 Section "Cutting and Patching" for repair and restoration of construction disturbed by testing and inspecting activities.

1.3 DEFINITIONS

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

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and

completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.

D. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.

E. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

F. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.

G. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

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

I. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

J. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to trades people of the corresponding generic name.

K. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the

most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

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

1.5 SUBMITTALS

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

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Description of test and inspection.
3. Identification of applicable standards.
4. Identification of test and inspection methods.
5. Number of tests and inspections required.
6. Time schedule or time span for tests and inspections.
7. Entity responsible for performing tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

C. Reports: Prepare and submit certified written reports that include the following:

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

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee

payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

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

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

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

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

E. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

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

1. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

G. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.

4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.

    a. Allow seven days for initial review and each re-review of each mockup.

5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed, unless otherwise indicated.

1.7 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor and the Contract Sum will be adjusted by Change Order.

B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

    a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 1 Section "Submittal Procedures."

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

E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

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

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

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

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

H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for commencement of the Work.

1. Distribution: Distribute schedule to Owner, Architect testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.8 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
2. Comply with the Contract Document requirements for Division 1 Section "Cutting and Patching."

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

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

END SECTION 01 40 00

SECTION 01 42 00 - REFERENCE STANDARDS AND DEFINITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

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

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

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

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

E. "Regulations": The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": The term "furnish" means to supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": The term "install" describes operations at the Project site including the actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": The term "provide" means to furnish and install, complete and ready for the intended use.

I. "Installer": An installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, or similar operations. Installers are required to be experienced in the operations they are engaged to perform.

1. The term "experienced," when used with the term "installer," means having successfully completed a minimum of five previous projects similar in size and scope to this Project;

being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.

2. Trades: Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.
3. Assigning Specialists: Certain Sections of the Specifications require that specific construction activities shall be performed by specialists who are recognized experts in those operations. The specialists must be engaged for those activities, and their assignments are requirements over which the Contractor has no option. However, the ultimate responsibility for fulfilling contract requirements remains with the Contractor.

    a. This requirement shall not be interpreted to conflict with enforcing building codes and similar regulations governing the Work. It is also not intended to interfere with local trade-union jurisdictional settlements and similar conventions.

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

K. "Testing Agencies": A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.3 SPECIFICATION FORMAT AND CONTENT EXPLANATION

A. Specification Format: These Specifications are organized into Divisions and Sections based on the CSI/CSC's "MasterFormat" numbering system.

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

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be interpolated as the sense requires. Singular words shall be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.
2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Section Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor or by others when so noted.

    a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

1.4 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of the date of the Contract Documents.

C. Conflicting Requirements: Where compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to the Architect for a decision before proceeding.

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

D. Copies of Standards: Each entity engaged in construction on the Project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source and make them available on request.

E. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where abbreviations and acronyms are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards-producing organization, authorities having jurisdiction, or other entity applicable to the context of the text provision. Refer to Gale Research's "Encyclopedia of Associations" or Columbia Books' "National Trade & Professional Associations of the U.S.," which are available in most libraries.

1.5 SUBMITTALS

A. Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

PRODUCTS (Not Applicable)

PART 2 - EXECUTION (Not Applicable)

END OF SECTION 01 42 00

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.3 USE CHARGES

A. General: Cost or use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to testing agencies and authorities having jurisdiction.

B. Sewer Service: Sewer service is not available at the site.

C. Water Service: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

D. Electric Power Service: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

E. Telephone Service: Provide temporary phone service to the site as required to contact Contractor site representatives.

1.4 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

D. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.

1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

E. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:

1. Locations of dust-control partitions at each phase of work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air-filtration system discharge.
4. Waste handling procedures.
5. Other dust-control measures.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Comply with Federal, State and local codes and regulations as well as utility company requirements.

C. Coordinate work with Owner’s requirements.

D. Materials: Materials must be new and adequate in capacity for the required usage. Materials must not create unsafe conditions nor violate requirements of applicable codes and standards.

E. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

B. Maintain excavations free of water. Provide and operate pumping equipment. Grade site to drain water away from buildings and excavations.

C. Provide temporary protection for installed products. Control traffic in immediate area to minimize damage.

D. Prohibit traffic and storage on waterproofed and roofed surfaces, on lawns and landscaped areas.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top rails.

B. Portable Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top and bottom rails. Provide concrete bases for supporting posts.

C. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil (0.25-mm) minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

D. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches (914 by 1624 mm).

E. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

F. Lumber and Plywood: Pressure-treated dimension lumber and plywood suitable for exterior exposure.

G. Paint: Exterior latex primer and matching topcoat.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect/Engineer and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.

2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- (1.2-m-) square tack and marker boards.
3. Drinking water and private toilet.
4. Coffee machine and supplies.
5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).
6. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. Heating Equipment: Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

Provide potable water for drinking and construction purposes.

1. The Contractor shall make all necessary arrangements for temporary water service for construction purposes, and furnish at his own expense all piping and accessories required.
2. Take positive measures to preclude cross-connections and backflow.
3. The Contractor will assume the cost of water consumed if responsible care and restraint are not exercised by the Contractor in its use.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

E. Construction Aids: The General Contractor and each Subcontractor shall provide construction aids and equipment required by their personnel and to facilitate execution of their Work. Examples are scaffolds, staging, ladders, stairs, ramps, runways, platforms, railings, hoists, cranes, chutes and other such facilities and equipment. Mutual use may be arranged by the Contractor where applicable.

F. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

G. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.

    a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
    b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

H. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

I. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

J. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Install electric power service underground unless otherwise indicated.
2. Connect temporary service to Owner's existing power source, as directed by Owner.

K. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
2. Install lighting for Project identification sign.

L. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.

1. Provide additional telephone lines for the following:

a. Provide a dedicated telephone line for each facsimile machine in each field office.

2. At each telephone, post a list of important telephone numbers.

a. Police and fire departments.
b. Ambulance service.
c. Contractor's home office.
d. Contractor's emergency after-hours telephone number.
e. Architect's office.
f. Engineers' offices.
g. Owner's office.
h. Principal subcontractors' field and home offices.

3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect/Engineer schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after

Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Security: Security of persons and property in the areas under control of the Contractor shall be the Contractor's exclusive responsibility.

1. The Contractor, at his own expense, shall initiate whatever programs that are necessary to execute his responsibility.
2. Control of access to the area under the Contractor's control shall be maintained. Visitors shall be required to report immediately to the Contractor's Superintendent and to produce full identification which will be recorded in the Contractor's Daily Log along with the purpose of the visit.

C. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants and control valves.
3. Provide and maintain uninterrupted vehicular access to site and within to temporary construction facilities and work areas for persons and equipment involved in the construction of Project.
4. Maintain traffic areas free of excavated materials, construction equipment, products, snow, ice and debris.

D. Traffic Regulation: Obtain all necessary permits for access to and use of public roads and streets for construction and hauling purposes. Comply with traffic control regulations applying to permit issuance.

1. Provide markers, signs, lights and barriers on and near the site to safely control construction traffic and public access.

E. Parking: Use designated areas of Owner's existing parking areas for construction personnel's private vehicles and of Contractor's light-weight vehicles.

F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

    a. Provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touchup signs so they are legible at all times.

G. Waste Disposal Facilities: Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

H. Cleaning During Construction: Control accumulation of waste materials and rubbish. Periodically dispose of legally off site.

1. Clean interior areas prior to the start of finish work. Maintain areas free of dust and other contaminants during finishing operations.

I. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

J. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

K. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

L. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

M. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

N. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings.

1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

O. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

P. Tree and Plant Protection: Comply with requirements specified in Section 015639 "Temporary Tree and Plant Protection."

Q. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control

procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

R. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose portion of site determined sufficient to accommodate construction operations and maintain security.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish 10 sets of keys to Owner.

S. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

T. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

U. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

V. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

W. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.4 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard, replace, or clean stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use permanent HVAC system to control humidity.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

    a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
    b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
    c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 01 50 00

(THIS PAGE INTENTIONALLY LEFT BLANK)

SECTION 01 56 00 - ENVIRONMENTAL PROTECTION

PART 1 - GENERAL

1.1 ENVIRONMENTAL PROTECTION

A. Environmental protection considerations consist of, but are not limited to, the following factors:

1. Natural resources including air, water, and land.
2. Solid waste disposal.
3. Noise.
4. Control of toxic substances and hazardous materials.
5. The presence of chemical, physical, and biological elements and agents that adversely effect and alter ecological balances.

1.2 GENERAL REQUIREMENTS

A. Provide and maintain environmental protection defined herein, other Sections and as indicated in the Drawings.

B. Comply with all Federal, State, and local laws, ordinances and regulations pertaining to environmental protection.

C. Compliance by subcontractors with the provisions of this and various other sections of these specifications is the responsibility of the Contractor.

D. Use of equipment from which factory-installed, anti-pollution and noise control devices are removed or rendered ineffective, either intentionally or through lack of proper maintenance is prohibited.

E. Furnish a certificate that all materials and operating equipment installed as a part of this project, the installation thereof and all equipment used in the construction, are in compliance with all applicable local laws, ordinances, regulations and permits concerning environmental pollution control and abatement.

1.3 PROTECTION OF NATURAL RESOURCES

A. General: It is intended that the natural resources within the project boundaries and outside the limits of permanent work performed be preserved in their existing condition, be restored to an equivalent of the existing condition or improved as indicated, as approved by the Architect/Engineer, upon completion of the work. Confine on-site construction activities to areas defined by the drawings and specifications.

1.4 TOXIC SUBSTANCES

B. Asbestos and Hazardous Materials Procedure: In the event the Contractor, during the course of the work on the project, encounters the presence of asbestos or any materials containing asbestos, or polychlorinated biphenyl (PCB's) or any other hazardous materials as recognized by local Authorities having jurisdiction, promptly notify the Owner through the Architect/Engineer. Do not perform any work pertinent to the asbestos or hazardous material prior to receipt of special instructions from the Owner through the Architect/Engineer. Any delay in the progress of the work as a result of encountering either asbestos or hazardous materials on the project will be mitigated by the Architect/Engineer. Within 24 hours of this notification to the Owner through the Architect/Engineer of the encountering of the presence of asbestos or hazardous materials, the Contractor will meet with the Architect/Engineer to replan and work around the affected area. The Architect/Engineer will provide the special instructions without delay and upon confirmation by the local Authorities of the actions taken and authorize work to progress.

C. Comply with all applicable provisions of the National Emission Standards for Asbestos (40 CFR 61 Subpart B).

D. Comply with the local regulations of polychlorinated biphenyl (PCB). Since these chemicals are used in some existing insulation, existing fixed and vehicular transformers, assure proper marking, handling, and disposal of any PCB's in accordance with the regulations of 40 CFR 761.

1. Do not use PCB chemical substance, mixture, equipment, container, sealant, coating, or dust-control agent except in accordance with regulations of 40 CFR 761.
2. Immediately report any PCB chemical substance, mixture, equipment, container, sealant, coating or dust control agent found stored within the project area to the Architect in writing and stop work in the area.

E. Lead paint is not known to be present in cite elements containing lead.

F. Asbestos is not known to be present in cite elements containing asbestos.

1.5 CONTROL AND DISPOSAL OF EXCESS MATERIAL, TRASH AND DEBRIS

A. Dispose of excess excavated material that is approved by the Architect/Engineer as clean fill onsite if an onsite soil disposal area is approved by the Architect/Engineer. If no such site is approved, dispose of the material in accordance with the provision of paragraph 1.5 (C).

B. Pick-up trash and place in containers. Empty containers on a regular schedule. Conduct handling and disposal to prevent contamination of the site and other areas. Do not dispose of in areas of natural vegetation. On completion, leave the area clean and natural looking.

C. Dispose of rubbish and debris as follows:

1. Transport all waste off the site and dispose of it in a manner that complies with State, and local requirements. Secure a permit or license prior to transporting any material off the site. Do not burn or bury waste materials on the site.

1.6 CONTROL AND DISPOSAL OF CHEMICAL AND SANITARY WASTES

A. Store chemical waste in corrosion-resistant containers, remove from the project site, and dispose of as necessary, but not less frequently than monthly. Provide for disposal of chemical waste in accordance with standard established practices as approved by the Architect. Dispose of lubricants to be discarded in accordance with approved procedures meeting state, and local regulations.

1.7 DUST CONTROL

A. Keep dust down at all times including nonworking hours, weekends, and holidays.

B. Secure and cover transport equipment and loose materials in transit to ensure that materials do not become airborne during transit.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 56 00

(THIS PAGE INTENTIONALLY LEFT BLANK)

SECTION 01 56 39 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

B. Related Sections:

1. Section 015000 "Temporary Facilities and Controls" for temporary site fencing.
2. Section 311000 "Site Clearing" for removing existing trees and shrubs.

1.3 DEFINITIONS

A. Caliper: Diameter of a trunk measured by a diameter tape at 6 inches (150 mm) above the ground for trees up to, and including, 4-inch (100-mm) size; and 12 inches (300 mm) above the ground for trees larger than 4-inch (100-mm) size.

B. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

C. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.

D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: For each type of the following:

1. Organic Mulch: 1-pint (0.5-L) volume of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.
2. Protection-Zone Fencing: Assembled Samples of manufacturer's standard size made from full-size components.

3. Protection-Zone Signage: Full-size Samples of each size and text, ready for installation.

C. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.

1. Species and size of tree.
2. Location on site plan. Include unique identifier for each.
3. Reason for pruning.
4. Description of pruning to be performed.
5. Description of maintenance following pruning.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified arborist and tree service firm.

B. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

C. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

D. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1. Use sufficiently detailed photographs or videotape.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

1.6 QUALITY ASSURANCE

A. Arborist Qualifications: Certified Arborist as certified by ISA.

B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.

C. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:

a. Construction schedule. Verify availability of materials, personnel, and equipment needed to make progress and avoid delays.
b. Enforcing requirements for protection zones.
c. Arborist's responsibilities.

d. Field quality control.

1.7 PROJECT CONDITIONS

A. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil: Natural or cultivated top layer of the soil profile or manufactured topsoil; containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch (25 mm) in diameter; and free of weeds, roots, and toxic and other nonsoil materials.

1. Obtain topsoil only from well-drained sites where topsoil is 4 inches (100 mm) deep or more; do not obtain from bogs or marshes.

B. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:

1. Type: Shredded hardwood.
2. Size Range: 3 inches (76 mm) maximum, 1/2 inch (13 mm) minimum.
3. Color: Natural.

C. Protection-Zone Fencing: Fencing fixed in position and meeting one of the following requirements.

1. Chain-Link Protection-Zone Fencing: Galvanized-steel fencing fabricated from minimum 2-inch (50-mm) opening, 0.148-inch- (3.76-mm-) diameter wire chain-link fabric; with pipe posts, minimum 2-3/8-inch- (60-mm-) OD line posts, and 2-7/8-inch-

(73-mm-) OD corner and pull posts**;** with 1-5/8-inch- (42-mm-) OD top rails; with 0.177-inch- (4.5-mm-) diameter top tension wire and 0.177-inch- (4.5-mm-) diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.

a. Height: 4 feet (1.2 m).

2. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch (50-mm) maximum opening in pattern and weighing a minimum of 0.4 lb/ft. (0.6 kg/m); remaining flexible from minus 60 to plus 200 deg F (minus 16 to plus 93 deg C); inert to most chemicals and acids; minimum tensile yield strength of 2000 psi (13.8 MPa) and ultimate tensile strength of 2680 psi (18.5 MPa); secured with plastic bands or galvanized-steel or stainless-steel wire ties; and supported by tubular or T-shape galvanized-steel posts spaced not more than 8 feet (2.4 m) apart.

a. Height: 4 feet (1.2 m).
b. Color: High-visibility orange, nonfading.

D. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering and as follows:

1. Size and Text: DO NOT ENTER. TREE PROTECTION ZONE.
2. Lettering: 3-inch- (75-mm-) high minimum, white characters on red background.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

B. For the record, prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

A. Locate and clearly identify trees, shrubs, and other vegetation to remain. Flag each tree trunk at 54 inches (1372 mm) above the ground.

B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated.

1. Apply 4-inch (100-mm) average thickness of organic mulch. Do not place mulch within 6 inches (150 mm) of tree trunks.

3.3 TREE- AND PLANT-PROTECTION ZONES

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected area except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.

1. Chain-Link Fencing: Install to comply with ASTM F 567 and with manufacturer's written instructions.
2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.

B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Architect. Install one sign spaced approximately every 20 feet (6 m) on protection-zone fencing, but no fewer than one sign with each facing a different direction.

C. Maintain protection zones free of weeds and trash.

D. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

E. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.

1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 312000 "Earth Moving."

B. Trenching near Trees: Where utility trenches are required within protection zones, hand excavate under or around tree roots or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning.

C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches (75 mm) back from new construction and as required for root pruning.

D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

A. Prune roots that are affected by temporary and permanent construction. Prune as follows:

1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
2. Cut Ends: Coat cut ends of roots more than 1-1/2 inches (38 mm) in diameter with an emulsified asphalt or other coating formulated for use on damaged plant tissues and that is acceptable to arborist.
3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
4. Cover exposed roots with burlap and water regularly.
5. Backfill as soon as possible according to requirements in Section 312000 "Earth Moving."

B. Root Pruning at Edge of Protection Zone: Prune roots 6 inches (150 mm) inside of the protection zone, by cleanly cutting all roots to the depth of the required excavation.

C. Root Pruning within Protection Zone: Clear and excavate by hand to the depth of the required excavation to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

3.6 CROWN PRUNING

A. Prune branches that are affected by temporary and permanent construction. Prune branches as follows:

1. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.
2. Pruning Standards: Prune trees according to ANSI A300 (Part 1) and the following:

    a. Type of Pruning: Cleaning.

3. Cut branches with sharp pruning instruments; do not break or chop.

4. Do not apply pruning paint to wounds.

B. Chip removed branches and spread over areas identified by Architect.

3.7 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.

1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.

C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

D. Minor Fill within Protection Zone: Where existing grade is 2 inches (50 mm) or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.

3.8 FIELD QUALITY CONTROL

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.9 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

1. Submit details of proposed root cutting and tree and shrub repairs.
2. Have arborist perform the root cutting, branch pruning, and damage repair of trees and shrubs.
3. Treat damaged trunks, limbs, and roots according to arborist's written instructions.
4. Perform repairs within 24 hours.
5. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by Architect.

B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.

1. Provide new trees of same size and species as those being replaced for each tree that measures 6 inches (150 mm) or smaller in caliper size.

    a. Species: Match existing tree to be replaced.

C. Soil Aeration: Where directed by Architect, aerate surface soil compacted during construction. Aerate 10 feet (3 m) beyond drip line and no closer than 36 inches (900 mm) to tree trunk. Drill 2-inch- (50-mm-) diameter holes a minimum of 12 inches (300 mm) deep at 24 inches (600 mm) o.c. Backfill holes with an equal mix of augered soil and sand.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 01 56 39

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Sections include but are not limited to the following:

1. Division 1 Section "References" for applicable industry standards for products specified.
2. Division 1 Section "Closeout Procedures" for submitting warranties for Contract closeout.
3. Other included Sections for specific requirements for warranties on products and installations specified to be warranted.

1.3 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

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

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

1.4 SUBMITTALS

A. Product List: Submit a list, in tabular from, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.

1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
2. Form: Tabulate information for each product under the following column headings:

    a. Specification Section number and title.
    b. Generic name used in the Contract Documents.
    c. Proprietary name, model number, and similar designations.
    d. Manufacturer's name and address.
    e. Supplier's name and address.
    f. Installer's name and address.
    g. Projected delivery date or time span of delivery period.
    h. Identification of items that require early submittal approval for scheduled delivery date.

3. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.

    a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.

4. Completed List: Within 60 days after date of commencement of the Work, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
5. Architect's Action: Architect will respond in writing to Contractor within 15 days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.

B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use CSI Form 13.1A at the end of this section.

2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

    a. Statement indicating why specified material or product cannot be provided.
    b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
    c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
    d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    e. Samples, where applicable or requested.
    f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
    g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
    h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
    i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
    j. Cost information, including a proposal of change, if any, in the Contract Sum.
    k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
    l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's/Engineer’s Action: If necessary, Architect/Engineer will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. Architect/Engineer will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

    a. Form of Acceptance: Change Order.
    b. Use product specified if Architect/Engineer cannot make a decision on use of a proposed substitution within time allocated.

C. Comparable Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Architect's Action: If necessary, Architect/Engineer will request additional information or documentation for evaluation within one week of receipt of a comparable product

request. Architect/Engineer will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

a. Form of Approval: As specified in Division 1 Section "Submittal Procedures."
b. Use product specified if Architect cannot make a decision on use of a comparable product request within time allocated.

D. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 1 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

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

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect/Engineer will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store cementitious products and materials on elevated platforms.

5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
3. Refer to Divisions 2 through 33 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 1 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.

3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Part 2 "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
8. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.
9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's/Engineer’s sample. Architect's decision will be final on whether a proposed product matches.

    a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.

10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.

    a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
    b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 PRODUCT SUBSTITUTIONS

A. Timing: Architect will consider requests for substitution if received within **30** days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.

B. Conditions: Architect/Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
2. Requested substitution does not require extensive revisions to the Contract Documents.
3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
4. Substitution request is fully documented and properly submitted.
5. Requested substitution will not adversely affect Contractor's Construction Schedule.
6. Requested substitution has received necessary approvals of authorities having jurisdiction.
7. Requested substitution is compatible with other portions of the Work.
8. Requested substitution has been coordinated with other portions of the Work.
9. Requested substitution provides specified warranty.
10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

2.3 COMPARABLE PRODUCTS

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

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

PART 3 - EXECUTION (Not Used)

Knowledge for Creating and Sustaining the Built Environment

SUBSTITUTION REQUEST

(After the Bidding/Negotiating Phase)

Project: _____ Substitution Request Number: _____

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Phone: _____

Address: _____

Trade Name: _____ Model No.: _____

Installer: _____ Phone: _____

Address: _____

History: ☐ New product ☐ 1-4 years old ☐ 5-10 years old ☐ More than 10 years old

Differences between proposed substitution and specified product:

☐ Point-by-point comparative data attached — REQUIRED BY A/E

Reason for not providing specified item:

Similar Installation:

Project: _____ Architect: _____

Address: _____ Owner: _____

_____ Date Installed: _____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explain _____

Savings to Owner for accepting substitution: _____ ($ _____)

Proposed substitution changes Contract Time: ☐ No ☐ Yes [Add] [Deduct] _____ days.

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

© Copyright 2007, Construction Specifications Institute,
99 Canal Center Plaza, Suite 300, Alexandria, VA 22314

Form Version: June 2004
CSI Form 13.1A

SUBSTITUTION REQUEST
(After the Bidding/Negotiating Phase — Continued)

The Undersigned certifies:
- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____

Attachments: ☐

A/E's REVIEW AND ACTION

☐ Substitution approved - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.
☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.
☐ Substitution rejected - Use specified materials.
☐ Substitution Request received too late - Use specified materials.

Signed by: _____ Date: _____

Additional Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ A/E ☐ Other:

© Copyright 2007, Construction Specifications Institute,
99 Canal Center Plaza, Suite 300, Alexandria, VA 22314

Form Version: June 2004
CSI Form 13.1A

END OF SECTION 0 160 00

SECTION 01 73 00 – EXECUTION REEQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. General installation of products.
3. Coordination of Owner-installed products.
4. Progress cleaning.
5. Starting and adjusting.
6. Protection of installed construction.
7. Correction of the Work.

B. Related Sections include the following:

1. Division 1 Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
2. Division 1 Section "Cutting and Patching" for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.
3. Division 1 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
4. Division 02 Section "Selective Demolition" for demolition and removal of selected portions of the building.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

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

1. Before construction, verify the location and points of connection of utility services.

B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.

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

C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

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

a. Description of the Work.
b. List of detrimental conditions, including substrates.
c. List of unacceptable installation tolerances.
d. Recommended corrections.

2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

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

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

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

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents. Submit requests on CSI Form 13.2A, "Request for Interpretation."

3.3 CONSTRUCTION LAYOUT

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

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

C. Building Lines and Levels: Locate and lay out control lines and levels for foundations including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations from two or more locations.

D. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
4. Maintain minimum headroom clearance of 8 feet (2.4 m) in spaces without a suspended ceiling.

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

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

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

E. Tools and Equipment: Do not use tools or equipment that produces harmful noise levels.

F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that

adequate provisions are made for locating and installing products to comply with indicated requirements.

G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect/engineer.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.5 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction forces.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction forces.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction forces at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction forces if portions of the Work depend on Owner's construction.

3.6 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).

3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

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

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

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

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

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

G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

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

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

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

3.7 STARTING AND ADJUSTING

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

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

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

D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section "Quality Requirements."

3.8 PROTECTION OF INSTALLED CONSTRUCTION

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

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

3.9 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

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

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

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

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

END OF SECTION 01 73 00

SECTION 01 73 29 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. Related Sections include the but are not limited to the following:

1. Division 2 Section "Selective Demolition" for demolition of selected portions of the building for alterations.

1.3 DEFINITIONS

A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. Operational Elements: Do not cut and patch the following operating elements and related components in a manner that results in reducing their capacity to perform as intended or that result in increased maintenance or decreased operational life or safety.

1. Primary operational systems and equipment.
2. Fire-protection systems.
3. Control systems.
4. Communication systems.
5. Electrical wiring systems.

C. Miscellaneous Elements: Do not cut and patch the following elements or related components in a manner that could change their load-carrying capacity, which results in reducing their capacity to perform as intended, or that result in increased maintenance or decreased operational life or safety.

1. Water, moisture, or vapor barriers.
2. Membranes and flashings.
3. Piping and ductwork.

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

E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections of these Specifications.

B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

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

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete & Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
5. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

END OF SECTION 01 73 29

SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes: Administrative and procedural requirements for construction waste management activities.

1.2 DEFINITIONS

A. Construction, Demolition, and Land clearing (CDL) Waste: Includes all non-hazardous solid wastes resulting from construction, remodeling, alterations, repair, demolition and land clearing. Includes material that is recycled, reused, salvaged or disposed as garbage.

B. Salvage: Recovery of materials for on-site reuse, sale or donation to a third party.

C. Reuse: Making use of a material without altering its form. Materials can be reused on-site or reused on other projects off-site. Examples include, but are not limited to the following: Crushing or grinding of concrete for use as sub-base material. Chipping of land clearing debris for use as mulch.

D. Recycling: The process of sorting, cleaning, treating, and reconstituting materials for the purpose of using the material in the manufacture of a new product.

E. Source-Separated CDL Recycling: The process of separating recyclable materials in separate containers as they are generated on the job-site. The separated materials are hauled directly to a recycling facility or transfer station.

F. Co-mingled CDL Recycling: The process of collecting mixed recyclable materials in one container on-site. The container is taken to a material recovery facility where materials are separated for recycling.

G. Approved Recycling Facility: Any of the following:

1. A facility that can legally accept CDL waste materials for the purpose of processing the materials into an altered form for the manufacture of a new product.

2. Material Recovery Facility: A general term used to describe a waste-sorting facility. Mechanical, hand-separation, or a combination of both procedures, are used to recover recyclable materials.

H. Universal waste components (UWC) are as follows: electric motors, PCB ballasts, non PCB ballasts, capacitors, contactors, circuit breakers, elemental and liquid mercury containing articles, transformers, lead acid batteries, fluorescent light bulbs, and all HID light bulbs.

1.3 SUBMITTALS

A. Contractor shall develop a Waste Management Plan: Submit 3 copies of plan within 14 days of date established for the **Notice to Proceed**.

B. Contractor shall provide Waste Management Report: Concurrent with each Application for Payment, submit **3** copies of report.

1.4 PERFORMANCE REQUIREMENTS

A. General: Divert a minimum of **75%** CDL waste, by weight, from the landfill by one, or a combination of the following activities:

1. Salvage
2. Reuse
3. Source-Separated CDL Recycling
4. Co-mingled CDL Recycling

B. CDL waste materials that can be salvaged, reused or recycled include, but are not limited to, the following:

1. Acoustical ceiling tiles
2. Asphalt
3. Asphalt shingles
4. Cardboard packaging
5. Carpet and carpet pad
6. Concrete
7. Drywall
8. Fluorescent lights and ballasts
9. Land clearing debris (vegetation, stumpage, dirt)
10. Metals
11. Paint (through hazardous waste outlets)
12. Wood
13. Plastic film (sheeting, shrink wrap, packaging)
14. Window glass
15. Wood
16. Field office waste, including office paper, aluminum cans, glass, plastic, and office cardboard.

1.5 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of projects with similar requirements, that employs a LEED Accredited Professional, certified by the USGBC as waste management coordinator.

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

C. Regulatory Requirements: Conduct construction waste management activities in accordance with hauling and disposal regulations of all authorities having jurisdiction and all other applicable laws and ordinances.

D. Preconstruction Conference: Schedule and conduct meeting at Project site prior to construction activities.

1. Attendees: Inform the following individuals, whose presence is required, of date and time of meeting.

a. Owner
b. Architect
c. Contractor's superintendent
d. Major subcontractors
e. Waste Management Coordinator
f. Other concerned parties.

2. Agenda Items: Review methods and procedures related to waste management including, but not limited to, the following:

a. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
b. Review requirements for documenting quantities of each type of waste and its disposition.
c. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
d. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
e. Review waste management requirements for each trade.

3. Minutes: Record discussion. Distribute meeting minutes to all participants.
Note: If there is a Project Architect, they will perform this role.

1.6 WASTE MANAGEMENT PLAN – Contactor shall develop and document the following:

A. Develop a plan to meet the requirements listed in this section at a minimum. Plan shall consist of waste identification, waste reduction plan and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight throughout the plan.

B. Indicate anticipated types and quantities of demolition, site-cleaning and construction waste generated by the project. List all assumptions made for the quantities estimates.

C. List each type of waste and whether it will be salvaged, recycled, or disposed of in an landfill. The plan should included the following information:

1. Types and estimated quantities, by weight, of CDL waste expected to be generated during demolition and construction.

2. Proposed methods for CDL waste salvage, reuse, recycling and disposal during demolition including, but not limited to, one or more of the following:

    a. Contracting with a deconstruction specialist to salvage materials generated,
    b. Selective salvage as part of demolition contractor's work,
    c. Reuse of materials on-site or sale or donation to a third party.

3. Proposed methods for salvage, reuse, recycling and disposal during construction including, but not limited to, one or more of the following:

    a. Requiring subcontractors to take their CDL waste to a recycling facility;
    b. Contracting with a recycling hauler to haul recyclable CDL waste to an approved recycling or material recovery facility;
    c. Processing and reusing materials on-site;
    d. Self-hauling to a recycling or material recovery facility.

4. Name of recycling or material recovery facility receiving the CDL wastes.

5. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on project site where materials separation will be located.

D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:

1. Total quantity of waste.
2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
3. Total cost of disposal (with no waste management).
4. Revenue from salvaged materials.
5. Revenue from recycled materials.
6. Savings in hauling and tipping fees by donating materials.
7. Savings in hauling and tipping fees that are avoided.
8. Handling and transportation costs. Including cost of collection containers for each type of waste.
9. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS (Not Used)

PART 3 – EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT, GENERAL

A. Provide containers for CDL waste that is to be recycled clearly labeled as such with a list of acceptable and unacceptable materials. The list of acceptable materials must be the same as the materials recycled at the receiving material recovery facility or recycling processor.

B. The collection containers for recyclable CDL waste must contain no more than 10% non-recyclable material, by volume.

C. Provide containers for CDL waste that is disposed in a landfill clearly labeled as such.

D. Use detailed material estimates to reduce risk of unplanned and potentially wasteful cuts.

E. To the greatest extent possible, include in material purchasing agreements a waste reduction provision requesting that materials and equipment be delivered in packaging made of recyclable material, that they reduce the amount of packaging, that packaging be taken back for reuse or recycling, and to take back all unused product. Insure that subcontractors require the same provisions in their purchase agreements.

F. Conduct regular visual inspections of dumpsters and recycling bins to remove contaminants.

3.2 SOURCE SEPARATION

A. General: Contractor shall separate recyclable materials from CDL waste to the maximum extent possible.

Separate recyclable materials by type.

1. Provide containers, clearly labeled, by type of separated materials or provide other storage method for managing recyclable materials until they are removed from Project site.
2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water and to minimize pest attraction. Cover to prevent windblown dust.
3. Stockpile materials away from demolition area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from weather.

3.3 CO-MINGLED RECYCLING

A. General: Do not put CDL waste that will be disposed in a landfill into a co-mingled CDL waste recycling container.

3.4 REMOVAL OF CONSTRUCTION WASTE MATERIALS

A. Remove CDL waste materials from project site on a regular basis. Do not allow CDL waste to accumulate on-site.

B. Transport CDL waste materials off Owner's property and legally dispose of them.

C. Burning of CDL waste is not permitted.

3.5 UNIVERSAL WASTE DIVERSION

A. Remove all universal waste from fixtures, panels, and related devices for proper diversion and reclamation.

B. Store all universal waste in containers provided by contact person within facilities operations.

C. Store all universal waste in a secured location and request periodic removal from assigned contact person.

D. Exemption: electric motors, circuit breakers, transformers and lighting contactors are exempt from this provision provided the contractor chooses to salvage or reuse the components.

E. No identified universal waste will be discarded into the waste stream.

END OF SECTION

WASTE MANAGEMENT PROGRESS REPORT				
	DISPOSED IN MUNICIPAL SOLID WASTE LANDFILL	**DIVERTED FROM LANDFILL BY RECYCLING, SALVAGE OR REUSE**		
MATERIAL CATEGORY		Recycled	Salvaged	Reused
1. Acoustical Ceiling Tiles				
2. Asphalt				
3. Asphalt Shingles				
4. Cardboard Packaging				
5. Carpet and Carpet Pad				
6. Concrete				
7. Drywall				
8. Fluorescent Lights and Ballasts				
9. Land Clearing Debris (vegetation, stumpage, dirt)				
10. Metals				
11. Paint (through hazardous waste outlets)				
12. Wood				
13. Plastic Film (sheeting, shrink wrap, packaging)				
14. Window Glass				
15. Field Office Waste (office paper, aluminum cans, glass, plastic, and coffee cardboard)				
16. Other (insert description)				
17. Other (insert description)				
Total (In Weight)		(TOTAL OF ALL ABOVE VALUES – IN WEIGHT)		
	Percentage of Waste Diverted	(TOTAL WASTE DIVIDED BY TOTAL DIVERTED)		

(THIS PAGE INTENTIONALLY LEFT BLANK)

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Inspection procedures.
2. Project Record Documents.
3. Operation and maintenance manuals.
4. Warranties.
5. Instruction of Owner's personnel.
6. Final cleaning.

B. Related Sections include the following:

1. Division 1 Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.
2. Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
3. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
4. Divisions 02 through 33 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, damage or settlement surveys, and similar final record information.

6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Complete startup testing of systems.
8. Submit test/adjust/balance records.
9. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
10. Advise Owner of changeover in heat and other utilities.
11. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
12. Complete final cleaning requirements, including touchup painting.
13. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect/Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect/Engineer will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect/Engineer, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.4 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."
2. Submit certified copy of Architect's/Engineer’s Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect/Engineer. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training videotapes.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect/Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Contractor.
    e. Page number.

1.6 PROJECT RECORD DOCUMENTS

A. General: Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

B. Record Drawings: Maintain and submit one original set of blue- or black-line white prints with two copies of Contract Drawings and Shop Drawings.

1. Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

    a. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
    b. Accurately record information in an understandable drawing technique.
    c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
    d. Mark Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on Contract Drawings.

2. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
3. Mark important additional information that was either shown schematically or omitted from original Drawings.

4. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.
5. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.

C. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications. Mark copy to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Note related Change Orders, Record Drawings**,** and Product Data, where applicable.

D. Record Product Data: Submit three copies of each Product Data submittal. Mark one set to indicate the actual product installation where installation varies substantially from that indicated in Product Data.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, Record Drawings**,** and Record Specifications, where applicable.

E. Miscellaneous Record Submittals: Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

1.7 OPERATION AND MAINTENANCE MANUALS

A. Assemble three complete sets of operation and maintenance data indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include operation and maintenance data required in individual Specification Sections and as follows:

1. Maintenance Data:

a. Manufacturer's information, including list of spare parts.
b. Name, address, and telephone number of Installer or supplier.
c. Maintenance procedures.
d. Maintenance and service schedules for preventive and routine maintenance.
e. Maintenance record forms.
f. Sources of spare parts and maintenance materials.
g. Copies of maintenance service agreements.
h. Copies of warranties and bonds.

B. Organize operation and maintenance manuals into suitable sets of manageable size. Bind and index data in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, with pocket inside the covers to receive folded oversized sheets. Identify each binder on front and spine with the printed title "OPERATION AND MAINTENANCE MANUAL," Project name, and subject matter of contents.

1.8 WARRANTIES

A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

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

1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

C. Provide additional copies of each warranty to include in each operation and maintenance manual.

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 FINAL CLEANING

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

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances. Provide a magnetic sweep of all areas around the building to retrieve stray nails, screws and other fasteners or metal shards.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
g. Sweep concrete floors broom clean in unoccupied spaces.
h. Clean transparent materials, including glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
i. Remove labels that are not permanent.
j. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

k. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 01 77 00

SECTION 01 78 23 – OPERATIONS AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for preparing maintenance manuals, including the following:

1. Maintenance documentation directory.
2. Maintenance manuals for the care and maintenance of products, and materials.

B. Related Sections include but are not limited to the following:

1. Division 1 Section "Submittal Procedures" for submitting copies of submittals for maintenance manuals.
2. Division 1 Section "Closeout Procedures" for submitting maintenance manuals.
3. Division 1 Section "Project Record Documents" for preparing Record Drawings for maintenance manuals.
4. Divisions 02 through 33 Sections for specific maintenance manual requirements for the Work in those Sections.

1.3 SUBMITTALS

A. Final Submittal: Submit 1 copy of each manual in final form at least 15 days before final inspection. Architect will return copy with comments within 15 days after final inspection.

1. Correct or modify each manual to comply with Architect's/Engineer’s comments. Submit 3 copies of each corrected manual within 15 days of receipt of Architect's/Engineer’s comments.

1.4 COORDINATION

A. Where maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: Include a section in the directory for each of the following:

1. List of documents.
2. Table of contents.

B. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

2.2 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name, address, and telephone number of Contractor.
6. Name and address of Architect/Engineer.

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

1. If maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

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

1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
b. Identify each binder on front and spine, with printed title "MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch, 20-lb/sq. ft. white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 PRODUCT MAINTENANCE MANUAL

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

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

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

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

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.

5. Repair instructions.

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

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

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

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to operation and maintenance manuals.

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

C. Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

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

1. Do not use original Project Record Documents as part of maintenance manuals.
2. Comply with requirements of newly prepared Record Drawings in Division 1 Section "Project Record Documents."

F. Comply with Division 1 Section "Closeout Procedures" for the schedule for submitting maintenance documentation.

END OF SECTION 01 78 23

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.

B. Related Sections include but are not limited to the following:

1. Division 1 Section "Closeout Procedures" for general closeout procedures and maintenance manual requirements.
2. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Divisions 02 through 33 Sections for specific requirements for project record documents of the Work in those Sections.

1.3 SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit copies of Record Drawings as follows:

a. Final Submittal: Submit two sets of marked-up Record Prints. Print each Drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit two copies of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit two copies of each Product Data submittal.

1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in the manual instead of submittal as Record Product Data.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.

1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an understandable drawing technique.
c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Depths of foundations below first floor.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.
j. Changes made by Change Order or Construction Change Directive.
k. Changes made following Architect's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Prints: Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with Architect. When authorized, prepare a full set of corrected drawings and electronic files (PDF) of the Contract Drawings and Shop Drawings.

1. Incorporate changes and additional information previously marked on Record Prints. Erase, redraw, and add details and notations where applicable.
2. Refer instances of uncertainty to Architect for resolution.
3. Print the Contract Drawings and Shop Drawings.

C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Record CAD Drawings: Organize CAD information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each CAD file.
3. Identification: As follows:

    a. Project name.
    b. Date.
    c. Designation "PROJECT RECORD DRAWINGS."
    d. Name of Architect/Engineer.
    e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of the manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
5. Note related Change Orders, Record Drawings, and Product Data where applicable.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturers' written instructions for installation.
3. Note related to Change Orders, Record Drawings, and Product Data where applicable.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

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

B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's/Engineer’s reference during normal working hours.

END OF SECTION 01 78 39

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training videotapes.

B. See Divisions 2 through 33 Sections for specific requirements for demonstration and training for products in those Sections.

1.2 SUBMITTALS

A. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objectives and outline for each training module.

B. Demonstration and Training CDs/Flash Drives: Submit two copies within seven days of end of each training module.

1.3 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 1 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Pre-instruction Conference: Conduct conference at Project site. Review methods and procedures related to demonstration and training.

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

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

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

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:

1. Basis of System Design, Operational Requirements, and Criteria: Include system and equipment descriptions, operating standards, regulatory requirements, equipment function, operating characteristics, limiting conditions, and performance curves.
2. Documentation: Review emergency, operations, and maintenance manuals; Project Record Documents; identification systems; warranties and bonds; and maintenance service agreements.
3. Emergencies: Include instructions on stopping; shutdown instructions; operating instructions for conditions outside normal operating limits; instructions on meaning of warnings, trouble indications, and error messages; and required sequences for electric or electronic systems.
4. Operations: Include startup, break-in, control, and safety procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; operating procedures for emergencies and equipment failure; and required sequences for electric or electronic systems.
5. Adjustments: Include alignments and checking, noise, vibration, economy, and efficiency adjustments.
6. Troubleshooting: Include diagnostic instructions and test and inspection procedures.
7. Maintenance: Include inspection procedures, types of cleaning agents, methods of cleaning, procedures for preventive and routine maintenance, and instruction on use of special tools.
8. Repairs: Include diagnosis, repair, and disassembly instructions; instructions for identifying parts; and review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

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

1. Owner will describe Owner's operational philosophy.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner, through Architect, with at least seven days' advance notice.

D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

3.2 DEMONSTRATION AND TRAINING RECORD

A. General: Engage a qualified commercial photographer to record demonstration and training sessions. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video Format: Provide high-quality color video saved on CD’s or flash drives. Save in a format acceptable to the Owner.

C. Narration: Describe scenes on video by dubbing audio narration off-site after session is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.

END OF SECTION 01 79 00

(THIS PAGE INTENTIONALLY LEFT BLANK)

SECTION 02 32 00 - GEOTECHNICAL INVESTIGATION

PART 1 GENERAL

1.1 SUMMARY

A. The following soils report and additional test report information was utilized during the design phases and is included with the project manual: Soils Report Titled "Report of Subsurface Exploration and Geotechnical Consulting Services for the DNREC White Clay Creek State Park Nature Center" dated December 19, 2024, prepared by John D. Hynes & Associates, Inc.

1.2 SITE CONDITIONS

A. Site Information

1. Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings.

2. It is to be expressly understood that the Owner will not be responsible for interpretations or conclusions drawing there from by Contractor. Data is made available for convenience of Contractor.

3. The locations of test borings at various points are shown in the report. While it is believed the results of the test boring accurately indicate the existing soil conditions below the surface at points and planes indicated, the Owner, the Architect, and Engineer assume no responsibility for the actual conditions which may be encountered in the execution of the contract.

4. Additional test borings and other exploratory operations may be made by Bidder or Contractor at no cost to Owner.

1.3 WARRANTY

A. Neither the Owner, the Architect, or the Engineer, represent, warrant or guarantee that the materials actually encountered in the prosecution of the work, or any part thereof, will be of the same character as those indicated by the sample or logs of the test borings, and if the Contractor relies, for any purpose, upon the accuracy or completeness of said borings or log information, he does so at his own risk.

1.4 ATTACHMENTS

A. Soils Report Titled "Report of Subsurface Exploration and Geotechnical Consulting Services for the DNREC White Clay Creek State Park Nature Center" dated December 19, 2024, prepared by John D. Hynes & Associates, Inc.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 02 32 00

JOHN D. HYNES & ASSOCIATES, INC.

Geotechnical and Environmental Consultants
Monitoring Well Installation
Construction Inspection and Materials Testing

December 19, 2024

Danielle Peters
GWWO Architects
800 Wyman Park Drive, Suite 300
Baltimore, Maryland 21211

Re: Report of Subsurface Exploration and Geotechnical Consulting Services
DNREC-White Clay Creek State Park Nature Center
Newark, Delaware
Project No.: JDH-10/24/220

Dear Ms. Peters:

John D. Hynes & Associates, Inc. has completed the authorized subsurface exploration and geotechnical engineering consulting services for the DNREC-White Clay Creek State Park Nature Center project in Newark, Delaware. Our services were performed, generally, in accordance with our proposal dated March 28, 2024.

This report describes the exploration methods employed, exhibits the data obtained, and presents our evaluations and recommendations for the proposed building and site improvements. In summary, we recommend that the new nature center building structural elements be supported by spread footing foundations bearing on firm, natural soils or compacted structural fill. If the recommendations of this report regarding subgrade preparation and construction are followed, a maximum allowable bearing pressure of 2,000 psf should be used to proportion the building foundations.

We appreciate the opportunity to be of service to you. If you have any questions regarding the contents of this report or if we may be of further assistance, please contact our office.

Respectfully,
JOHN D. HYNES & ASSOCIATES, INC.

Kelly Childs
for: Evan H. Cross
Geologist

Richard D. Rhoads, P.G.
Project Geologist

Amy Cross
for: Christian H. Matemu
Geotechnical Staff Engineer

Professional Certification. I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the State of Delaware.

JOHN D. HYNES REGISTERED No. 7591 PROFESSIONAL ENGINEER DELAWARE

John D. Hynes, P.E.
License No. 7591

Expiration Date: 06/30/2026

EHC: CHM: RDR: JDH/kc

32185 Beaver Run Drive • Salisbury, Maryland 21804 • 410-546-6462 • Fax 410-548-5346
Email: jdh@jdhynesinc.com

REPORT OF
SUBSURFACE EXPLORATION
AND
GEOTECHNICAL CONSULTING SERVICES

DNREC-WHITE CLAY CREEK STATE PARK NATURE CENTER
NEWARK, DELAWARE

PREPARED FOR
GWWO ARCHITECTS

DECEMBER 19, 2024
PROJECT NO.: JDH-10/24/220

32185 Beaver Run Drive • Salisbury, Maryland 21804 • 410-546-6462 • Fax 410-548-5346
Email: jdh@jdhynesinc.com

HYNES

TABLE OF CONTENTS

PAGE

PURPOSE AND SCOPE 1
EXISTING SITE CONDITIONS 1
PROJECT CHARACTERISTICS 1
FIELD EXPLORATION AND STUDY 2
SUBSURFACE CONDITIONS 2
LOCAL GEOLOGY 3
RECOMMENDATIONS 4
A. Site Preparation 4
B. Fill Selection, Placement and Compaction 4
C. Structure Foundations 5
D. Retaining Walls and Below Grade Walls 6
E. Floor Slab Support 7
F. Pavement Subgrade Preparation and Pavement Cross-Section Design 7
G. Seismic Site Classification 8
H. Infiltration Testing 9
I. Groundwater and Drainage 10
ADDITIONAL SERVICES RECOMMENDED 11
A. Site Preparation and Proofrolling Monitoring 11
B. Fill Placement and Compaction Monitoring 11
C. Footing Excavation Inspections 11
D. Pavement System Inspection 11
REMARKS 11
APPENDIX 13

32185 Beaver Run Drive • Salisbury, Maryland 21804 • 410-546-6462 • Fax 410-548-5346
Email: jdh@jdhynesinc.com

PURPOSE AND SCOPE

The subsurface exploration study was performed to evaluate the subsurface conditions with respect to the following:

1. General site and subgrade preparation;
2. Fill and backfill construction;
3. Foundation recommendations, including frost depth, allowable bearing capacity, and estimated foundation settlement;
4. Foundation construction and inspection procedures;
5. Earth pressure requirements for below grade walls;
6. Seismic Site Classification;
7. Floor slab support;
8. Pavement subgrade preparation and pavement cross-section design;
9. Stormwater management structure construction and infiltration test results;
10. Location of groundwater and applicable construction dewatering control procedures; and
11. Other aspects of the design and construction for the proposed structures indicated by the exploration.

An evaluation of the site, with respect to potential construction problems and recommendations dealing with earthwork and inspection during construction, is included. The inspection is considered necessary both to confirm the subsurface conditions and to verify that the soils related construction phases are performed properly.

EXISTING SITE CONDITIONS

As shown on the Project Location Map (Drawing JDH-10/24/220-A) in the Appendix, the project site is located on Creek Road in Newark, Delaware. The project site is located in a cleared and partially wooded area to the west of Creek Road and to the south of the existing White Clay Creek Park Nature Center. The site is bounded by undeveloped wooded property to the west, the existing Nature Center to the north, Creek Road to the east and undeveloped wooded property followed by Hopkins Road to the south. At the time of our exploration, the nature center building site was located on the west side of the existing Nature Center parking lot and in the field adjacent to the parking lot. The proposed parking lot and stormwater management improvements are located in an undeveloped wooded area south of the existing Nature Center facility parking lot. The site is located in a rural area and is generally surrounded by wooded property. Topographically, the site slopes gently upwards to the west.

PROJECT CHARACTERISTICS

The project includes a new Nature Center building, stormwater management improvements, and a new parking lot. The new 8,667 square feet Nature Center building will have 2 stories to be constructed using structural steel and/or timber framing. The first floor will consist of an exhibit room, a mechanical room, storage and bathroom facilities, and the main lobby. The second floor will consist of classrooms, bathroom facilities, a mud room, and an outdoor terrace and covered outdoor area. The building will be constructed with the finished floor of the 2nd story of the building at grade (Elevation El. 123) and the finished floor of the ground level of the building at grade (El 109). The site slopes downward from west (El. 123) to east (El. 109). Based on information provided by the Structural Engineer, we understand that the maximum column loads will be 115 kips and maximum wall loads will be 3 klf.

32185 Beaver Run Drive • Salisbury, Maryland 21804 • 410-546-6462 • Fax 410-548-5346
Email: jdh@jdhynesinc.com

A paved parking area and stormwater management structure (SWM) are proposed for the project. The parking lot will consist of 58 parking spaces located to the south of the new nature center building. A bio-retention SWM structure is proposed to the east of the new parking lot. The remaining portion of the site will be landscape areas.

Based on the "Schematic Design Site Plan" drawing provided by CDA Engineering Inc., dated October 15, 2024, up to 8 feet of soil will be undercut on the north side of the proposed building to achieve the finished floor elevation of El. 109 for the first floor. Below grade walls are proposed on the north, east, and south sides of the building.

FIELD EXPLORATION AND STUDY

In order to determine the nature of the subsurface conditions at the site, 15 test borings were drilled at the site on November 7 and November 8, 2024 at the approximate locations shown on our Boring Location Plan (Drawing No. JDH-10/24/220-B) in the Appendix. Test borings B-1 through B-5 were drilled at the locations of the proposed building to depths of 20.5 feet below grade. Test borings TP-1 through TP-7 were drilled at the locations of the stormwater management areas to depths of 12 feet below existing grade. Test borings P-1, P-2, and P-3 were drilled to depths of 10 feet in the proposed pavement areas. The borings were drilled using a track-mounted Geoprobe 7822 DT drill rig. A bulk soil sample was collected at test boring location P-3 for California Bearing Ratio (CBR) testing.

Soil sampling and testing were carried out in accordance with ASTM Specification D-1586 for the test borings. A brief description of our field procedures is included in the Appendix. The results of all boring and sampling operations are shown on the boring logs.

Samples of the subsurface soils were examined by our engineering staff and were visually classified in accordance with the Unified Soil Classification System (USCS) and ASTM Specification D-2488. The test borings drilled at the stormwater management area were, also, classified in accordance with the United States Department of Agriculture (USDA) classification system. The estimated USCS symbols and USDA descriptions appear on the boring logs (where applicable) and keys to the systems' nomenclature are provided in the Appendix of this report. Also included are reference sheets which define the terms and symbols used on the boring logs and explain the Standard Penetration Test procedures. The Munsell soil color code description is, also, provided for each stratum, for the SWM borings.

We note that the test boring records represent our interpretation of the field data based on visual examination and selected soil classification tests. Indicated interfaces between materials may be gradual.

The field exploration data was supplemented with laboratory testing data. The laboratory at John D. Hynes & Associates, Inc. performed 4 Atterberg Limits (liquid and plastic) tests and 4 Natural Moisture Content tests. The test results are noted on the boring logs in the Appendix. A CBR test was performed on the bulk sample obtained from location P-3. The CBR and Modified Proctor test results are included in the Appendix.

SUBSURFACE CONDITIONS

At the time of our field exploration, approximately 8 to 24 inches of organic bearing soil were encountered at the ground surface at most of the boring locations. Approximately 48 inches of organic bearing soil were encountered at boring P-3. Approximately 3 inches of asphalt and 5 to 6 inches of stone were encountered at the ground surface at boring locations B-2 and B-5. Varying thicknesses of organic bearing soil, asphalt, stone, or other surficial materials may be encountered at other locations on site.

32185 Beaver Run Drive • Salisbury, Maryland 21804 • 410-546-6462 • Fax 410-548-5346
Email: jdh@jdhynesinc.com

The majority of subsurface soils, visually classified in accordance with the USCS, consisted of interbedded layers of low-silt SAND (SP-SM), Silty SAND (SM), Clayey SILT (ML), Silty CLAY (CL) and Clayey SILT/Silty CLAY (MH/CH) to the boring termination depths. A layer of Organic SILT (OL) was encountered at depths of 10 to 12 feet at boring location TP-5. Decomposed rock was encountered as shallow as 4 feet in the test borings. The granular soil layers were characterized by a Standard Penetration Test (SPT) value (N-values) ranging from 9 to 14 blows per foot indicating an in-place relative density of loose to medium dense. N-values in the cohesive soil layers ranged from 7 blows per foot to 50 blows over 5 inches indicating in-place consistencies of medium stiff to hard. We note that most of the soil samples were micaceous.

Stormwater management area test samples were, also, visually classified in accordance with the USDA classification system. The classifications were Sand, Loamy sand, Silt, Silt loam, and Clay. Refer to the test boring logs in the Appendix for the USDA classification for each strata encountered.

Based on information available on the NRCS Web Soil Survey website, the site is located in an area that is mapped as the Hatboro-Codorus complex, 0 to 3 percent slopes (Hw). The typical profile for Hw soil is described as silt loam from 0 to 44 inches, sandy clay loam from 44 to 55 inches, and stratified gravelly sand to clay from 55 to 80 inches. Groundwater is typically found at depths of 0 to 6 inches.

Groundwater was not encountered at any of the soil test borings to depths of up to 20.5 feet below existing grade. Groundwater elevations may vary at other times during the year depending upon the amount of local precipitation, and the extent of local surface development.

Water level data from nearby DGS Well ID Ca55-204 is included in the Appendix for reference. The DGS well is screened from 19 feet to 25 feet below grade and penetrates the Columbia Aquifer. Water levels at the DGS well fluctuate approximately 3 to 4 feet during the year. In consideration of this information, and based on subsurface conditions, it is our opinion that the seasonal high water table (SHWT) at the project site is estimated to be approximately 3 to 4 feet higher than conditions at the time the "SWM" soil borings were drilled. We note that subsurface conditions at the DGS well site may vary from conditions at the project location.

LOCAL GEOLOGY

The site is located in the Atlantic Coastal Plain Physiographic Region. The Atlantic Coastal Plain is characterized by interbedded layers of unconsolidated sands, silts, clays and gravels. Based on information provided on the Delaware Geologic Society (DGS) Web Data Viewer, the site is mapped as the Wissahickon Formation (Cowf). The Wissahickon Formation is described as "Interlayered psammitic and pelitic gneiss with amphibolite. Psammitic gneiss is a medium- to fine-grained biotite-plagioclase-quartz gneiss with or without small garnets. Contacts with pelitic gneiss are gradational. Pelitic gneiss is medium- to coarse-grained garnet-sillimanite-biotite-plagioclase-quartz gneiss. Unit has a streaked or flasered appearance owing to the segregation of garnet-sillimanite-biotite stringers that surround lenses of quartz and feldspar. Throughout, layers of fine to medium-grained amphibolite composed of plagioclase and hornblende, several inches to 30 feet thick or as large massive bodies, are in sharp contact with the psammitic and pelitic gneisses. An attempt has been made to show some of the amphibolites mappable at the scale of the map. Granitic pegmatite is ubiquitous and occurs at all scales. Pyroxene bearing quartzite with garnet occurs locally near the contact with the Wilmington Complex. An ultramafic lens composed of cumulus layers of serpentinized peridotite, metapyroxenite, and metagabbro occurs near Hoopes Reservoir. The ultramafic lens may be correlative with the Baltimore Mafic Complex".

32185 Beaver Run Drive • Salisbury, Maryland 21804 • 410-546-6462 • Fax 410-548-5346
Email: jdh@jdhynesinc.com

RECOMMENDATIONS

The following recommendations and considerations are based on our understanding of the proposed construction, the data obtained from the exploration, and our previous experience with similar subsurface conditions and projects. If there are any significant changes to the project characteristics, such as revised structural loadings differing significantly from those noted above, structure geometry, structure location, elevations, etc., we request that this office be advised so the recommendations of this report can be re-evaluated.

A. Site Preparation

Prior to the construction of foundations, ground slabs, pavements, or the placement of fill in any structural areas, all existing organic materials, frozen or wet soils, excessively soft or loose soils, old foundations, rubble, abandoned utilities, ground slabs, pavement debris, miscellaneous debris, and other deleterious materials should be removed and wasted. The existing organic bearing soil should be stripped and can be stockpiled for reuse in landscape areas. If perched surface water is encountered during any grading or excavation process, Hynes & Associates should be consulted for additional recommendations regarding the stabilization of the bases of the excavations and backfilling.

After the stripping operations have been completed, the exposed subgrade soils should be inspected. The inspector should verify that organic matter has been removed from structural subgrade areas. The inspector should require the exposed subgrade materials be proofrolled utilizing a heavily-loaded dump truck or other pneumatic tired vehicle of similar size and weight. The purpose of proofrolling would be to provide surficial densification and to locate any isolated areas of soft, loose or existing fill soils requiring undercutting. Proofrolling is not advised in wet areas which may deteriorate under repeated vehicular loading. Wet areas should be drained and allowed to dry prior to proofrolling. Precipitation may result in standing water (perched water) at low areas. If the water is allowed to pond, the natural soils may deteriorate and overexcavation or subgrade improvements may be necessary at those areas. The Geotechnical Engineer should be consulted to evaluate poor subgrade conditions during construction.

Care should be exercised during the grading operations at the site. Shallow SM, ML, MH/CH, and CL materials were identified at the boring locations. These materials are moderately (SM) to highly (ML, MH/CH, CL) sensitive to changes in moisture conditions and should therefore be protected. With the exception of the single granular soil layer encountered beneath the asphalt and subbase stone at boring location B-5, the shallow soils at the site are cohesive SILTs and CLAYs and are highly sensitive to changes in moisture conditions. The contractor should be very careful to protect the subgrade by draining the site properly. The contractor should keep the site graded to direct water off of structural subgrade during the stripping and filling operation. If earthwork is performed in the presence of moisture, the traffic of heavy equipment, including heavy compaction equipment, may create pumping and a general deterioration of the subgrade soils. Construction traffic should be minimized at structural subgrade areas. If subgrade problems arise, the Geotechnical Engineer should be consulted for an evaluation of the conditions. Other subgrade stabilization methods may, also, be required. Overexcavated areas resulting from the removal of organic matter, old foundations, rubble, abandoned utilities, or otherwise unacceptable materials should be backfilled with properly compacted materials in accordance with the procedures discussed in the following section.

B. Fill Selection, Placement and Compaction

It is recommended that all materials to be used as structural fill be inspected, tested and approved by the Geotechnical Engineer prior to use. The native SM, ML and CL soils may be re-used for structural fill if it does not contain organics. Acceptable borrow material should include GW, SM, SW, ML and CL classified

32185 Beaver Run Drive • Salisbury, Maryland 21804 • 410-546-6462 • Fax 410-548-5346
Email: jdh@jdhynesinc.com

in accordance with the USCS. SP material may be used as backfill for drainage material (e.g. above French Drains) Furthermore, the material to be utilized as structural fill should have a Plasticity Index (PI) less than 20. Hynes & Associates does not recommend reusing the native MH/CH for structural fill.

The importation of high quality, granular material should be allowed, and acceptable unit rates for importation and placement should be established. Sand, gravel or sand/gravel mixtures would be appropriate for wet weather placement. Otherwise, the materials noted above will be acceptable for use as structural fill. Native or imported SM, ML, and CL soils will be sensitive to alteration in moisture content and will become unworkable during and following periods of precipitation. For this reason, if earthwork is attempted in late autumn, winter or early spring, the above mentioned high quality imported granular material should be limited to those soils better than SM. SM, ML and CL materials become unworkable at moisture contents greater than 3 percentage points above optimum. The contractor would have to dry these materials or set them aside for use in landscaping areas.

Structural fill should be placed in lifts which are 8 inches or less in loose thickness and should be compacted to at least 95 percent of the Modified Proctor maximum dry density (ASTM D-1557). Adjustments to the natural moisture content of the soils may be required in order to obtain specified compaction levels. Should utility construction be performed after earthwork, the Contractor should be responsible for achieving 95 percent compaction in all trench backfill. These guidelines should be set for all structural fill at the site including, but not limited to building, ground slab and pavement fills.

For the proofrolling and fill compaction operations, fill limits should be extended at least 10 feet beyond the structure exterior walls, exterior columns, pavement and slab boundaries. A sufficient number of in-place density tests should be performed by an engineering technician to verify that the proper degree of compaction is being obtained in all fill soils.

C. Structure Foundations

As discussed in the "Project Characteristics" Section, the project includes a new Nature Center building. We understand that the new Nature Center building will measure approximately 6,700 sf in plan dimensions and will be 2 stories constructed using structural steel and/or timber framing. The building will be constructed into a hillside with the finished floor of the 2nd story on the west side of the building at grade (Elevation El. 123) and the finished floor of the ground level on the eastern side of the building at grade (El 109). Based on the information provided by GWWO Architects, the building will be supported on wall and column footings. Based on structural load data provided by Structural Engineer, the maximum column load will be 115 kips and the maximum wall load will be 3 klf.

Considering current and proposed grade levels, the in-situ soil conditions and the proposed structural loadings, we recommend that the building structural elements be supported on spread footing foundations bearing on firm, natural soils or controlled, structural fill. Footings supporting structural elements for the building columns and walls may be proportioned based on a maximum allowable soil bearing pressure of 2,000 psf bearing. If our recommendations are followed, we estimate a total settlement of 1 inch or less. We estimate differential settlement to be ½ inch or less.

Some locations may be encountered where less than the required bearing is available. At those locations, compaction in the footing excavations may be necessary or minor overexcavation may yield greater soil support. For this reason, the inspection of the footing excavations by the Geotechnical Engineer is advised. Minimum dimensions of 30 inches for square footings, and 24 inches for continuous or rectangular footings should be used in foundation design to minimize the possibility of a local shear failure. All foundation

32185 Beaver Run Drive • Salisbury, Maryland 21804 • 410-546-6462 • Fax 410-548-5346
Email: jdh@jdhynesinc.com

excavations should be inspected by the Geotechnical Engineer or his approved representative prior to the placement of concrete. The purpose of the inspection would be to verify that the exposed bearing materials are acceptable for the design soil bearing pressure and that loose, wet, frozen or compressible soils are not present.

Where continuous wall footings may need to be raised in elevation in a direction away from and perpendicular to other footings, footings may be gradually changed or lowered to the desired elevation using step construction procedures with a 2H:1V, or more gentle, slope. In addition, discrete column, pier or wall footings bearing at a higher elevation than lower footings should be located at a distance apart which is equal to or greater than the difference in the elevations of the footings.

In Newark, exterior footings and footings in unheated areas should be located at a depth of at least 32 inches to bottom of footing below the outside final grade to provide adequate frost cover protection. We recommend bearing the footings at 36 inches or more below final grade. If the building is to be constructed during the winter months or if the building will be subjected to freezing temperatures after footing construction, then all footings should be adequately protected during freezing periods.

Soils exposed at the bases of all satisfactory foundation excavations should be protected against any detrimental change in condition, such as disturbance from rain or frost. Surface runoff should be drained away from the excavations and not be allowed to pond. Foundation excavations should be adequately protected from rainfall or freezing conditions.

D. Retaining Walls and Below Grade Walls

We propose recommendations for retaining walls and for basement walls. Basement walls shall be drained. Retaining walls may be drained or undrained.

Retaining walls will not restrict the lateral movement of the earth backfill, and therefore the full internal resistance of the soil will be mobilized. For this case, an active lateral earth pressure condition will apply for design. For basement walls, where the building walls restrict the lateral movement of the soil backfill, the full internal resistance of the soil will not be mobilized, and an at-rest lateral earth pressure condition will apply for design. For the above cases, we recommend the following design soil parameters:

SELECT BACKFILL – Behind unbalanced walls
Unified Soil Classification: Silty SAND (SM) or better
Angle of internal friction (Ø) = 30°
Bulk (wet) density = 120 pcf

Retaining Walls:
Coefficient of Active Earth Pressure (K_a) = 0.33
Equivalent Fluid Pressure (EFP) = 40 pcf

Basement Walls:
Coefficient of At-Rest Earth Pressure (K_o) = 0.5
Equivalent Fluid Pressure (EFP) = 60 pcf

32185 Beaver Run Drive • Salisbury, Maryland 21804 • 410-546-6462 • Fax 410-548-5346
Email: jdh@jdhynesinc.com

Unbalanced walls should be backfilled with non-plastic soils of Unified Classification Silty SAND (SM) or better. The design parameters are based on: 1) adequate drainage of backfill to prevent the accumulation of free water against the wall or within the backfill; 2) exterior granular backfill capped with a 12 inch thick layer of impervious soil; and 3) surcharge loadings from vehicles and other sources must be added to the stated earth pressure. Heavy compaction equipment must not be operated immediately adjacent to the wall.

Surcharge loads at the surface should be multiplied by 0.5 and superimposed on the recommended lateral loading. We recommend a friction factor of 0.4 to resist sliding at the base of walls which are founded on firm, natural soil.

E. Floor Slab Support

Ground supported slabs may be supported on firm, natural soils or on a layer of controlled, structural fill. The subgrade should be prepared in accordance with the procedures described in Sections A and B of this report. It is, also, recommended that a 4 to 6 inch clean, granular, leveling and load-distributing material such as washed gravel, or screened crushed stone, be used beneath the floor slabs. This material will require acquisition from off-site sources. Prior to placing the leveling and load distributing material, the slab subgrade should be free of standing water or mud. An acceptable moisture barrier should, also, be provided for the building slab. These procedures will help to prevent capillary rise and damp floor slab conditions. For native soil or fill material placed and compacted according to the procedures outlined in this report, we recommend using a value of modulus of subgrade reaction of 150 pounds per cubic inch.

F. Pavement Subgrade Preparation and Pavement Cross-Section Design

The project includes a parking lot with 58 parking spaces to be located to the south of the proposed Nature Center building. Test borings P-1, P-2, and P-3 were drilled in the proposed pavement areas to depths of 10 feet below the ground surface. Approximately 16 to 48 inches of organic soil layers were encountered at the test borings. We note that approximately 4 feet of organic bearing soil was encountered at the ground surface at test boring location P-3. The organic bearing soils shall be removed before the placement of pavement area fill and pavement layers. Below the surficial organic bearing soil, the borings identified Clayey SILT (ML) in the upper 10 feet of the subgrade. We encountered CL and MH/CH at shallow depths in other test borings.

During the exploration phase of this project, a bulk soil sample was excavated at boring location P-3 for California Bearing Ratio (CBR) testing. The CBR test result was a CBR of 3. The CBR and Modified Proctor test procedures are described in the "Investigative Procedures" section of this report, and the test results are included in the Appendix. The CBR test was performed on a Clayey SILT (ML) material.

All pavement subgrade areas should be inspected and proofrolled in accordance with Section A and B of this report. The pavement subgrade soils will consist of materials having the classifications ML in accordance with the USCS. The top 12 inches of the natural subgrades at pavement areas should be compacted to 95 percent of the Modified Proctor maximum dry density (ASTM D-1557) prior to fill or stone placement. Areas that contain "topsoil," and organic matter should be undercut. Refer to Sections A and B for recommendations for subgrade preparation and fill construction related to areas that have organics, rubble or demolition debris at the pavement subgrade.

32185 Beaver Run Drive • Salisbury, Maryland 21804 • 410-546-6462 • Fax 410-548-5346
Email: jdh@jdhynesinc.com

The following recommendations are provided for on-site pavements assuming an improved subgrade (top 12 inches compacted to 95 percent of the Modified Proctor maximum dry density), organic soils have been removed from pavement subgrade areas, approved subgrade soil types and the indicated traffic usage:

RESTRICTED AUTOMOBILE PAVEMENT AREAS

Asphalt Surface Course (Delaware Superpave 9.5 mm)	1.5 inches
Asphalt Concrete Base Course (Delaware Superpave 19 mm)	2.5 inches
Graded Aggregate Subbase (Delaware Type CR-1 or GAB Subbase)	6.0 inches

PAVEMENTS FOR BUS PARKING/DROP OFF AREA, DRIVEWAY FOR TRUCKS AND FIRE LANES

Asphalt Surface Course (Delaware Superpave 9.5 mm)	1.5 inches
Asphalt Concrete Base Course (Delaware Superpave 19 mm)	3.5 inches
Graded Aggregate Subbase (Delaware Type CR-6 or GAB Subbase)	9.0 inches

The pavement materials and construction should be in accordance with the Delaware Department of Transportation (DelDOT), State Highway Administration, Standard Specifications for Construction and Materials latest edition, and this report. The aggregate subbase should be compacted to a minimum 95 percent of the Modified Proctor (ASTM D-1557) maximum dry density. All pavement subgrade areas should be inspected, proofrolled and tested by the Geotechnical Engineer.

The pavement subgrade and pavement layers should be graded such that surface water is carried off the pavement areas and away from building areas. The surface water should not be allowed to pond. Runoff onto adjacent properties should be controlled property.

Hynes & Associates recommends that rigid pavement be designed and installed for use at trash container storage and pick-up locations. These "dumpster pad" locations receive extreme wheel loads during emptying and placement. Also, hydraulic oils usually accumulate at these areas causing a breakdown in asphalt pavement mixtures.

G. Seismic Site Classification

Hynes & Associates is providing below, the seismic site classification in accordance with the International Building Code (IBC) 2018. The code stipulates that we evaluate the strength of soil to a depth of 100 feet below grade. We used the soil properties indicated in the test boring B-1 which was drilled to a depth of 20.5 feet, and our experience locally. In consideration of the test boring data and our experience locally, it is our opinion that the average properties of the soils in the upper 100 feet of the local subsurface stratigraphy meet Site Classification "D" criteria. We note that we did not drill deep enough to encounter rock. It is possible that the site is a Class C site. Additional exploration would be required to verify another site classification.

32185 Beaver Run Drive • Salisbury, Maryland 21804 • 410-546-6462 • Fax 410-548-5346
Email: jdh@jdhynesinc.com

We recommend using the following spectral design coefficients for seismic design for the DNREC-White Clay Creek State Park Nature Center project in Newark, Delaware:

Seismic Design Coefficients for Newark, Delaware	
F_a	1.6
F_v	2.4
S_S	0.182
S_1	0.047
S_{DS}	0.195
S_{D1}	0.075

These values were obtained and calculated in accordance with the IBC 2018 and ASCE 7. These are site specific design values and are based on a Site Classification of D.

H. Infiltration Testing

Infiltration tests were performed at boring locations TP-1 through TP-7. The infiltration tests were performed at depths ranging from 5 to 7 feet below the ground surface. The testing was completed at the approximate depths that were specified by CDA Engineering, Inc. Standard falling head infiltration tests were completed at each location. The testing was completed in general accordance with DNREC regulations (ASTM-D 5126). Tests performed at 5 or 6 feet below the ground surface were completed in test pits using 12 inch diameter rings. Tests performed at 7 feet below the ground surface were completed using 4 inch diameter cased boreholes. A hand auger was used to advance a boring to the test depth. The test locations, depth to groundwater, infiltration test depth, and last test increment infiltration rates are summarized in the table below.

Table 1: Summary of Infiltration Test Results

Test Location	Surface Elevation	Depth to Groundwater (ft.)	Infiltration Test Depth (ft.)	Approximate Infiltration Test Elevation (ft.)	K_m (in./hr.) (Infiltration Rate)
TP-1	105.5	NE	6.0	99.5	4.0
TP-2	107.0	NE	6.0	101.0	0.0
TP-3	108.5	NE	7.0	101.5	0.0
TP-4	109.0	NE	6.0	103.0	0.0
TP-5	112.0	NE	7.0	105.0	0.0
TP-6	114.0	NE	7.0	107.0	0.0
TP-7	104.5	NE	5.0	99.5	2.0

NE = Not Encountered (greater than 12 feet)

32185 Beaver Run Drive • Salisbury, Maryland 21804 • 410-546-6462 • Fax 410-548-5346
Email: jdh@jdhynesinc.com

We note that redoximorphic features can indicate seasonal high groundwater, "perched water", or a restrictive soil layer. Redoximorphic features were not observed in the stormwater borings. Water levels at the DGS well fluctuate approximately 3 to 4 feet during the year. In consideration of this information, and based on subsurface conditions at the site, it is our opinion that the seasonal high water table (SHWT) at the project site is estimated to be 3 to 4 feet higher than the conditions at the time the stormwater "TP" soil borings were drilled. We note that subsurface conditions at the DGS well site may vary from conditions at the project location.

Refer to the "Infiltration Data Table" and "Single Ring Infiltration" test procedures in the Appendix for additional information regarding the infiltration tests. Elevations were on site plans prepared by CDA Engineering.

Based on the location of the proposed SWM structures, subsurface conditions at each of the test locations were utilized in our design evaluation. In consideration of the measured infiltration rates, we recommend design infiltration rates as summarized in Table 2. The DNREC required safety factor of 2.5 was applied to the recommended infiltration rate for falling head tests that were completed in 4 inch cased boreholes (TP-3, TP-5, and TP-6). A safety factor of 2 was applied to the recommended infiltration rate for falling head tests that were completed in 12 inch rings at the other 4 test locations.

Table 2: Recommended Design Infiltration Rates

Test Location	Recommended Infiltration Rate (in./hr.)	Approximate Elevation Range
TP-1	2.0	96.5 to 99.5
TP-2	NR	101.0 to 104.0
TP-3	NR	101.5 to 104.5
TP-4	NR	103.0 to 106.0
TP-5	NR	105.0 to 108.0
TP-6	NR	107.0 to 110.0
TP-7	1.0	96.5 to 99.5

Note: NR – Not Recommended

Based on observed soil conditions at the test locations, it is our opinion that the recommended design rates are valid as summarized in Table 2. We note that soil conditions were found to be variable across the infiltration testing locations. We note that soil conditions and infiltration rates may vary between the test locations, and may, also, vary with depth.

I. Groundwater and Drainage

Groundwater was not encountered at any of the boring locations to depths of up to 20.5 feet below existing grade. Considering the proposed construction, the contractor will likely not experience construction problems relating to the groundwater in foundation excavations. The Contractor should be prepared to dewater the lowest excavations in the event of the infiltration of precipitation. The contractor should be prepared to dewater for deep utility line excavations. If required, acceptable measures for dewatering should be implemented. These methods may include well point systems, sumping and pumping, etc. Efforts should be made to keep exposed subgrade areas dry during construction, primarily, because the soils will be susceptible

32185 Beaver Run Drive • Salisbury, Maryland 21804 • 410-546-6462 • Fax 410-548-5346
Email: jdh@jdhynesinc.com

to deterioration and loss of strength in the presence of moisture. Adequate drainage should be provided at the site to minimize any increase in moisture content of the foundation and pavement subgrade soils. All pavements and site grades should be sloped away from the buildings to prevent ponding of water around them. The final site drainage should, also, be designed such that run-off onto adjacent properties is controlled properly.

ADDITIONAL SERVICES RECOMMENDED

Additional engineering, testing and consulting services recommended for this project are summarized below.

A. Site Preparation and Proofrolling Monitoring

The Geotechnical Engineer or experienced soils inspector should inspect the site after it has been stripped and excavated. The inspector should determine if any undercutting or in-place densification is necessary to prepare a subgrade for fill placement, or slab and pavement support. The inspector should verify that organic soils, organic matter, tree stumps, and demolition debris have been removed from all structural subgrade areas prior to filling operations.

B. Fill Placement and Compaction Monitoring

The Geotechnical Engineer or experienced soils inspector should witness all fill operations and take sufficient in-place density tests to verify that the specified degree of fill compaction is achieved. The inspector should observe and approve borrow materials used and should determine if their existing moisture contents are acceptable.

C. Footing Excavation Inspections

The Geotechnical Engineer should inspect all foundation excavations for the structures. He should verify that the design bearing pressures are available and that no loose or soft areas exist beneath the bearing surfaces of the foundation excavations.

D. Pavement System Inspection

Pavement subgrade soils should be inspected prior to the placement of pavement materials to verify that proper compaction has been achieved and that project specifications are being followed. A sufficient number of in place density tests should be performed to assure that the specified degree of compaction is achieved for the subgrade, the fill layers and the subbase stone layer.

REMARKS

This report has been prepared solely and exclusively for GWWO Architects. to provide guidance to design professionals in developing facilities plans for the proposed DNREC-White Clay State Park Nature Center project located in Newark, Delaware. It has not been developed to meet the needs of others, and application of this report for other than its intended purpose could result in substantial difficulties. The Consulting Engineer cannot be held accountable for any problems which occur due to the application of this report to other than its intended purpose. This report in its entirety should be attached to the project specifications.

These analyses and recommendations are, of necessity, based on the concepts made available to us at the time of the writing of this report, and on-site conditions, surface and subsurface that existed at the time the exploratory borings were drilled. Further assumption has been made that the limited exploratory borings, in relation both to

32185 Beaver Run Drive • Salisbury, Maryland 21804 • 410-546-6462 • Fax 410-548-5346
Email: jdh@jdhynesinc.com

the areal extent of the site and to depth, are representative of conditions across the site. It is, also, recommended that we be given the opportunity to review all plans for the project in order to comment on the interaction of soil conditions as described herein and the design requirements.

Our professional services have been performed, our findings obtained and our recommendations prepared in accordance with generally accepted engineering principles and practices.

32185 Beaver Run Drive • Salisbury, Maryland 21804 • 410-546-6462 • Fax 410-548-5346
Email: jdh@jdhynesinc.com

APPENDIX

1. Investigative Procedures
2. Project Location Map
3. Boring Location Plan
4. Boring Logs
5. California Bearing Ratio (CBR) Test Results
6. Modified Proctor Test Results
7. Earth Pressure Requirements for Below Grade Walls (Drained)
8. Earth Pressure Requirements for Below Grade Walls (Undrained)
9. Infiltration Test Results
10. Infiltration Test Procedures
11. DGS Well Ca55-204 Data
12. Unified Soil Classification Sheet
13. Field Classification Sheet
14. USDA Soil Classification System Sheet
15. Important Information Sheet

32185 Beaver Run Drive • Salisbury, Maryland 21804 • 410-546-6462 • Fax 410-548-5346
Email: jdh@jdhynesinc.com

INVESTIGATIVE PROCEDURES

SOIL TEST BORINGS

Soil drilling and sampling operations were performed in accordance with ASTM Specification D-1586. The borings were advanced by mechanically turning continuous hollow stem auger flights into the ground. At regular intervals, samples were obtained with a standard 1.4 inch I.D., 2.0 inch O.D. splitspoon sampler. The sampler was first seated 6 inches to penetrate any loose cuttings and then driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot is the "Standard Penetration Resistance". The penetration resistance, when properly evaluated, is an index to the soil's strength, density and behavior under applied loads. The soil descriptions and penetration resistances for each boring are presented on the Test Boring Records in the Appendix.

HAND AUGER SOIL TEST BORINGS

Test borings were performed using a hand auger. The auger is manually advanced by rotating the shaft of the auger. The auger is withdrawn at short intervals for inspection of soils collected in the auger head. Soil samples are taken when soil conditions are noted to change. The soil descriptions for each boring are presented on the boring logs in the Appendix.

SOIL CLASSIFICATION

Soil classifications provide a general guide to the engineering properties of various soil types and enable the engineer to apply his past experience to current problems. In our investigation, jar samples obtained during drilling operations are examined in our laboratory and visually classified by the geotechnical engineer in accordance with ASTM Specification D-2488. The soils are classified according to the Unified Classification System (ASTM D-2487). Each of these classification systems and the in-place physical soil properties provides an index for estimating the soil's behavior.

ATTERBERG LIMITS TEST

Portions from representative soil samples obtained during drilling operations were selected for Atterberg Limits tests. The Atterberg Limits are indicative of the soil's plasticity characteristics. The liquid limit is the moisture content at which the soil will flow as a heavy viscous fluid and is determined in accordance with ASTM Specification D-4318. The plastic limit is the moisture content at which the soil begins to lose its plasticity and is determined in accordance with ASTM Specification D-4318.

NATURAL MOISTURE

Portions from representative soil samples obtained during drilling operations were selected for Natural Moisture Content tests. The Natural Moisture Content Test determines the water content of soils by drying into an oven with a standard drying temperature of 110 °C. The loss of mass drying the sample, determines the water content into the soil. The water content of the sample is calculated in percentage. The water content of soils (natural moisture) is determined in accordance with ASTM Specification D-2216.

32185 Beaver Run Drive • Salisbury, Maryland 21804 • 410-546-6462 • Fax 410-548-5346
Email: jdh@jdhynesinc.com

INVESTIGATIVE PROCEDURES (CONTINUED)

CALIFORNIA BEARING RATIO

The results of the compaction testing described above were utilized in compacting samples for the laboratory California Bearing Ratio tests. The California Bearing Ratio, abbreviated as CBR, is a punching shear test. It provides data that are a semi-empirical index of the strength and deflection characteristics of a soil that has been correlated with pavement performance. This correlation has resulted in the establishment of design curves for pavement thickness.

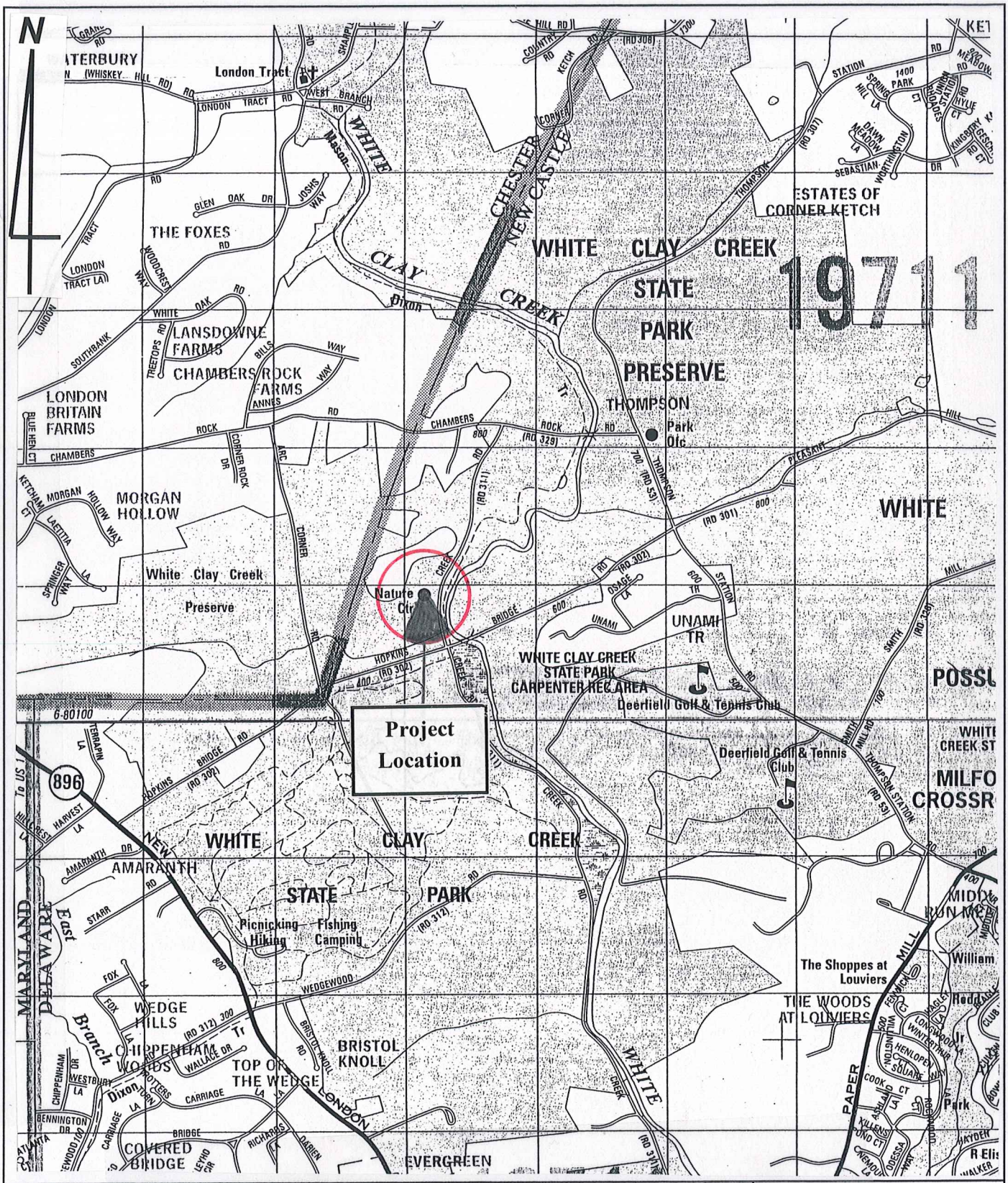
The test is performed on a 6-inch diameter, 5-inch thick, disc of compacted soil which is confined in a steel cylinder. The specimens are first tested immediately after compaction and then soaked for four (4) days to simulate a saturated pavement subgrade.

A 1.95-inch diameter piston is forced into the soil at a standard rate and the resistance of the piston penetration is measured. The CBR is the ratio expressed as a percentage of the load at 1.0-inch piston penetration compared to the load required to produce the same penetration in a standard crushed stone.

MODIFIED PROCTOR

A bulk sample was obtained from the pavement area test boring. A MODIFIED Proctor compaction test (ASTM D 1557) was performed on this soil to determine its compaction characteristics, including its maximum dry density and optimum moisture content.

32185 Beaver Run Drive • Salisbury, Maryland 21804 • 410-546-6462 • Fax 410-548-5346
Email: jdh@jdhynesinc.com

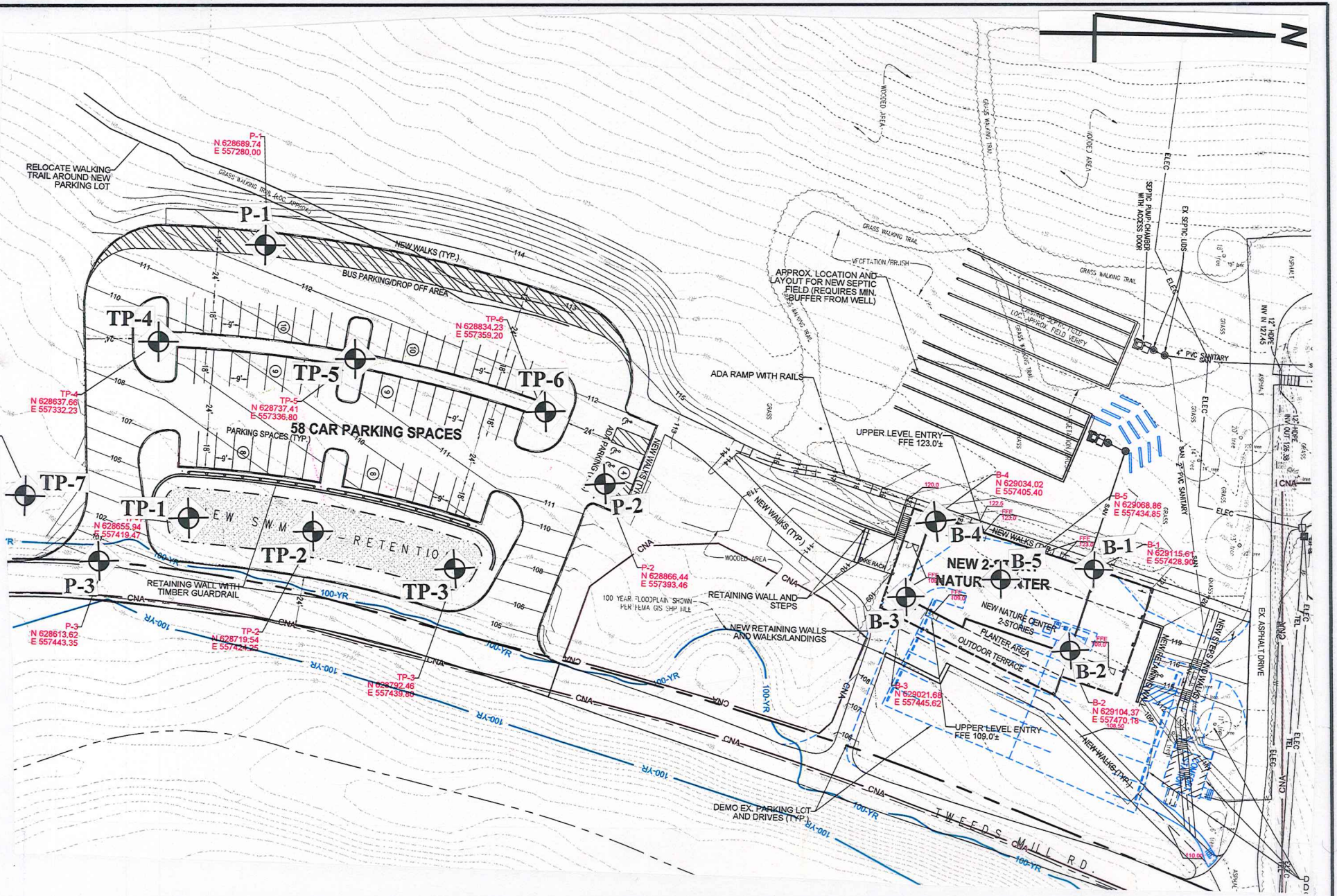


HYNES JOHN D. HYNES & ASSOCIATES, INC.
32185 Beaver Run Drive • Salisbury, Maryland 21804
410-546-6462 / Fax: 410-548-5346

Date: November 19, 2024
Scale: 1 in. = 2,000 ft.
Drawn: ADC Map

Project Location Map
DNREC – White Clay Creek State Park Nature Center
Newark, Delaware

DWG. No.
JDH-10/24/220-A



HYNES

JOHN D. HYNES & ASSOCIATES, INC.
32185 Beaver Run Drive • Salisbury, Maryland 21804
410-546-6462 / Fax: 410-548-5346

Boring Location Plan
DNREC – White Clay Creek State Park Nature Center
Newark, Delaware

Date: November 19, 2024
Scale: 1 inch ≈ 30 feet
Drawn: CDA
DWG. No. JDH-10/24/220

HYNES & ASSOCIATES

LOG OF BORING B-1

GWWO Architects
800 Wyman Park Drive, Suite 300
Baltimore, Maryland 21211

DNREC-White Clay Crk. State Park Nature Ctr.

Project No.: JDH-10/24/220

Date Completed: : November 7, 2024
Logged By: : E. Cross
Drilled By: : B. Hynes
Drilling Method: : HSA (Geoprobe 7822 DT)
Total Depth: : 20.5 feet

Depth in Feet	Surf. Elev. 118.5	DESCRIPTION	GRAPHIC	USCS	Sample No.	Blow count	REMARKS
0	118.5	Brownish gray, wet, stiff, silty CLAY, with trace sand		CL	1	4-5-7	Scale 1" ~ 4.5 feet Approximately 18 inches of organic bearing soil was encountered at the ground surface.
2	116.5						
4	114.5				2	3-5-7	Groundwater was not encountered during drilling operations.
6	112.5	Brown, wet, medium stiff, clayey SILT, with trace sand		ML	3	4-5-5	Laboratory Test Results Sample No. 2 From 3 to 4.5 feet
8	110.5						
10	108.5	Brown, wet, stiff, clayey SILT (trace decomposed rock, trace micaceous)		ML	4	4-5-6	Atterberg Limits Liquid Limit = 30 Plasticity Index = 8 Natural Moisture = 19.6%
12	106.5	Brown, wet, medium stiff, clayey SILT (trace decomposed rock, rock fragments, micaceous)		ML			
14	104.5				5	4-5-5	
16	102.5						
18	100.5	Gray, wet, hard, clayey SILT (trace decomposed rock, micaceous)		ML			
20	98.5				6	9-13-20	
		Boring terminated at 20.5 feet.					
22	96.5						
24	94.5						
26	92.5						
28	90.5						
30							

HYNES & ASSOCIATES

LOG OF BORING B-2

GWWO Architects
800 Wyman Park Drive, Suite 300
Baltimore, Maryland 21211

DNREC-White Clay Crk. State Park Nature Ctr.

Project No.: JDH-10/24/220

Date Completed: : November 7, 2024
Logged By: : E. Cross
Drilled By: : B. Hynes
Drilling Method: : HSA (Geoprobe 7822 DT)
Total Depth: : 20.5 feet

Depth in Feet	Surf. Elev. 114.0	DESCRIPTION	GRAPHIC	USCS	Sample No.	Blow count	REMARKS
0	114	Asphalt and stone					
		Brown, wet, medium stiff, clayey SILT		ML	1	1-3-4	Scale 1" ~ 4.5 feet Approximately 3 inches of asphalt and 5 inches of stone were encountered at the ground surface.
2	112						
					2	3-4-6	
4	110						Groundwater was not encountered during drilling operations.
					3	2-3-5	Laboratory Test Results Sample No. 2 From 3 to 4.5 feet
6	108						
8	106						
		Brown, wet, medium stiff, clayey SILT (decomposed rock, micaceous)		ML	4	2-4-6	Natural Moisture = 23.5% Sample No. 5 From 14 to 15.5 feet
10	104						
12	102						Atterberg Limits Liquid Limit = 36 Plasticity Index = 13 Natural Moisture = 18.8%
		Brownish gray, wet, stiff, silty CLAY (trace decomposed rock, micaceous)		CL	5	3-5-9	
14	100						
16	98						
18	96	Brown, wet, hard, clayey SILT, with trace sand (decomposed rock, micaceous, rock fragments)		ML			
20	94				6	10-29-50/5"	
		Boring terminated at 20.5 feet.					
22	92						
24	90						
26	88						
28	86						
30							

HYNES & ASSOCIATES

LOG OF BORING B-3

GWWO Architects
800 Wyman Park Drive, Suite 300
Baltimore, Maryland 21211

DNREC-White Clay Crk. State Park Nature Ctr.

Project No.: JDH-10/24/220

Date Completed: : November 7, 2024
Logged By: : E. Cross
Drilled By: : B. Hynes
Drilling Method: : HSA (Geoprobe 7822 DT)
Total Depth: : 20.5 feet

Depth in Feet	Surf. Elev. 112.0	DESCRIPTION	GRAPHIC	USCS	Sample No.	Blow count	REMARKS
0	112	Brown, wet, stiff, clayey SILT, with trace sand		ML	1	4-6-8	Scale 1" ~ 4.5 feet Approximately 18 inches of organic bearing soil was encountered at the ground surface. Groundwater was not encountered during drilling operations. Laboratory Test Results Sample No. 4 From 9 to 10.5 feet Atterberg Limits Liquid Limit = 51 Plasticity Index = 22 Natural Moisture = 33.9%
2	110						
		Brown, wet, stiff, clayey SILT, with trace sand (trace micaceous)			2	4-5-6	
4	108			ML			
6	106				3	4-5-7	
8	104						
		Gray, wet, medium stiff, clayey SILT, with trace silt			4	2-4-5	
10	102			MH			
12	100	Brown, wet, very stiff, clayey SILT, with some weathered rock (trace decomposed rock, trace micaceous)					
14	98			ML	5	5-8-10	
16	96						
		Brown to orange-brown, wet, hard, clayey SILT (decomposed rock, rock fragments, micaceous)					
18	94			ML			
20	92				6	3-12-27	
		Boring terminated at 20.5 feet.					
22	90						
24	88						
26	86						
28	84						
30							

HYNES & ASSOCIATES

LOG OF BORING B-4

GWWO Architects
800 Wyman Park Drive, Suite 300
Baltimore, Maryland 21211

DNREC-White Clay Crk. State Park Nature Ctr.

Project No.: JDH-10/24/220

Date Completed: : November 7, 2024
Logged By: : E. Cross
Drilled By: : B. Hynes
Drilling Method: : HSA (Geoprobe 7822 DT)
Total Depth: : 20.5 feet

Depth in Feet	Surf. Elev. 116.5	DESCRIPTION	GRAPHIC	USCS	Sample No.	Blow count	REMARKS
0	116.5	Brown, wet, stiff, clayey SILT, with trace sand		ML	1	3-5-6	Scale 1" ~ 4.5 feet Approximately 10 inches of organic bearing soil was encountered at the ground surface. Groundwater was not encountered during drilling operations. Laboratory Test Results Sample No. 3 From 6 to 7.5 feet Atterberg Limits Liquid Limit = 29 Plasticity Index = 3 Natural Moisture = 26.1%
2	114.5						
4	112.5				2	6-7-8	
6	110.5	Brown, wet, medium stiff, clayey SILT, with trace sand (trace micaceous)		ML	3	3-4-5	
8	108.5						
10	106.5				4	3-5-5	
12	104.5	Brownish gray, wet, stiff, clayey SILT (trace decomposed rock, micaceous)		ML			
14	102.5				5	4-6-8	
16	100.5						
18	98.5	Dark brown, wet, very stiff, clayey SILT, with trace organic silt (trace decomposed rock, micaceous)		ML			
20	96.5				6	5-7-10	
		Boring terminated at 20.5 feet.					
22	94.5						
24	92.5						
26	90.5						
28	88.5						
30							

HYNES & ASSOCIATES

LOG OF BORING B-5

GWWO Architects
800 Wyman Park Drive, Suite 300
Baltimore, Maryland 21211

DNREC-White Clay Crk. State Park Nature Ctr.

Project No.: JDH-10/24/220

Date Completed: : November 7, 2024
Logged By: : E. Cross
Drilled By: : B. Hynes
Drilling Method: : HSA (Geoprobe 7822 DT)
Total Depth: : 20.5 feet

Depth in Feet	Surf. Elev. 114.5	DESCRIPTION	GRAPHIC	USCS	Sample No.	Blow count	REMARKS
0	114.5	Asphalt and stone					
		Brown, wet, loose, fine to coarse SAND, with little silt		SM	1	3-4-5	Scale 1" ~ 4.5 feet
2	112.5						Approximately 3 inches of asphalt and 6 inches of stone were encountered at the ground surface.
		Brownish gray, wet, medium stiff, clayey SILT (trace micaceous)		ML	2	5-7-8	
4	110.5						Groundwater was not encountered during drilling operations.
6	108.5	Brown, wet, medium stiff, clayey SILT		ML	3	3-4-5	Laboratory Test Results
8	106.5						Sample No. 3 From 6 to 7.5 feet
		Orange-brown to gray, wet, stiff, clayey SILT, with trace sand (decomposed rock, micaceous)			4	3-4-7	Natural Moisture = 25.3%
10	104.5						
12	102.5						
14	100.5			ML	5	3-5-7	
16	98.5						
18	96.5						
20	94.5				6	10-17-29	
		Orange-brown, wet, hard, clayey SILT and weathered rock (rock fragments, micaceous)		ML			
22	92.5	Boring terminated at 20.5 feet.					
24	90.5						
26	88.5						
28	86.5						
30							

HYNES & ASSOCIATES

LOG OF BORING P-1

GWWO Architects
800 Wyman Park Drive, Suite 300
Baltimore, Maryland 21211

DNREC-White Clay Crk. State Park Nature Ctr.

Project No.: JDH-10/24/220

Date Completed: : November 8, 2024
Logged By: : E. Cross
Drilled By: : B. Hynes
Drilling Method: : HSA (Geoprobe 7822 DT)
Total Depth: : 10 feet

Depth in Feet	Surf. Elev. 115.0	DESCRIPTION	GRAPHIC	USCS	Sample No.	Blow count	REMARKS
0	115	Brown, wet, medium stiff, clayey SILT		ML	1	3-3-4-5	Scale 1" ~ 4.5 feet
2	113	Brown, wet, very stiff, clayey SILT		ML	2	3-6-8-10	Approximately 16 inches of organic bearing soil was encountered at the ground surface.
4	111				3	3-6-8-11	Groundwater was not encountered during drilling operations.
6	109	Brown, wet, stiff, clayey SILT, with trace sand (trace decomposed rock, micaceous)		ML	4	3-5-7-7	Laboratory Test Results
8	107				5	3-4-6-6	Sample No. 2 From 2 to 4 feet
10	105	Boring terminated at 10 feet.					Natural Moisture = 20.1%
12	103						
14	101						
16	99						
18	97						
20	95						
22	93						
24	91						
26	89						
28	87						
30							

HYNES & ASSOCIATES

LOG OF BORING P-2

GWWO Architects
800 Wyman Park Drive, Suite 300
Baltimore, Maryland 21211

DNREC-White Clay Crk. State Park Nature Ctr.

Project No.: JDH-10/24/220

Date Completed: : November 7, 2024
Logged By: : E. Cross
Drilled By: : B. Hynes
Drilling Method: : HSA (Geoprobe 7822 DT)
Total Depth: : 10 feet

Depth in Feet	Surf. Elev. 112.5	DESCRIPTION	GRAPHIC	USCS	Sample No.	Blow count	REMARKS
0	112.5	Brown, wet, medium stiff, clayey SILT, with trace sand		ML	1	4-4-5-5	Scale 1" ~ 4.5 feet Approximately 20 inches of organic bearing soil was encountered at the ground surface. Groundwater was not encountered during drilling operations.
2	110.5				2	3-4-4-5	
4	108.5	Brown, wet, medium stiff to very stiff, clayey SILT, with trace sand (trace micaceous)		ML	3	3-5-7-9	
6	106.5				4	3-4-5-5	
8	104.5				5	4-4-5-6	
10	102.5	Boring terminated at 10 feet.					
12	100.5						
14	98.5						
16	96.5						
18	94.5						
20	92.5						
22	90.5						
24	88.5						
26	86.5						
28	84.5						
30							

HYNES & ASSOCIATES

LOG OF BORING P-3

GWWO Architects
800 Wyman Park Drive, Suite 300
Baltimore, Maryland 21211

DNREC-White Clay Crk. State Park Nature Ctr.

Project No.: JDH-10/24/220

Date Completed: : November 8, 2024
Logged By: : E. Cross
Drilled By: : B. Hynes
Drilling Method: : HSA (Geoprobe 7822 DT)
Total Depth: : 10 feet

Depth in Feet	Surf. Elev. 101.0	DESCRIPTION	GRAPHIC	USCS	Sample No.	Blow count	REMARKS
0	101	Brown, wet, stiff, clayey SILT		ML	1	3-4-5-6	Scale 1" ~ 4.5 feet
2	99	Dark brown, wet, stiff, clayey SILT, with trace organic silt		ML	2	3-5-7-8	Approximately 48 inches of organic bearing soil was encountered at the ground surface.
4	97	Brown, wet, very stiff, clayey SILT, with trace sand		ML	3	4-6-8-11	Groundwater was not encountered during drilling operations.
6	95	Brown, wet, stiff, clayey SILT (trace micaceous)		ML	4	3-5-6-8	Laboratory Test Results
8	93	Brown, wet, very stiff, clayey SILT (decomposed rock, micaceous)		ML	5	4-6-8-10	Sample No. 3 From 4 to 6 feet Natural Moisture = 15.6%
10	91	Boring terminated at 10 feet.					
12	89						
14	87						
16	85						
18	83						
20	81						
22	79						
24	77						
26	75						
28	73						
30							

HYNES & ASSOCIATES

LOG OF BORING TP-1

GWWO Architects
800 Wyman Park Drive, Suite 300
Baltimore, Maryland 21211

DNREC-White Clay Crk. State Park Nature Ctr.

Project No.: JDH-10/24/220

Date Completed: : November 8, 2024
Logged By: : E. Cross
Drilled By: : B. Hynes
Drilling Method: : HSA (Geoprobe 7822 DT)
Total Depth: : 12 feet

Depth in Feet	Surf. Elev. 105.5	DESCRIPTION	GRAPHIC	USCS	Sample No.	Blow count	REMARKS
0	105.5	Brown, wet, stiff, silty CLAY, with trace sand (10YR 5/3, Silt)		CL	1	2-4-5-7	Scale 1" ~ 4.5 feet Approximately 18 inches of organic bearing soil was encountered at the ground surface. Groundwater was not encountered during drilling operations.
2	103.5	Brown, wet, stiff, clayey SILT (10YR 5/3, Silt, trace micaceous)		ML	2	3-6-7-7	
4	101.5	Brown, wet, stiff, clayey SILT, with some sand (10YR 5/3, Silt loam, trace decomposed rock, trace micaceous)		ML	3	4-5-7-8	
6	99.5	Brown, wet, stiff to very stiff, clayey SILT (10YR 5/3, Silt, micaceous, trace weathered rock)		ML	4	5-6-5-6	
8	97.5				5	5-7-9-11	
10	95.5	Brown, wet, very stiff, SILT, with some sand, trace clay ((10YR 5/3, Silt loam, decomposed rock, micaceous)		ML	6	6-8-10-14	
12	93.5	Boring terminated at 12 feet.					
14	91.5						
16	89.5						
18	87.5						
20	85.5						
22	83.5						
24	81.5						
26	79.5						
28	77.5						
30							

HYNES & ASSOCIATES

LOG OF BORING TP-2

GWWO Architects
800 Wyman Park Drive, Suite 300
Baltimore, Maryland 21211

DNREC-White Clay Crk. State Park Nature Ctr.

Project No.: JDH-10/24/220

Date Completed: : November 8, 2024
Logged By: : E. Cross
Drilled By: : B. Hynes
Drilling Method: : HSA (Geoprobe 7822 DT)
Total Depth: : 12 feet

Depth in Feet	Surf. Elev. 107.0	DESCRIPTION	GRAPHIC	USCS	Sample No.	Blow count	REMARKS
0	107	Brown, wet, medium stiff to stiff, clayey SILT, with trace sand (10YR 5/3, Silt)		ML	1	2-3-4-4	Scale 1" ~ 4.5 feet Approximately 16 inches of organic bearing soil was encountered at the ground surface. Groundwater was not encountered during drilling operations.
2	105				2	3-5-7-8	
4	103	Brown, wet, very stiff, clayey SILT, with trace sand (10YR 5/3, Silt)		ML	3	3-5-7-9	
6	101	Brown, wet, vstiff to very stiff, clayey SILT, with little sand (10YR 5/3, Silt loam, trace decomposed rock, trace micaceous)		ML	4	4-7-7-8	
8	99				5	5-7-9-10	
10	97	Gray, wet, medium stiff, silty CLAY (10YR 6/2, Clay, trace micaceous)		CL	6	3-4-4-6	
12	95	Boring terminated at 12 feet.					
14	93						
16	91						
18	89						
20	87						
22	85						
24	83						
26	81						
28	79						
30							

HYNES & ASSOCIATES

LOG OF BORING TP-3

GWWO Architects
800 Wyman Park Drive, Suite 300
Baltimore, Maryland 21211

DNREC-White Clay Crk. State Park Nature Ctr.

Project No.: JDH-10/24/220

Date Completed: : November 8, 2024
Logged By: : E. Cross
Drilled By: : B. Hynes
Drilling Method: : HSA (Geoprobe 7822 DT)
Total Depth: : 12 feet

Depth in Feet	Surf. Elev. 108.5	DESCRIPTION	GRAPHIC	USCS	Sample No.	Blow count	REMARKS
0	108.5	Brown, wet, medium stiff to stiff, clayey SILT, with trace sand (10YR 5/3, Silt)		ML	1	3-4-5-5	Scale 1" ~ 4.5 feet Approximately 12 inches of organic bearing soil was encountered at the ground surface. Groundwater was not encountered during drilling operations.
2	106.5				2	3-4-5-6	
4	104.5				3	3-5-6-7	
6	102.5	Grayish brown, wet, very stiff, clayey SILT, with trace sand (10YR 5/3-6/2, Silt loam, trace decomposed rock, rock fragments, micaceous)		ML	4	4-8-10-12	
8	100.5				5	5-7-11-13	
10	98.5				6	6-8-10-12	
12	96.5	Boring terminated at 12 feet.					
14	94.5						
16	92.5						
18	90.5						
20	88.5						
22	86.5						
24	84.5						
26	82.5						
28	80.5						
30							

HYNES & ASSOCIATES

LOG OF BORING TP-4

GWWO Architects
800 Wyman Park Drive, Suite 300
Baltimore, Maryland 21211

DNREC-White Clay Crk. State Park Nature Ctr.

Project No.: JDH-10/24/220

Date Completed: : November 8, 2024
Logged By: : E. Cross
Drilled By: : B. Hynes
Drilling Method: : HSA (Geoprobe 7822 DT)
Total Depth: : 12 feet

Depth in Feet	Surf. Elev. 109.0	DESCRIPTION	GRAPHIC	USCS	Sample No.	Blow count	REMARKS
0	109	Brown, wet, medium stiff to stiff, clayey SILT, with little sand (10YR 5/3, Silt loam, micaceous)		ML	1	3-4-4-5	Scale 1" ~ 4.5 feet Approximately 14 inches of organic bearing soil was encountered at the ground surface. Groundwater was not encountered during drilling operations.
2	107				2	3-5-5-6	
4	105				3	4-5-6-7	
6	103	Brown, wet, medium stiff, clayey SILT, with little sand (10YR 5/3, Silt loam, trace decomposed rock)		ML	4	3-3-4-5	
8	101				5	2-3-4-4	
10	99	Gray, wet, stiff, silty CLAY (10YR 6/2, Clay, trace micaceous)		CL	6	2-4-6-8	
12	97	Boring terminated at 12 feet.					
14	95						
16	93						
18	91						
20	89						
22	87						
24	85						
26	83						
28	81						
30							

HYNES & ASSOCIATES

LOG OF BORING TP-5

GWWO Architects
800 Wyman Park Drive, Suite 300
Baltimore, Maryland 21211

DNREC-White Clay Crk. State Park Nature Ctr.

Project No.: JDH-10/24/220

Date Completed: : November 7, 2024
Logged By: : E. Cross
Drilled By: : B. Hynes
Drilling Method: : HSA (Geoprobe 7822 DT)
Total Depth: : 12 feet

Depth in Feet	Surf. Elev. 112.0	DESCRIPTION	GRAPHIC	USCS	Sample No.	Blow count	REMARKS
0	112	Brown, wet, medium stiff to stiff, clayey SILT, with trace sand (10YR 5/3, Silt)		ML	1	2-3-5-5	Scale 1" ~ 4.5 feet Approximately 8 inches of organic bearing soil was encountered at the ground surface. Groundwater was not encountered during drilling operations.
2	110				2	2-4-5-8	
4	108	Brown to orange-brown, wet, stiff, clayey SILT (10YR 5/3-6/8, Silt, trace decomposed rock, micaceous)		ML	3	4-5-6-9	
6	106				4	3-5-6-6	
8	104	Brown, wet, very stiff, clayey SILT, with trace sand, trace organic silt (10YR 5/3, Silt, trace decomposed rock, micaceous)		ML	5	4-5-8-9	
10	102	Dark brown, wet, medium stiff, organic SILT, with trace peat (10YR 5/3, Peat)		OL	6	3-3-4-4	
12	100	Boring terminated at 12 feet.					
14	98						
16	96						
18	94						
20	92						
22	90						
24	88						
26	86						
28	84						
30							

HYNES & ASSOCIATES

LOG OF BORING TP-6

GWWO Architects
800 Wyman Park Drive, Suite 300
Baltimore, Maryland 21211

DNREC-White Clay Crk. State Park Nature Ctr.

Project No.: JDH-10/24/220

Date Completed: : November 7, 2024
Logged By: : E. Cross
Drilled By: : B. Hynes
Drilling Method: : HSA (Geoprobe 7822 DT)
Total Depth: : 12 feet

Depth in Feet	Surf. Elev. 114.0	DESCRIPTION	GRAPHIC	USCS	Sample No.	Blow count	REMARKS
0	114	Brown, wet, medium stiff, clayey SILT, with trace sand (10YR 5/3, Silt)		MH/CH	1	2-3-4-5	Scale 1" ~ 4.5 feet Approximately 18 inches of organic bearing soil was encountered at the ground surface. Groundwater was not encountered during drilling operations.
2	112	Brown, wet, stiff, clayey SILT, with trace sand (10YR 5/3, Silt, trace micaceous)		ML	2	4-5-6-7	
4	110				3	3-5-5-7	
6	108				4	4-5-6-6	
8	106	Brown, wet, stiff, clayey SILT, with some sand, (10YR 5/3, Silt loam, trace micaceous, trace decomposed rock)		ML	5	3-6-6-8	
10	104	Brownish gray, wet, stiff, silty CLAY, with trace sand, trace micaceous (10YR 5/3-6/2, Clay)		CL	6	4-4-6-6	
12	102	Boring terminated at 12 feet.					
14	100						
16	98						
18	96						
20	94						
22	92						
24	90						
26	88						
28	86						
30							

HYNES & ASSOCIATES

LOG OF BORING TP-7

GWWO Architects
800 Wyman Park Drive, Suite 300
Baltimore, Maryland 21211

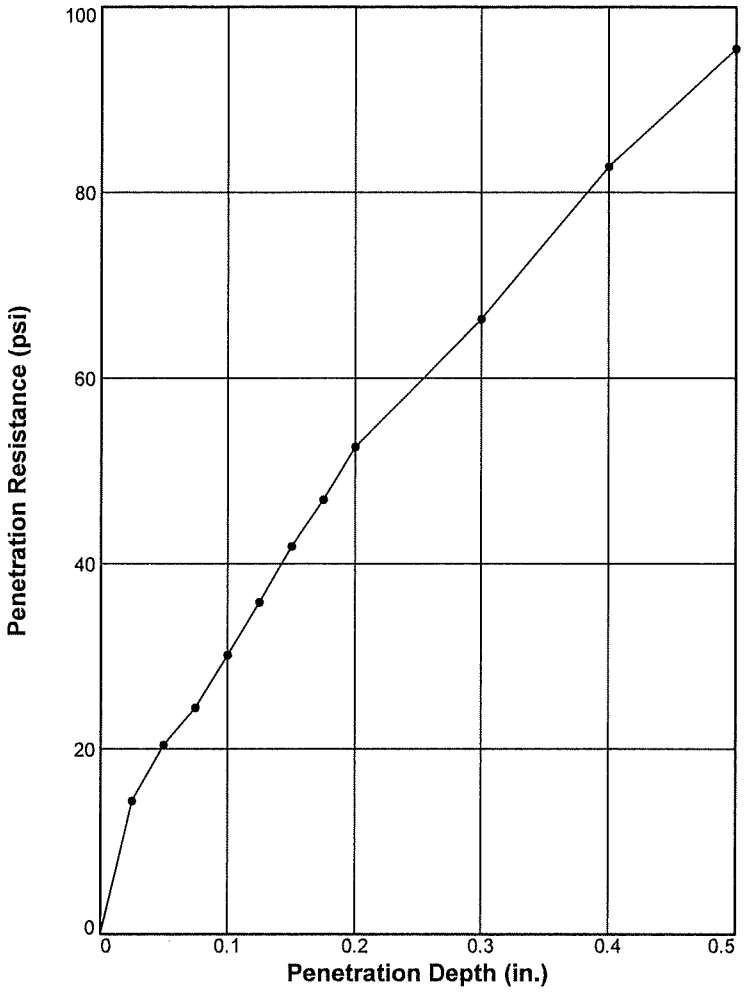
DNREC-White Clay Crk. State Park Nature Ctr.

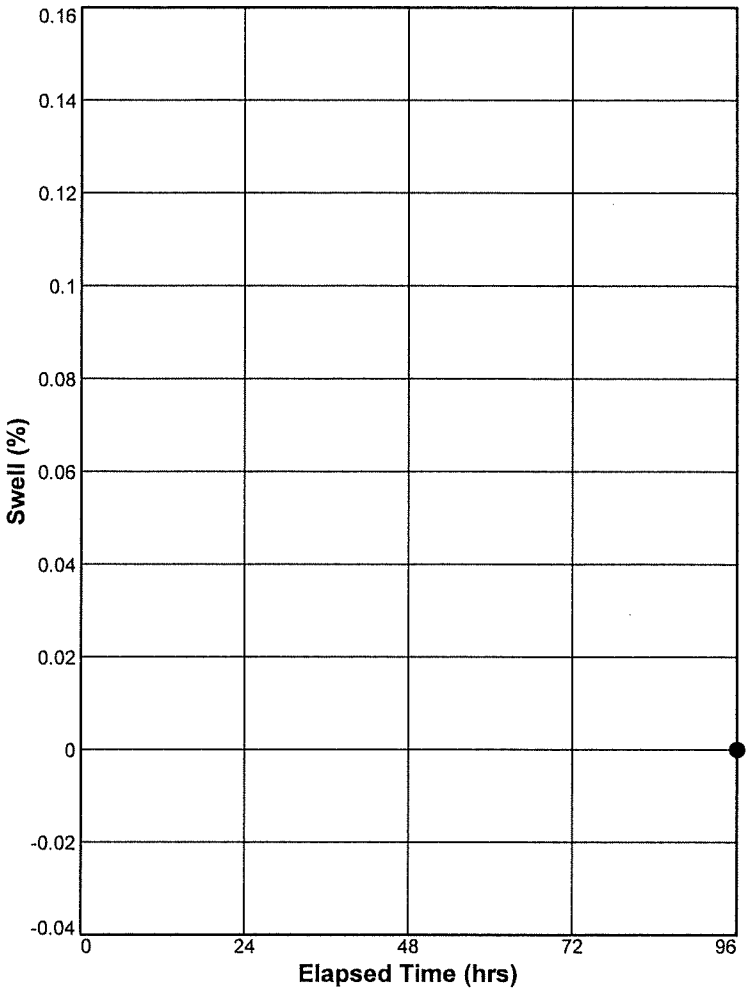
Project No.: JDH-10/24/220

Date Completed: : November 7, 2024
Logged By: : E. Cross
Drilled By: : B. Hynes
Drilling Method: : HSA (Geoprobe 7822 DT)
Total Depth: : 12 feet

Depth in Feet	Surf. Elev. 104.5	DESCRIPTION	GRAPHIC	USCS	Sample No.	Blow count	REMARKS
0	104.5	Brown, wet, medium stiff to stiff, clayey SILT, with trace sand (10YR 5/3, Silt)		ML-MH	1	3-4-5-5	Scale 1" ~ 4.5 feet Approximately 24 inches of organic bearing soil was encountered at the ground surface. Groundwater was not encountered during drilling operations.
2	102.5				2	3-5-6-7	
4	100.5				3	5-7-9-11	
6	98.5	Brown, wet, very stiff to stiff, clayey SILT (10YR 5/3, Silt, micaceous, trace weathered rock)		ML	4	3-5-6-8	
8	96.5	Brown, wet, stiff to hard, SILT, with some sand (10YR 5/3, Silt loam, decomposed rock, micaceous)		ML	5	4-6-6-8	
10	94.5				6	9-8-19-20	
12	92.5	Boring terminated at 12 feet.					
14	90.5						
16	88.5						
18	86.5						
20	84.5						
22	82.5						
24	80.5						
26	78.5						
28	76.5						
30							

BEARING RATIO TEST REPORT
AASHTO T 193-10





	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ●	102.8	97.4	23.6	102.8	97.4	24.1	3.0	3.5	0.000	15	0
2 ▲											
3 ■											

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
Brown Clayey SILT, with trace sand (ML)	ML	105.5	17.6		

Project No: JDH-10/24/220
Project: DNREC - White Clay Creek
Location: P-3
Sample Number: 16802
Date Sampled: 11-08-2024 **Date Received:** 11-08-2024

BEARING RATIO TEST REPORT

John D. Hynes & Associates, Inc.

Test Remarks:

Figure _____

Tested By: KAZ

BEARING RATIO TESTING RESULTS
(AASHTO T 193-10)

Date Sampled:	11-08-2024	**Date Received:**	11-08-2024
Project No.:	JDH-10/24/220		
Project:	DNREC - White Clay Creek		
Location:	P-3		
Sample Number:	16802		
Material Description:	Brown Clayey SILT, with trace sand (ML)		
USCS Classification:	ML		
Liquid Limit:		**Plasticity Index:**	
Test Description:			
Maximum Dry Density, pcf :	105.5	**Optimum Moisture Content, %:**	17.6
Testing Remarks:			

Sample 1 (56 Blows; Surcharge: 15 lbs.)

Water Content

Wt. Wet Soil+Tare, gms. 976.4 | Wt. Soil+Tare, gms. 871.3 | Wt. Tare, gms. 426.1 | Moisture, % 23.6

Unit Weight

Wt. Mold+Soil, lbs. 26.780 | Wt. Mold, lbs. 17.426 | Ht. Soil, in. 4.5 | Density, pcf 102.8

Swell Data

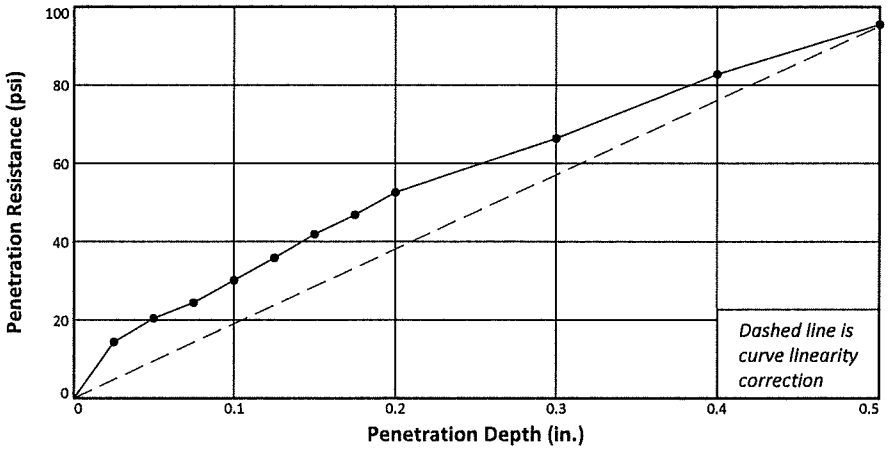
Elapsed Time, hrs.	Dial Reading in. x 1,000	Swell %
0	.3258	0.0
96	.325	0.0

Final Water Content

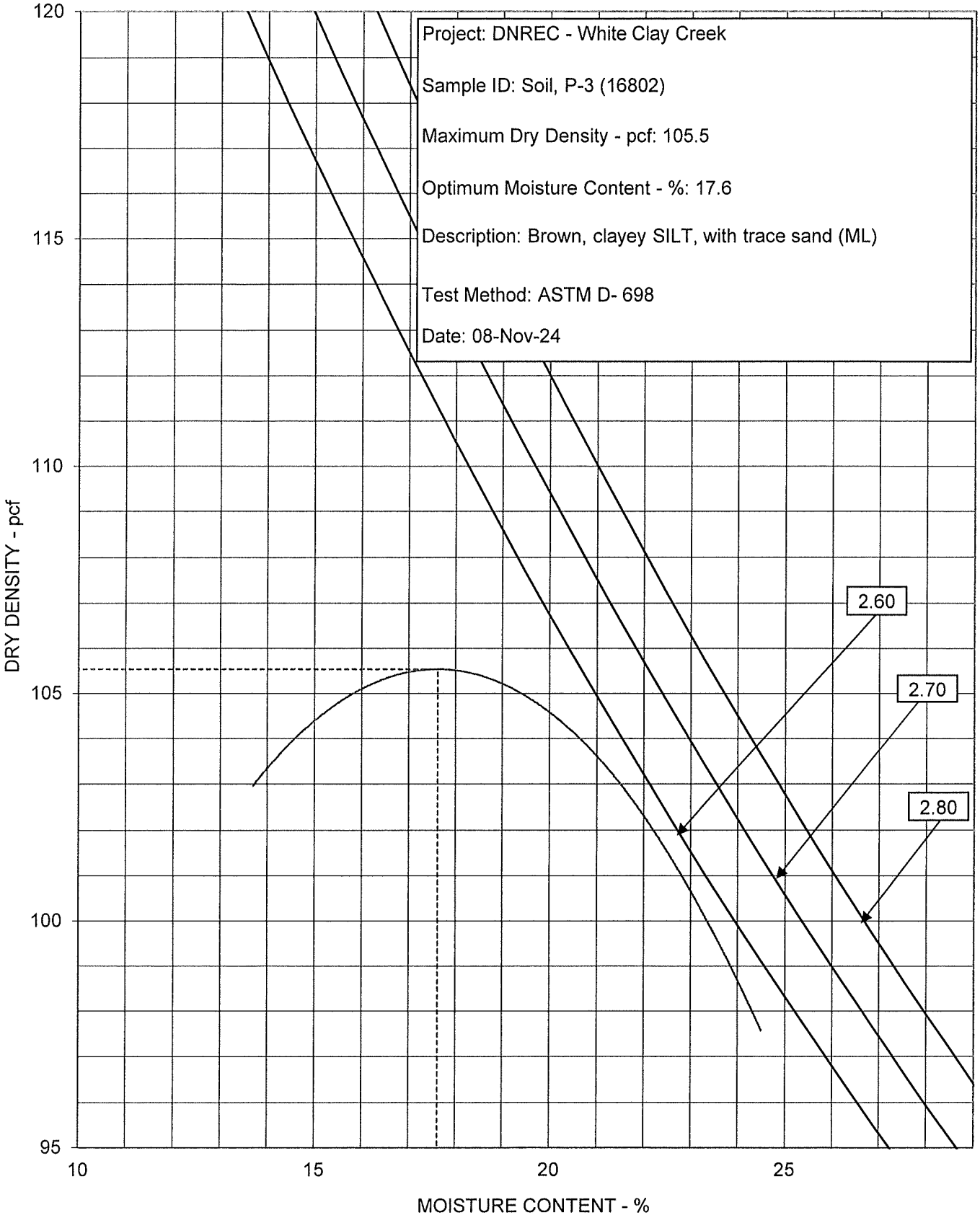
	Wt. Wet Soil+Tare, gms.	Dry Soil+Tare	Tare	Moisture, %
1)	971.5	870.5	451.9	24.1

Penetration Test Data

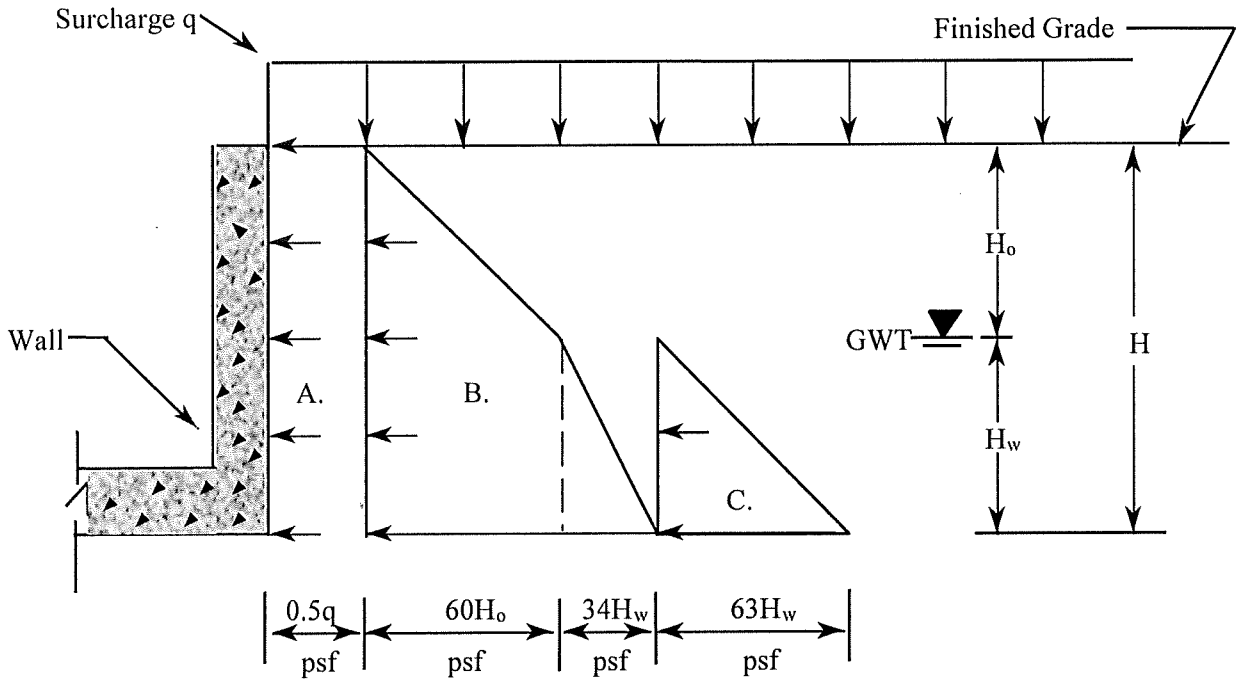
Pen. in.	Dial Reading	Stress psi	CBR %
0.0	0	0.0	
0.025	43	14.4	
0.05	61	20.4	
0.075	73	24.5	
0.1	90	30.1	3.0
0.125	107	35.8	
0.15	125	41.9	
0.175	140	46.9	
0.2	157	52.6	3.5
0.3	198	66.3	
0.4	247	82.7	
0.5	285	95.5	



John D. Hynes & Associates



EARTH PRESSURE REQUIREMENTS
FOR
BELOW GRADE WALLS (UNDRAINED)



A. Lateral Surcharge
B. Lateral Soil Pressure
C. Hydrostatic Pressure

1. Pressure diagram assumes undrained soil conditions.
2. Pressure diagram assumes at rest soil pressures on cantilevered walls or walls with one support level.
3. For backfill, use non-plastic SP or better quality material (ASTM D-2487).
4. Compact backfill in maximum 8-inch loose lifts to 92 to 95 percent maximum dry density (ASTM D-1557).
5. Use only light-duty hand operated compaction equipment within 10 feet of walls.
6. For surcharge q, consider the greater of the maximum expected construction equipment live loads or permanent structure dead and live loads.
7. For temporary retaining walls used for excavation support, use 2/3 of the above values for lateral surcharge and soil pressures. This reflects the active soil pressure condition.

HYNES

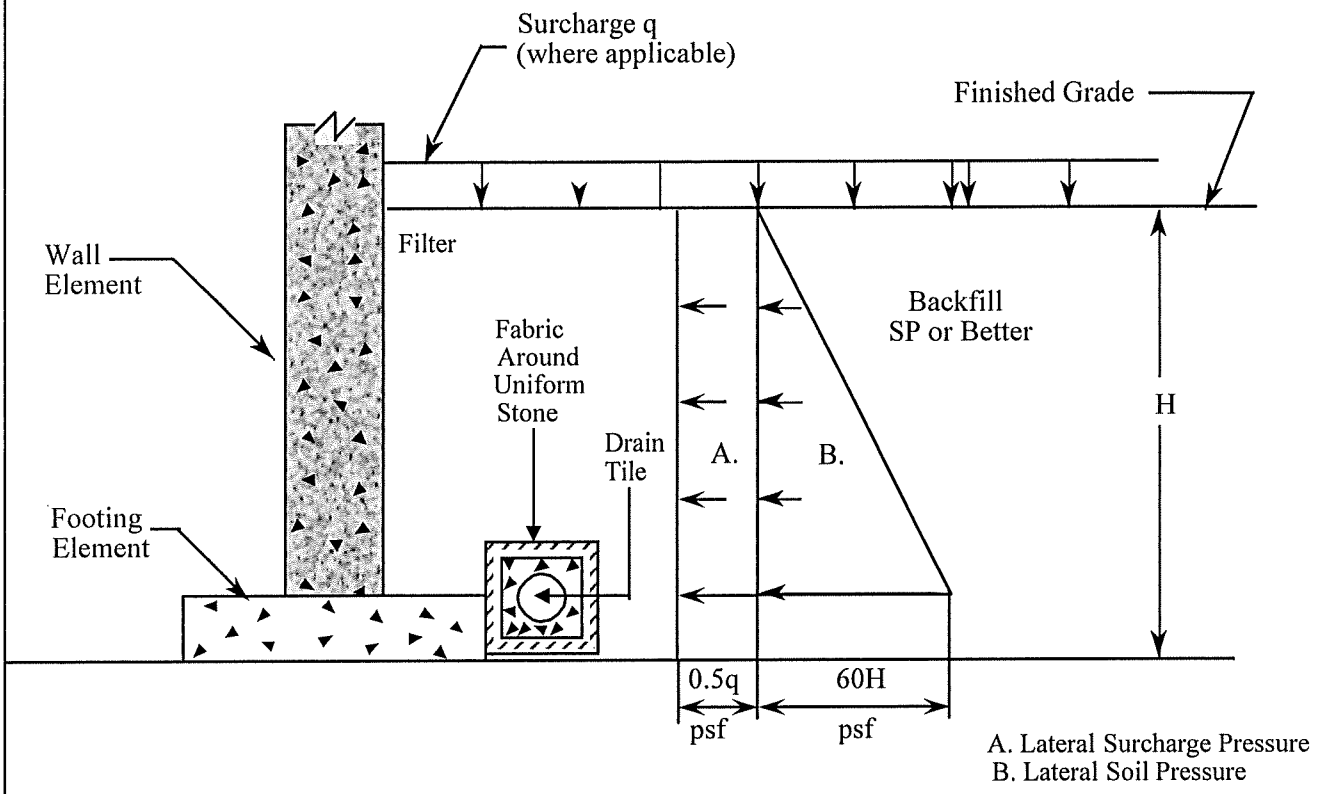
JOHN D. HYNES & ASSOCIATES, INC.
32185 Beaver Run Drive • Salisbury, Maryland 21804
410-546-6462 / Fax: 410-548-5346

Date: December 17, 2024
Scale: Not to Scale
Drawn: Hynes & Assoc.

Earth Pressure Requirements for Retaining Walls (Undrained)
DNREC-White Clay Creek State Park Nature Center
Newark, Delaware

DWG. No.
JDH-10/24/220-C

EARTH PRESSURE REQUIREMENTS
FOR
BELOW GRADE WALLS (DRAINED)



1. Pressure diagram assumes at rest soil pressures on cantilevered walls or walls with one support level.
2. Pressure diagram includes only loads resulting from backfill and surcharges.
3. This distribution assumes perimeter sub-drainage will be provided; therefore, hydrostatic pressure is not included.
4. For backfill, use SP or better quality material (ASTM D-2487).
5. Compact backfill in maximum 8-inch loose lifts to 92 to 95 percent maximum dry density (ASTM D-1557).
6. Use only light-duty hand operated compaction equipment within 10 feet of walls.
7. For surcharge q, consider the greater of the maximum expected construction equipment live loads or permanent structure dead and live loads.
8. For temporary retaining walls used for excavation support, use 2/3 of the above values for lateral surcharge and soil pressures. This reflects the active soil pressure condition.

HYNES

JOHN D. HYNES & ASSOCIATES, INC.
32185 Beaver Run Drive • Salisbury, Maryland 21804
410-546-6462 / Fax: 410-548-5346

	Date: December 19, 2024
	Scale: Not to Scale
	Drawn: Hynes & Assoc.
Earth Pressure Requirements for Below Grade Walls (Drained) DNREC-White Clay Creek State Park Nature Center Newark, Delaware	**DWG. No.** **JDH-10/24/220-D**

Single Ring
Falling Head Infiltration Test
12 Inch Ring

Project: DNREC White Clay Creek State Park Nature Center
Date: 12/12/2024
Project No.: JDH-10/24/220
Test Location: TP-1

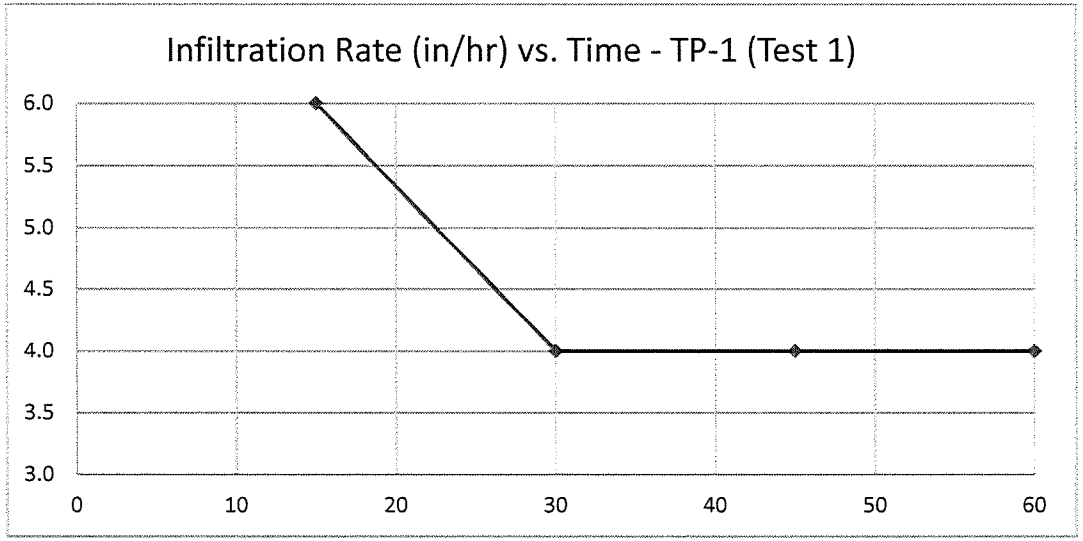
Weather: Sunny, 35
Test Depth: El. 99.5 ft.
Ring Embedment: 3 in.
Tester/ Technician Performing Test: E. Cross

	Time (t)	Time Elapsed (min)	Hydraulic Head (h) (in)	Change (Δh) (in)	Incremental Inf. Rate (in/hr)
Presoak	0	-	12.00	-	-
	60	60	4.50	7.50	7.5
Test 1	0	-	6.00	-	-
	15	15	4.50	1.50	6.0
	30	15	3.50	1.00	4.0
	45	15	2.50	1.00	4.0
	60	15	1.50	1.00	4.0
	Test 1		**Average Infiltration Rate (in./hr.) :**		**4.5**
			Steady State Infiltration Rate (in./hr.) :		**4.0**
Test 2	0	-	6.00	-	-
	15	15	4.50	1.50	6.0
	30	15	3.50	1.00	4.0
	45	15	2.50	1.00	4.0
	60	15	1.50	1.00	4.0
	Test 2		**Average Infiltration Rate (in./hr.) :**		**4.5**
			Steady State Infiltration Rate (in./hr.) :		**4.0**

DNREC White Clay

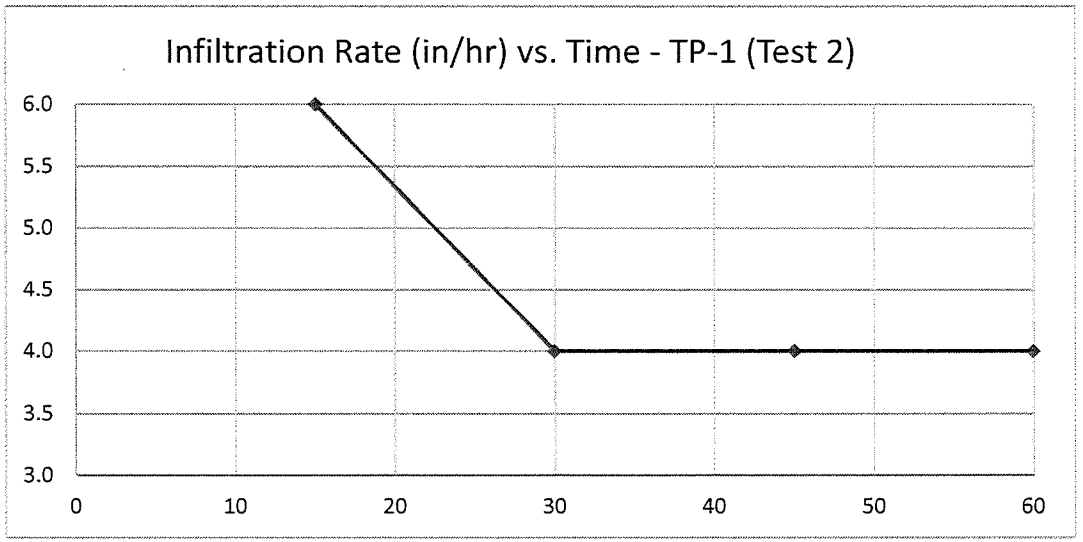
TP-1 Test 1

Interval #	Interval(min)	Cumulative Time	Rate(in/hr)
1	15	15	6.0
2	15	30	4.0
3	15	45	4.0
4	15	60	4.0



TP-1 Test 2

Interval #	Interval(min)	Cumulative Time	Rate(in/hr)
1	15	15	6.0
2	15	30	4.0
3	15	45	4.0
4	15	60	4.0



Single Ring
Falling Head Infiltration Test
12 Inch Ring

Project: DNREC White Clay Creek State Park Nature Center
Date: 12/12/2024
Project No.: JDH-10/24/220
Test Location: TP-2

Weather: Sunny, 35
Test Depth: El. 101.0 ft.
Ring Embedment: 3 in.
Tester/ Technician Performing Test: Evan & Paul

	Time (t)	Time Elapsed (min)	Hydraulic Head (h) (in)	Change (Δh) (in)	Incremental Inf. Rate (in/hr)
Presoak	0	-	12.00	-	-
	60	20	12.00	0.00	0.0
Test 1	0	-	6.00	-	-
	15	15	6.00	0.00	0.0
	30	15	6.00	0.00	0.0
	45	15	6.00	0.00	0.0
	60	15	6.00	0.00	0.0
Test 1			**Average Infiltration Rate (in./hr.) :**		**0.0**
			Steady State Infiltration Rate (in./hr.) :		**0.0**

Single Ring
Falling Head Infiltration Test
4 Inch Ring

Project: DNREC White Clay Creek **Date:** 12/12/2024
Project No.: JDH-10/24/220
Test Location: TP-3

Weather: Sunny, 35°
Depth from Top of Casing to Bottom of Boring: 10.0 ft.
Height of Casing Above Ground Surface: 3.0 ft.
Test Depth: 7.0 ft.
Test Elevation: 101.5 ft.
Casing Embedment: 3.0 in.
Tester/ Technician Performing Test: Evan & Paul

	Time (t)	Time Elapsed (min)	Hydraulic Head (h) (in)	Change (Δh) (in)	Incremental Inf. Rate
Presoak	0	-	12.00	-	-
	60	60	12.00	0.00	**N/A**
Test 1	0	-	6.00	-	-
	15	15	6.00	0.00	0.0
	30	15	6.00	0.00	0.0
	45	15	6.00	0.00	0.0
	60	15	6.00	0.00	0.0
	Test 1		**Average Infiltration Rate (in./hr.) :**		**0.0**
			Steady State Infiltration Rate (in./hr.) :		**0.0**

Single Ring
Falling Head Infiltration Test
12 Inch Ring

Project: DNREC White Clay Creek State Park Nature Center
Date: 12/12/2024
Project No.: JDH-10/24/220
Test Location: TP-2 (TP-4)
Weather: Sunny, 35
Test Depth: El. 103.0 ft.
Ring Embedment: 3 in.
Tester/ Technician Performing Test: Evan & Paul

	Time (t)	Time Elapsed (min)	Hydraulic Head (h) (in)	Change (Δh) (in)	Incremental Inf. Rate (in/hr)
Presoak	0	-	12.00	-	-
	60	20	12.00	0.00	0.0
Test 1	0	-	6.00	-	-
	15	15	6.00	0.00	0.0
	30	15	6.00	0.00	0.0
	45	15	6.00	0.00	0.0
	60	15	6.00	0.00	0.0
Test 1			**Average Infiltration Rate (in./hr.) :**		**0.0**
			Steady State Infiltration Rate (in./hr.) :		**0.0**

Single Ring
Falling Head Infiltration Test
4 Inch Ring

Project: DNREC White Clay Creek **Date:** 12/12/2024
Project No.: JDH-10/24/220
Test Location: TP-5

Weather: Sunny, 35°
Depth from Top of Casing to Bottom of Boring: 10.0 ft.
Height of Casing Above Ground Surface: 3.0 ft.
Test Depth: 7.0 ft.
Test Elevation: 105.0 ft.
Casing Embedment: 3.0 in.
Tester/ Technician Performing Test: Evan & Paul

	Time (t)	Time Elapsed (min)	Hydraulic Head (h) (in)	Change (Δh) (in)	Incremental Inf. Rate
Presoak	0	-	12.00	-	-
	60	60	10.80	1.20	**N/A**
Test 1	0	-	6.00	-	-
	15	15	6.00	0.00	0.0
	30	15	6.00	0.00	0.0
	45	15	6.00	0.00	0.0
	60	15	6.00	0.00	0.0
	Test 1		**Average Infiltration Rate (in./hr.) :**		**0.0**
			Steady State Infiltration Rate (in./hr.) :		**0.0**
Test 2	0	-	6.00	-	-
	15	15	6.00	0.00	0.0
	30	15	6.00	0.00	0.0
	45	15	6.00	0.00	0.0
	60	15	6.00	0.00	0.0
	Test 2		**Average Infiltration Rate (in./hr.) :**		**0.0**
			Steady State Infiltration Rate (in./hr.) :		**0.0**

Single Ring
Falling Head Infiltration Test
4 Inch Ring

Project: DNREC White Clay Creek **Date:** 12/12/2024
Project No.: JDH-10/24/220
Test Location: TP-6

Weather: Sunny, 35°
Depth from Top of Casing to Bottom of Boring: 10.0 ft.
Height of Casing Above Ground Surface: 3.0 ft.
Test Depth: 7.0 ft.
Test Elevation: 107.0 ft.
Casing Embedment: 3.0 in.
Tester/ Technician Performing Test: Evan & Paul

	Time (t)	Time Elapsed (min)	Hydraulic Head (h) (in)	Change (Δh) (in)	Incremental Inf. Rate
Presoak	0	-	12.00	-	-
	60	60	10.80	1.20	**N/A**
Test 1	0	-	6.00	-	-
	15	15	6.00	0.00	0.0
	30	15	6.00	0.00	0.0
	45	15	6.00	0.00	0.0
	60	15	6.00	0.00	0.0
Test 1			**Average Infiltration Rate (in./hr.) :**		**0.0**
			Steady State Infiltration Rate (in./hr.) :		**0.0**

Single Ring
Falling Head Infiltration Test
12 Inch Ring

Project: DNREC White Clay Creek State Park Nature Center
Date: 12/12/2024
Project No.: JDH-10/24/220
Test Location: TP-7

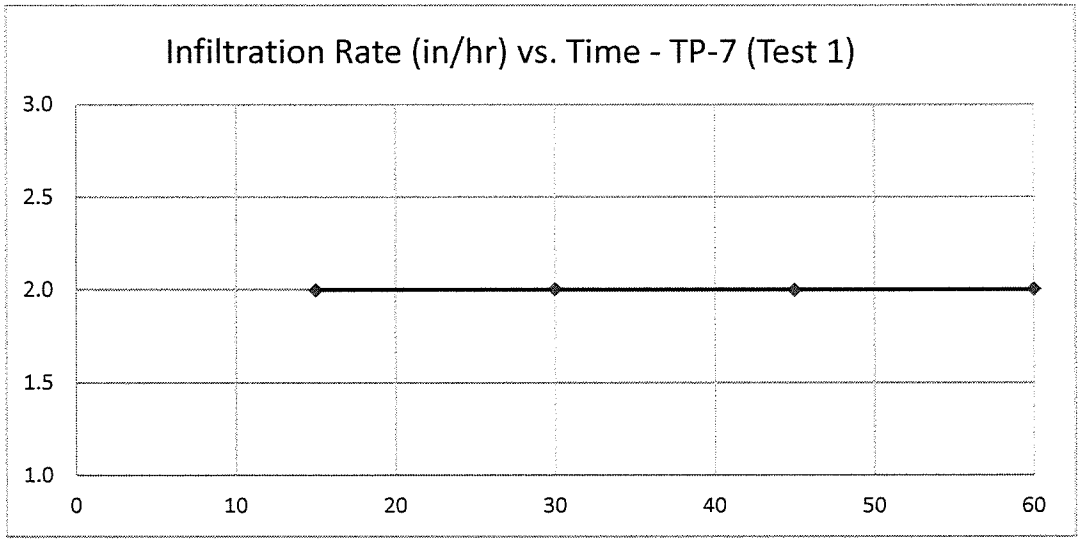
Weather: Sunny, 35
Test Depth: El. 99.5 ft.
Ring Embedment: 3 in.
Tester/ Technician Performing Test: E. Cross

	Time (t)	Time Elapsed (min)	Hydraulic Head (h) (in)	Change (Δh) (in)	Incremental Inf. Rate (in/hr)
Presoak	0	-	12.00	-	-
	60	60	4.50	7.50	7.5
Test 1	0	-	6.00	-	-
	15	15	5.50	0.50	2.0
	30	15	5.00	0.50	2.0
	45	15	4.50	0.50	2.0
	60	15	4.00	0.50	2.0
	Test 1		**Average Infiltration Rate (in./hr.) :**		**2.0**
			Steady State Infiltration Rate (in./hr.) :		**2.0**
Test 2	0	-	6.00	-	-
	15	15	5.50	0.50	2.0
	30	15	5.00	0.50	2.0
	45	15	4.50	0.50	2.0
	60	15	4.00	0.50	2.0
	Test 2		**Average Infiltration Rate (in./hr.) :**		**2.0**
			Steady State Infiltration Rate (in./hr.) :		**2.0**

DNREC White Clay

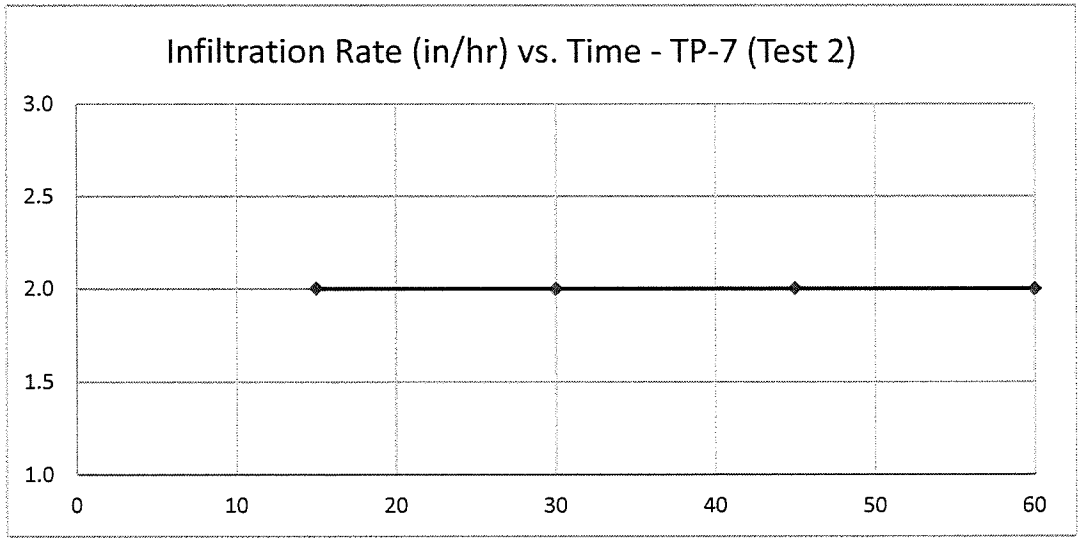
TP-7 Test 1

Interval #	Interval(min)	Cumulative Time	Rate(in/hr)
1	15	15	2.0
2	15	30	2.0
3	15	45	2.0
4	15	60	2.0

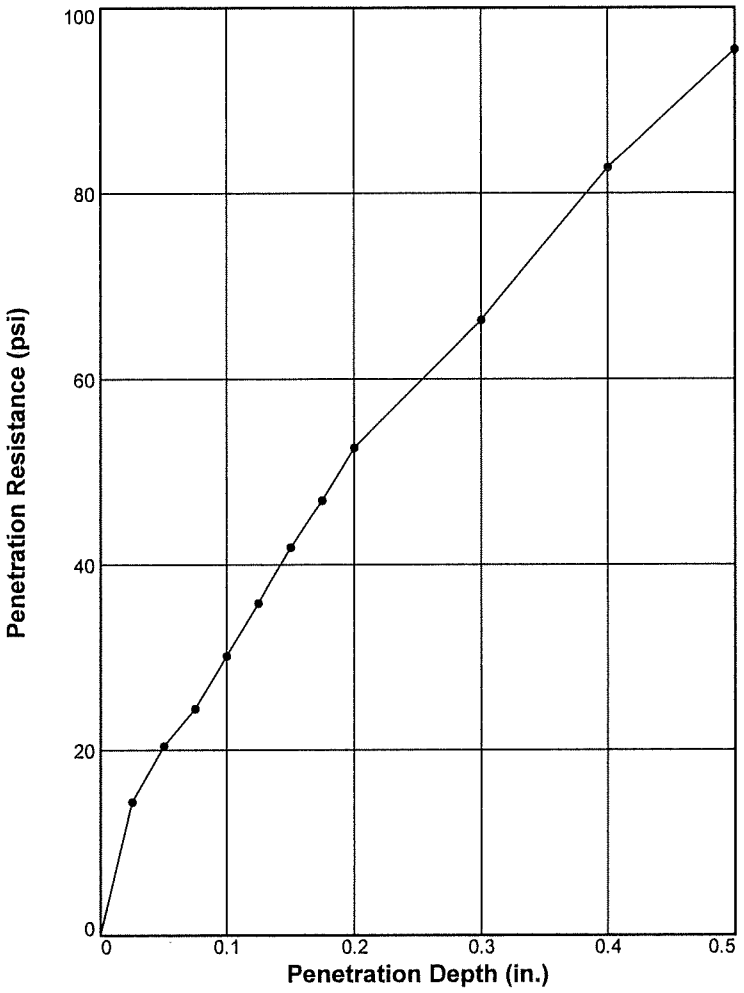


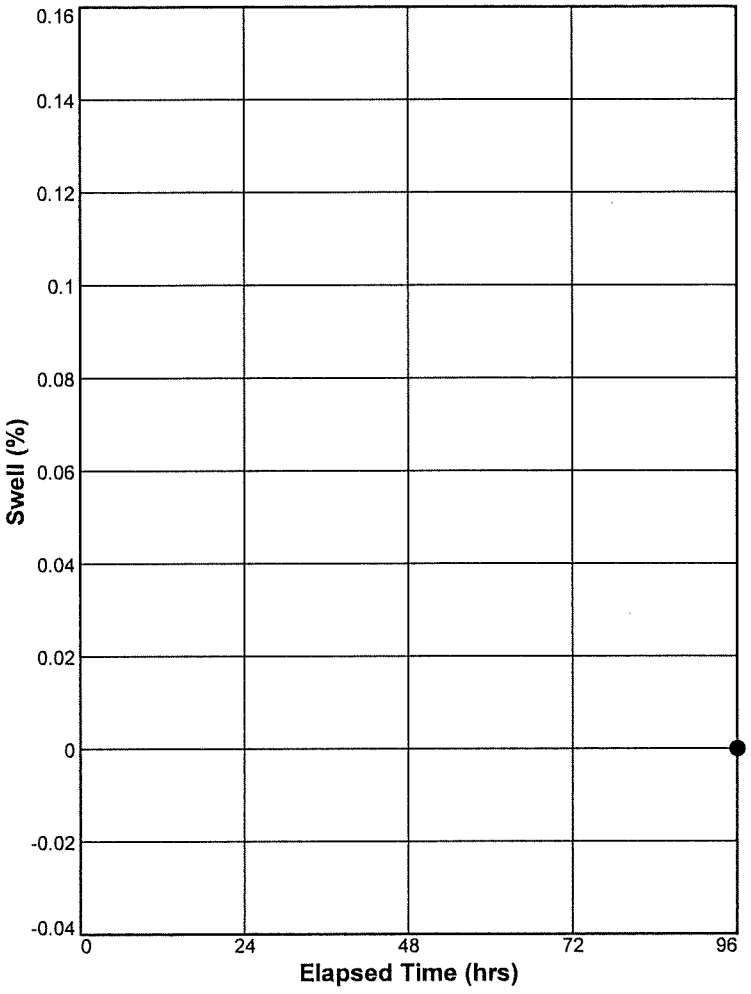
TP-7 Test 2

Interval #	Interval(min)	Cumulative Time	Rate(in/hr)
1	15	15	2.0
2	15	30	2.0
3	15	45	2.0
4	15	60	2.0



BEARING RATIO TEST REPORT
AASHTO T 193-10





	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ●	102.8	97.4	23.6	102.8	97.4	24.1	3.0	3.5	0.000	15	0
2 ▲											
3 ■											

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
Brown Clayey SILT, with trace sand (ML)	ML	105.5	17.6		

Project No: JDH-10/24/220
Project: DNREC - White Clay Creek
Location: P-3
Sample Number: 16802
Date Sampled: 11-08-2024 **Date Received:** 11-08-2024

BEARING RATIO TEST REPORT

John D. Hynes & Associates, Inc.

Test Remarks:

Figure _____

Tested By: KAZ

BEARING RATIO TESTING RESULTS
(AASHTO T 193-10)

Date Sampled: 11-08-2024 **Date Received:** 11-08-2024
Project No.: JDH-10/24/220
Project: DNREC - White Clay Creek
Location: P-3
Sample Number: 16802
Material Description: Brown Clayey SILT, with trace sand (ML)
USCS Classification: ML
Liquid Limit: **Plasticity Index:**

Test Description:
Maximum Dry Density, pcf : 105.5 **Optimum Moisture Content, %:** 17.6
Testing Remarks:

Sample 1 (56 Blows; Surcharge: 15 lbs.)

Water Content

Wt. Wet Soil+Tare, gms. 976.4 | Wt. Soil+Tare, gms. 871.3 | Wt. Tare, gms. 426.1 | Moisture, % 23.6

Unit Weight

Wt. Mold+Soil, lbs. 26.780 | Wt. Mold, lbs. 17.426 | Ht. Soil, in. 4.5 | Density, pcf 102.8

Swell Data

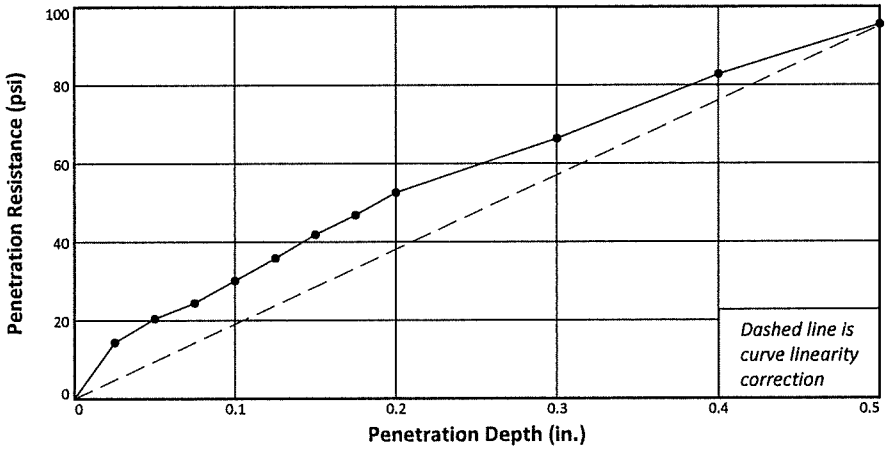
Elapsed Time, hrs.	Dial Reading in. x 1,000	Swell %
0	.3258	0.0
96	.325	0.0

Final Water Content

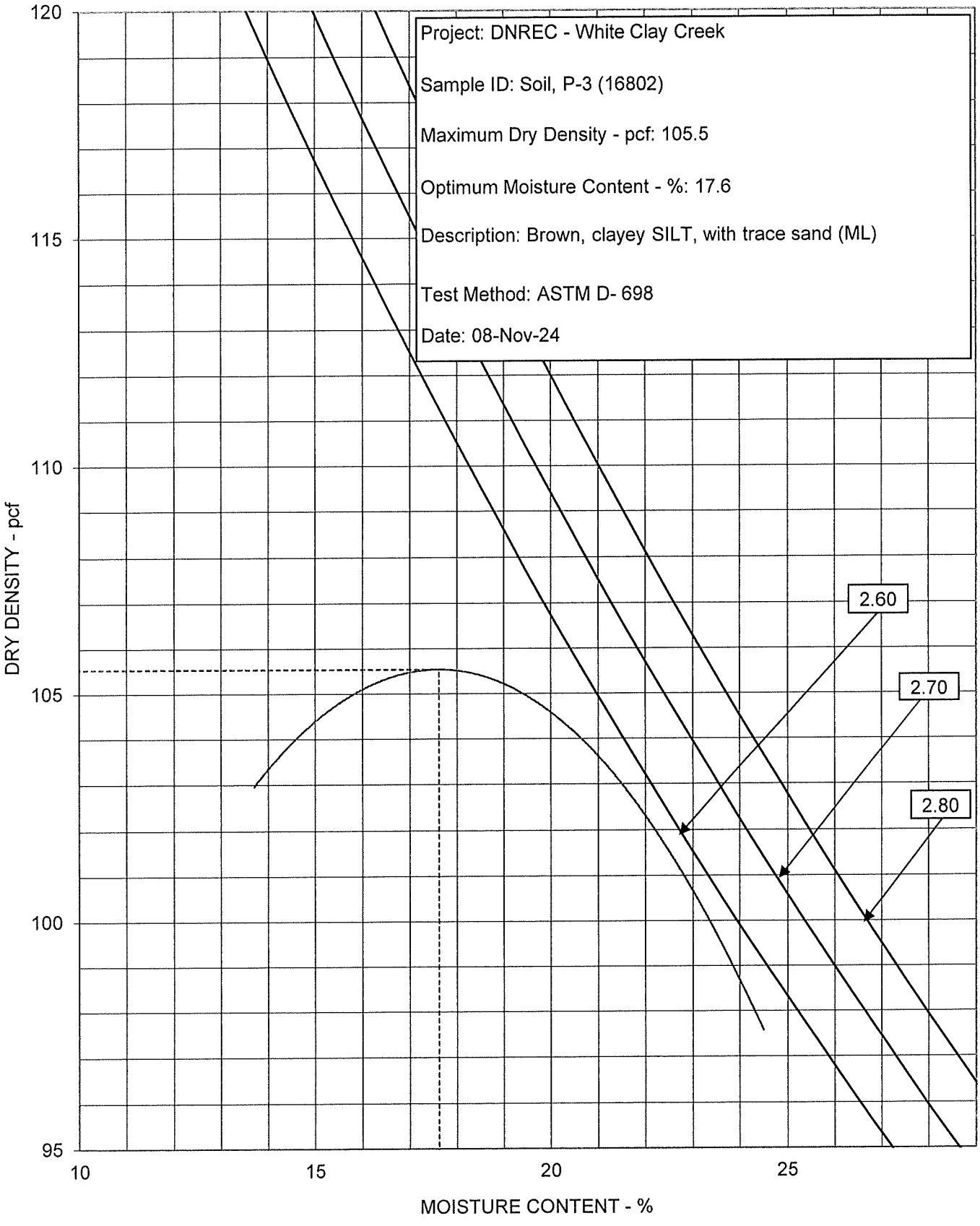
	Wt. Wet Soil+Tare, gms.	Dry Soil+Tare	Tare	Moisture, %
1)	971.5	870.5	451.9	24.1

Penetration Test Data

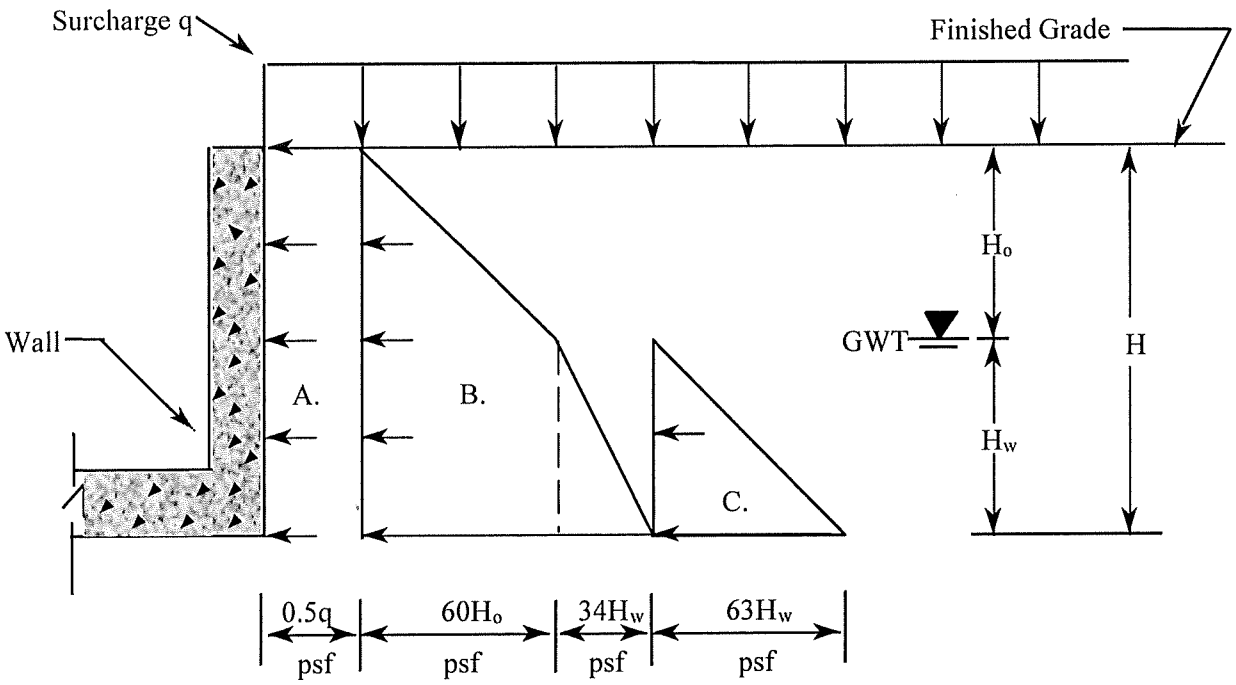
Pen. in.	Dial Reading	Stress psi	CBR %
0.0	0	0.0	
0.025	43	14.4	
0.05	61	20.4	
0.075	73	24.5	
0.1	90	30.1	3.0
0.125	107	35.8	
0.15	125	41.9	
0.175	140	46.9	
0.2	157	52.6	3.5
0.3	198	66.3	
0.4	247	82.7	
0.5	285	95.5	



John D. Hynes & Associates



EARTH PRESSURE REQUIREMENTS
FOR
BELOW GRADE WALLS (UNDRAINED)



A. Lateral Surcharge
B. Lateral Soil Pressure
C. Hydrostatic Pressure

1. Pressure diagram assumes undrained soil conditions.
2. Pressure diagram assumes at rest soil pressures on cantilevered walls or walls with one support level.
3. For backfill, use non-plastic SP or better quality material (ASTM D-2487).
4. Compact backfill in maximum 8-inch loose lifts to 92 to 95 percent maximum dry density (ASTM D-1557).
5. Use only light-duty hand operated compaction equipment within 10 feet of walls.
6. For surcharge q, consider the greater of the maximum expected construction equipment live loads or permanent structure dead and live loads.
7. For temporary retaining walls used for excavation support, use 2/3 of the above values for lateral surcharge and soil pressures. This reflects the active soil pressure condition.

HYNES

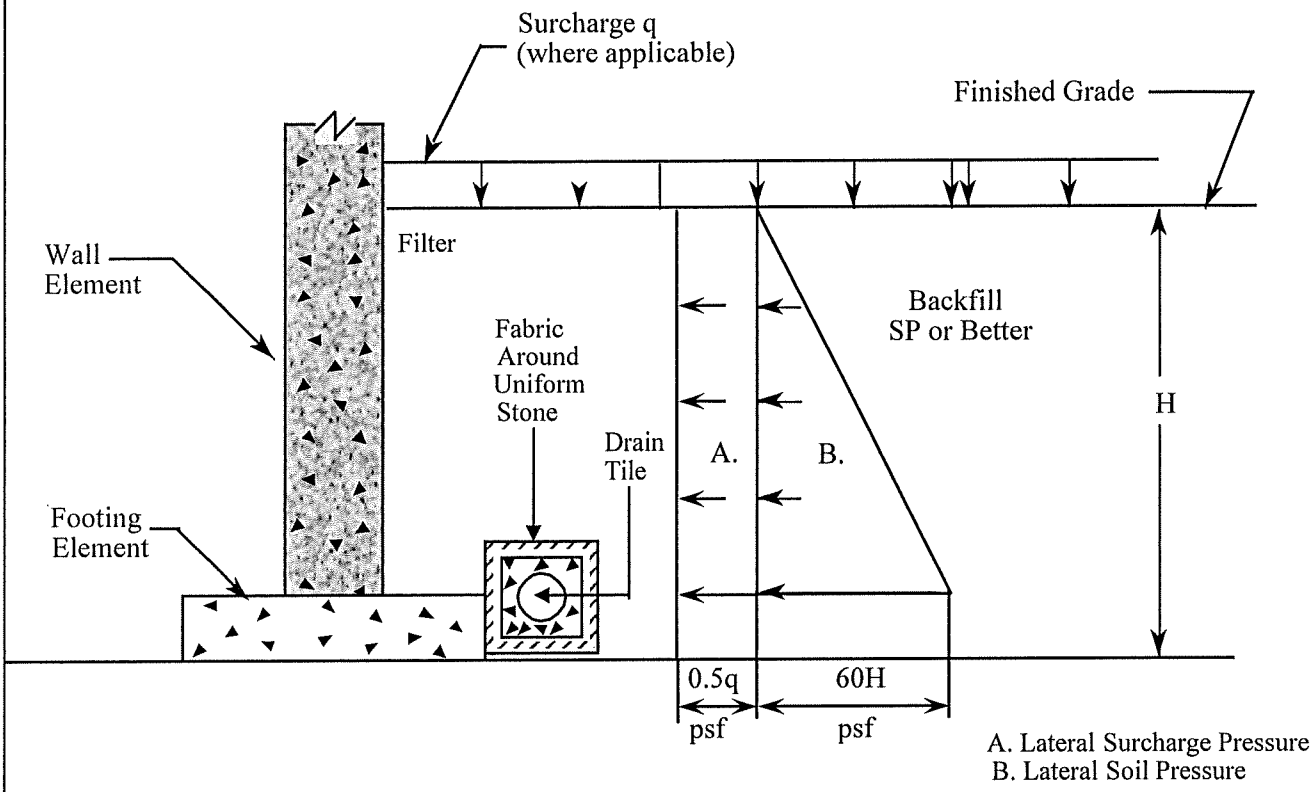
JOHN D. HYNES & ASSOCIATES, INC.
32185 Beaver Run Drive • Salisbury, Maryland 21804
410-546-6462 / Fax: 410-548-5346

Date: December 17, 2024
Scale: Not to Scale
Drawn: Hynes & Assoc.

Earth Pressure Requirements for Retaining Walls (Undrained)
DNREC-White Clay Creek State Park Nature Center
Newark, Delaware

DWG. No.
JDH-10/24/220-C

EARTH PRESSURE REQUIREMENTS
FOR
BELOW GRADE WALLS (DRAINED)



1. Pressure diagram assumes at rest soil pressures on cantilevered walls or walls with one support level.
2. Pressure diagram includes only loads resulting from backfill and surcharges.
3. This distribution assumes perimeter sub-drainage will be provided; therefore, hydrostatic pressure is not included.
4. For backfill, use SP or better quality material (ASTM D-2487).
5. Compact backfill in maximum 8-inch loose lifts to 92 to 95 percent maximum dry density (ASTM D-1557).
6. Use only light-duty hand operated compaction equipment within 10 feet of walls.
7. For surcharge q, consider the greater of the maximum expected construction equipment live loads or permanent structure dead and live loads.
8. For temporary retaining walls used for excavation support, use 2/3 of the above values for lateral surcharge and soil pressures. This reflects the active soil pressure condition.

HYNES
JOHN D. HYNES & ASSOCIATES, INC.
32185 Beaver Run Drive • Salisbury, Maryland 21804
410-546-6462 / Fax: 410-548-5346

	Date: December 19, 2024
	Scale: Not to Scale
	Drawn: Hynes & Assoc.
Earth Pressure Requirements for Below Grade Walls (Drained) DNREC-White Clay Creek State Park Nature Center Newark, Delaware	**DWG. No.** **JDH-10/24/220-D**

Single Ring
Falling Head Infiltration Test
12 Inch Ring

Project: DNREC White Clay Creek State Park Nature Center
Date: 12/12/2024
Project No.: JDH-10/24/220
Test Location: TP-1

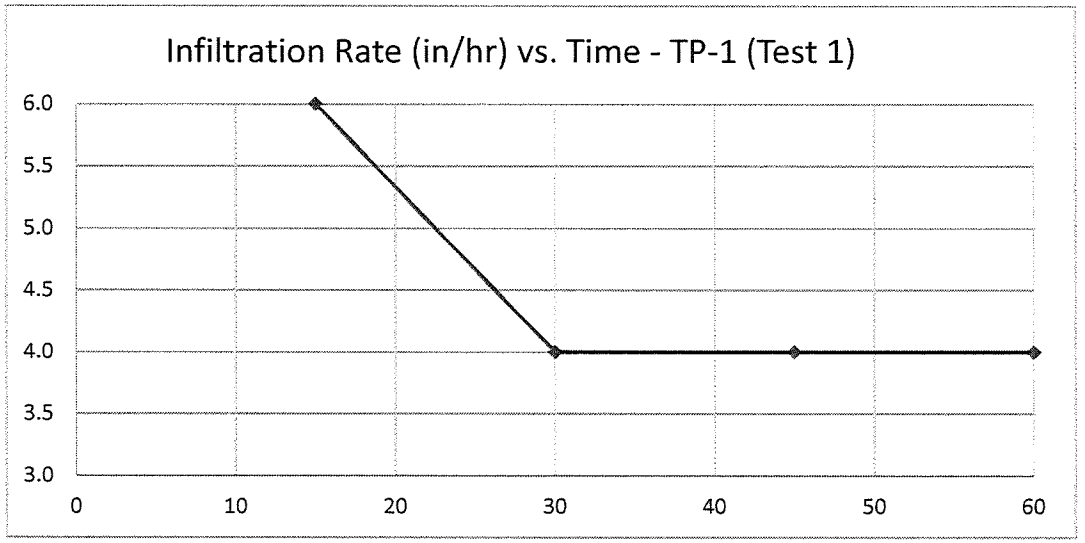
Weather: Sunny, 35
Test Depth: El. 99.5 ft.
Ring Embedment: 3 in.
Tester/ Technician Performing Test: E. Cross

	Time (t)	Time Elapsed (min)	Hydraulic Head (h) (in)	Change (Δh) (in)	Incremental Inf. Rate (in/hr)
Presoak	0	-	12.00	-	-
	60	60	4.50	7.50	7.5
Test 1	0	-	6.00	-	-
	15	15	4.50	1.50	6.0
	30	15	3.50	1.00	4.0
	45	15	2.50	1.00	4.0
	60	15	1.50	1.00	4.0
	Test 1		**Average Infiltration Rate (in./hr.) :**		**4.5**
			Steady State Infiltration Rate (in./hr.) :		**4.0**
Test 2	0	-	6.00	-	-
	15	15	4.50	1.50	6.0
	30	15	3.50	1.00	4.0
	45	15	2.50	1.00	4.0
	60	15	1.50	1.00	4.0
	Test 2		**Average Infiltration Rate (in./hr.) :**		**4.5**
			Steady State Infiltration Rate (in./hr.) :		**4.0**

DNREC White Clay

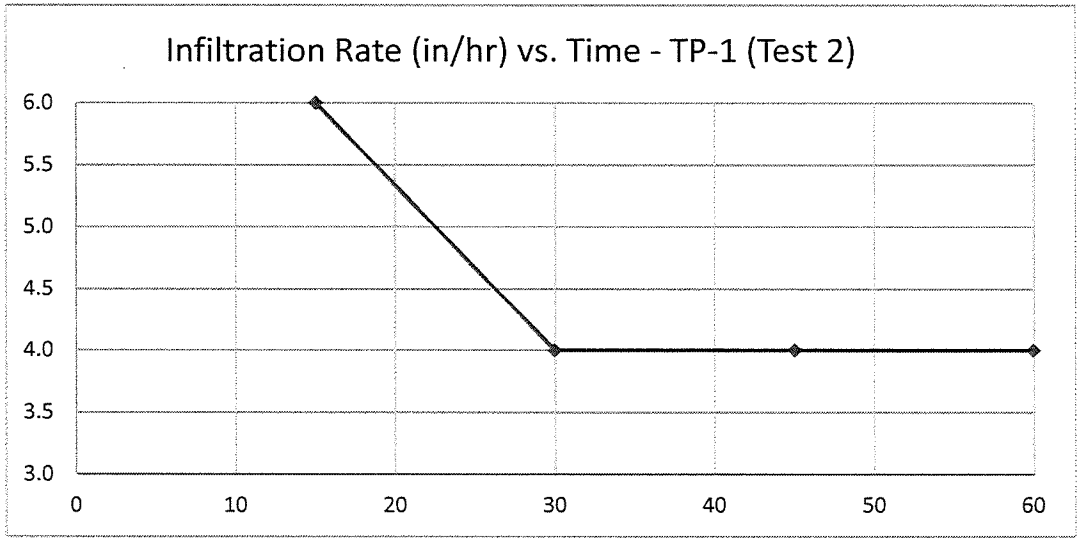
TP-1 Test 1

Interval #	Interval(min)	Cumulative Time	Rate(in/hr)
1	15	15	6.0
2	15	30	4.0
3	15	45	4.0
4	15	60	4.0



TP-1 Test 2

Interval #	Interval(min)	Cumulative Time	Rate(in/hr)
1	15	15	6.0
2	15	30	4.0
3	15	45	4.0
4	15	60	4.0



Single Ring
Falling Head Infiltration Test
12 Inch Ring

Project: DNREC White Clay Creek State Park Nature Center
Date: 12/12/2024
Project No.: JDH-10/24/220
Test Location: TP-2

Weather: Sunny, 35
Test Depth: El. 101.0 ft.
Ring Embedment: 3 in.
Tester/ Technician Performing Test: Evan & Paul

	Time (t)	Time Elapsed (min)	Hydraulic Head (h) (in)	Change (Δh) (in)	Incremental Inf. Rate (in/hr)
Presoak	0	-	12.00	-	-
	60	20	12.00	0.00	0.0
Test 1	0	-	6.00	-	-
	15	15	6.00	0.00	0.0
	30	15	6.00	0.00	0.0
	45	15	6.00	0.00	0.0
	60	15	6.00	0.00	0.0
	Test 1		Average Infiltration Rate (in./hr.) :		0.0
			Steady State Infiltration Rate (in./hr.) :		0.0

Single Ring
Falling Head Infiltration Test
4 Inch Ring

Project: DNREC White Clay Creek **Date:** 12/12/2024
Project No.: JDH-10/24/220
Test Location: TP-3

Weather: Sunny, 35°
Depth from Top of Casing to Bottom of Boring: 10.0 ft.
Height of Casing Above Ground Surface: 3.0 ft.
Test Depth: 7.0 ft.
Test Elevation: 101.5 ft.
Casing Embedment: 3.0 in.
Tester/ Technician Performing Test: Evan & Paul

	Time (t)	Time Elapsed (min)	Hydraulic Head (h) (in)	Change (Δh) (in)	Incremental Inf. Rate
Presoak	0	-	12.00	-	-
	60	60	12.00	0.00	**N/A**
Test 1	0	-	6.00	-	-
	15	15	6.00	0.00	0.0
	30	15	6.00	0.00	0.0
	45	15	6.00	0.00	0.0
	60	15	6.00	0.00	0.0
Test 1			**Average Infiltration Rate (in./hr.) :**		**0.0**
			Steady State Infiltration Rate (in./hr.) :		**0.0**

Single Ring
Falling Head Infiltration Test
12 Inch Ring

Project: DNREC White Clay Creek State Park Nature Center
Date: 12/12/2024
Project No.: JDH-10/24/220
Test Location: TP-4

Weather: Sunny, 35
Test Depth: El. 103.0 ft.
Ring Embedment: 3 in.
Tester/ Technician Performing Test: Evan & Paul

	Time (t)	Time Elapsed (min)	Hydraulic Head (h) (in)	Change (Δh) (in)	Incremental Inf. Rate (in/hr)
Presoak	0	-	12.00	-	-
	60	20	12.00	0.00	0.0
Test 1	0	-	6.00	-	-
	15	15	6.00	0.00	0.0
	30	15	6.00	0.00	0.0
	45	15	6.00	0.00	0.0
	60	15	6.00	0.00	0.0
Test 1			**Average Infiltration Rate (in./hr.) :**		**0.0**
			Steady State Infiltration Rate (in./hr.) :		**0.0**

Single Ring
Falling Head Infiltration Test
4 Inch Ring

Project: DNREC White Clay Creek **Date:** 12/12/2024
Project No.: JDH-10/24/220
Test Location: TP-5

Weather: Sunny, 35°
Depth from Top of Casing to Bottom of Boring: 10.0 ft.
Height of Casing Above Ground Surface: 3.0 ft.
Test Depth: 7.0 ft.
Test Elevation: 105.0 ft.
Casing Embedment: 3.0 in.
Tester/ Technician Performing Test: Evan & Paul

	Time (t)	Time Elapsed (min)	Hydraulic Head (h) (in)	Change (Δh) (in)	Incremental Inf. Rate
Presoak	0	-	12.00	-	-
	60	60	10.80	1.20	**N/A**
Test 1	0	-	6.00	-	-
	15	15	6.00	0.00	0.0
	30	15	6.00	0.00	0.0
	45	15	6.00	0.00	0.0
	60	15	6.00	0.00	0.0
	Test 1		**Average Infiltration Rate (in./hr.) :**		**0.0**
			Steady State Infiltration Rate (in./hr.) :		**0.0**
Test 2	0	-	6.00	-	-
	15	15	6.00	0.00	0.0
	30	15	6.00	0.00	0.0
	45	15	6.00	0.00	0.0
	60	15	6.00	0.00	0.0
	Test 2		**Average Infiltration Rate (in./hr.) :**		**0.0**
			Steady State Infiltration Rate (in./hr.) :		**0.0**

Single Ring
Falling Head Infiltration Test
4 Inch Ring

Project: DNREC White Clay Creek **Date:** 12/12/2024
Project No.: JDH-10/24/220
Test Location: TP-6

Weather: Sunny, 35°
Depth from Top of Casing to Bottom of Boring: 10.0 ft.
Height of Casing Above Ground Surface: 3.0 ft.
Test Depth: 7.0 ft.
Test Elevation: 107.0 ft.
Casing Embedment: 3.0 in.
Tester/ Technician Performing Test: Evan & Paul

	Time (t)	Time Elapsed (min)	Hydraulic Head (h) (in)	Change (Δh) (in)	Incremental Inf. Rate
Presoak	0	-	12.00	-	-
	60	60	10.80	1.20	**N/A**
Test 1	0	-	6.00	-	-
	15	15	6.00	0.00	0.0
	30	15	6.00	0.00	0.0
	45	15	6.00	0.00	0.0
	60	15	6.00	0.00	0.0
Test 1			**Average Infiltration Rate (in./hr.) :**		**0.0**
			Steady State Infiltration Rate (in./hr.) :		**0.0**

Single Ring
Falling Head Infiltration Test
12 Inch Ring

Project: DNREC White Clay Creek State Park Nature Center
Date: 12/12/2024
Project No.: JDH-10/24/220
Test Location: TP-7

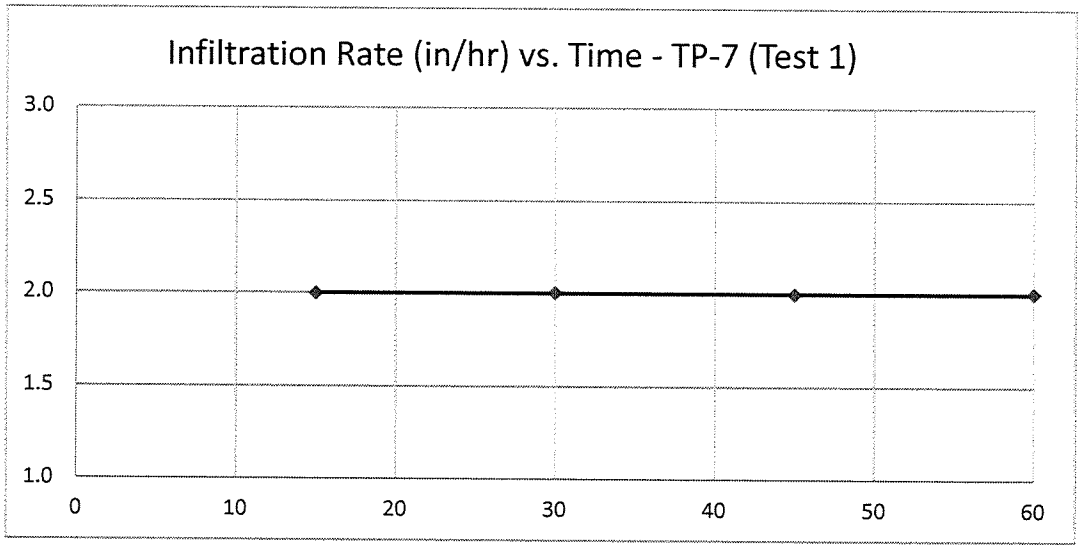
Weather: Sunny, 35
Test Depth: El. 99.5 ft.
Ring Embedment: 3 in.
Tester/ Technician Performing Test: E. Cross

	Time (t)	Time Elapsed (min)	Hydraulic Head (h) (in)	Change (Δh) (in)	Incremental Inf. Rate (in/hr)
Presoak	0	-	12.00	-	-
	60	60	4.50	7.50	7.5
Test 1	0	-	6.00	-	-
	15	15	5.50	0.50	2.0
	30	15	5.00	0.50	2.0
	45	15	4.50	0.50	2.0
	60	15	4.00	0.50	2.0
	Test 1		Average Infiltration Rate (in./hr.) :		2.0
			Steady State Infiltration Rate (in./hr.) :		2.0
Test 2	0	-	6.00	-	-
	15	15	5.50	0.50	2.0
	30	15	5.00	0.50	2.0
	45	15	4.50	0.50	2.0
	60	15	4.00	0.50	2.0
	Test 2		Average Infiltration Rate (in./hr.) :		2.0
			Steady State Infiltration Rate (in./hr.) :		2.0

DNREC White Clay

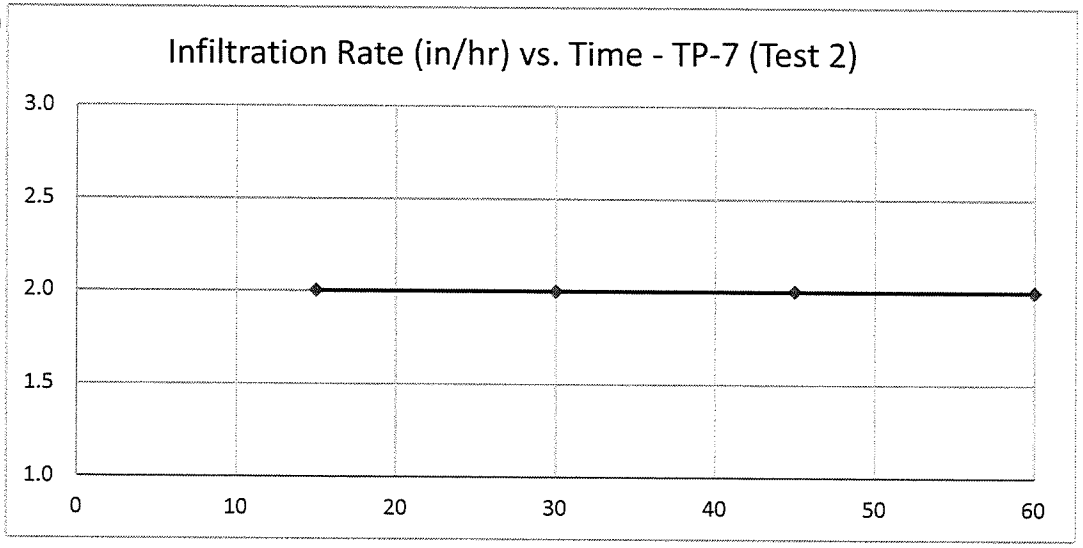
TP-7 Test 1

Interval #	Interval(min)	Cumulative Time	Rate(in/hr)
1	15	15	2.0
2	15	30	2.0
3	15	45	2.0
4	15	60	2.0



TP-7 Test 2

Interval #	Interval(min)	Cumulative Time	Rate(in/hr)
1	15	15	2.0
2	15	30	2.0
3	15	45	2.0
4	15	60	2.0



Falling Head
Single Ring Infiltration Test
(Delaware)
4 inch (cased borehole)

Tools and Supplies:

- ☐ 50 gallons of clean water per test
- ☐
- ☐ One 4 inch ring per test
- ☐ Well Sand
- ☐ Shovels Flat/Round
- ☐ Hand Rake
- ☐ Sledge Hammer
- ☐ Driving Block and Cap
- ☐ Purge Pump, tubing, and buckets
- ☐ Battery
- ☐ Mini Excavator – Rental (pits deeper than 2 feet)
- ☐ Gator/ATV (as necessary
- ☐ Hand Auger (with extensions)
- ☐ 4 inch thin wall PVC (at least one foot longer than test depth)

Note: 1 test period equals 1 hour max. or until water empties out of ring, or until infiltration rate equilibrates. Total cumulative time for all tests (after presoak) must be 2 hrs or more. Contact Project manager with questions about testing. **Be prepared to run 2 to 7 tests per location.**

Procedure:

A. Set up ring (permeameter)/Pre-soak

1. Advance a 5-inch diameter soil boring to the specified test depth. Check boring log to ensure that soil at bottom of excavation is soil type to be tested.
2. Cut thin wall PVC to length (approximately 1 to 2' longer than desired test depth).
3. If necessary, use 3-inch auger to clean out bottom of test hole to remove any soils that caved in during PVC placement. Drive PVC casing an additional 2" to ensure that bottom of test hole does not extend beyond the bottom of the PVC pipe.
4. Collect initial test information using water level indicator or tape measure.
5. Determine the total depth to the bottom of the hole from top of pipe and record.
6. Determine riser height above ground and record.
7. Fill ring with approximately **12** inches of water. Be careful not to erode soil at bottom
8. ****Contact project manager after pre-soak with infiltration data.****

B. Run Test (2 to 7 test periods)

1. Readings should be no greater than 15 minutes apart. Reading interval to be based on pre-soak data. See attached data sheet.
2. For each test period, fill ring with 6 inches of water.
3. After pre-soak, run min. of 2 test periods, depending on test data. **Unless the ring runs dry in less than 10 minutes, we should collect 0.5 to 2 hours of data (after pre-soak).** That means you will be running 2 to 7 tests per location. Call project manager after 2nd test period to determine if additional test periods are necessary. **Contact Project Manager after 2 test periods**. Have infiltration data readily available.

Falling Head
Single Ring Infiltration Test
(Delaware)
4 inch (cased borehole)

4. Test period can be terminated after 1 hour if four successive readings (water level drops) during a test period vary by ¼ inch or less (between the highest and lowest level drops) for rates greater than 2 in/hr., or vary by 1/8 inch for rates less than 2 in/hr. Note that test periods can run longer than 1 hour. Contact Project Manager if the water level changes don't meet the listed criteria after 1 hour of testing.
5. If ring runs dry in less than 10 minutes, contact project manager.

Example Readings:

Time	Change in Time	Water Level	Level Change
1:00	N/A	6 in	N/A
1:15	15 min	4.75	**1.25** *(6-4.75)*
1:30	15 min	3.625	**1.125** *(4.75-3.625)*
1:45	15 min	2.625	**1** *(3.625-2.625)*
2:00	15 min	1.625	**1** *(2.625-1.625)*

The difference between the greatest Level Change (1.25) and the least Level Change (1.00) is 0.25 (1.25 - 1.00 = 0.25). These readings meet the test criteria since the infiltration rate was more than 2 inches per hour, so the test period can be stopped.

Time	Change in Time	Water Level	Level Change
1:00	N/A	6 in	N/A
1:15	15 min	5.625	**0.375** *(6-5.625)*
1:30	15 min	5.375	**0.25** *(5.625-5.375)*
1:45	15 min	5.25	**0.125** *(5.375-5.25)*
2:00	15 min	5.125	**0.125** *(5.25-5.125)*

The difference between the greatest Level Change (0.375) and the least Level Change (0.125) is 0.25 (0.375 – 0.125 = 0.25). These readings **do not** meet the test criteria since the infiltration rate was less than 2 inches per hour, and the difference was more than 1/8 inch (0.125), so the test must continue.

Falling Head
Single Ring Infiltration Test
(Delaware)
4 inch (cased borehole)

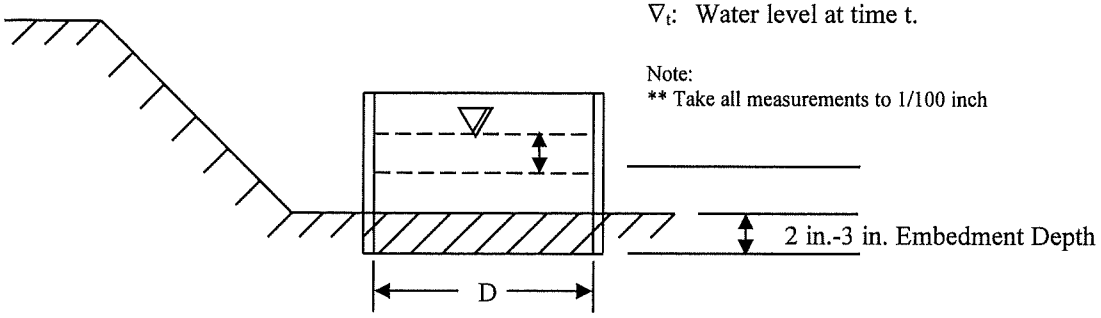
D: Diameter of Ring.

∇: Water level in infiltration Ring or Casing.

∇_i: Water level at time t=0.

∇_t: Water level at time t.

Note:
** Take all measurements to 1/100 inch



Falling Head
Single Ring Infiltration Test
(Delaware)
12 inch

Tools and Supplies:

- ☐ 50 gallons of clean water per test
- ☐
- ☐ One 12 inch (or 4 inch) ring per test
- ☐ Well Sand
- ☐ Shovels Flat/Round
- ☐ Hand Rake
- ☐ Sledge Hammer
- ☐ Driving Block and Cap
- ☐ Purge Pump, tubing, and buckets
- ☐ Battery
- ☐ Mini Excavator – Rental (pits deeper than 2 feet)
- ☐ Gator/ATV (as necessary
- ☐ Hand Auger (with extensions)
- ☐ 4 inch thin wall PVC (at least one foot longer than test depth)

Note: 1 test period equals 1 hour max. or until water empties out of ring, or until infiltration rate equilibrates. Total cumulative time for all tests (after presoak) must be 2 hrs or more. Contact Project manager with questions about testing. **Be prepared to run 2 to 7 tests per location**.

Procedure:

A. Excavate test pit to specified test depth. Test pit should be sloped or benched in accordance with OSHA standards. (For safety two people will be onsite for tests deeper than 4 feet).

B. Use Flat point shovel or trowel to grade bottom of test pit. Bottom of excavation should be flat but not compacted.

C. Set up ring (permeameter)/Pre-soak

1. Set ring at bottom of excavation.
2. Using driving block drive (ring) approximately 2-3 inches into the ground.
3. Lightly tamp disturbed soil along inside and outside edges of ring. **Do not compact soil at the bottom of the hole.**
4. Use hand rake to scarify soils within test ring.
5. Use ½ water filled ziplock bag or sand filled nylons to prevent scouring. Remove bag after filling…..sand filled nylons do not need to be removed.
6. Fill ring with approximately 12 inches of water. Be careful not to erode soil at bottom. Use removable shield/deflector as necessary.
7. Measure using tape measure distance from top of ring to to water surface. You may also use water level indicator device.
8. Monitor water drop every 15 minutes for 1 hour or until ring runs dry (whichever occurs first).
9. ****Contact project manager after pre-soak with infiltration data.****

D. Run Test (2 to 7 test periods)

1. Readings should be no greater than 15 minutes apart. Reading interval to be based on pre-soak data. See attached data sheet.

Falling Head
Single Ring Infiltration Test
(Delaware)
12 inch

2. For each test period, fill ring with 6 inches of water.
3. After pre-soak, run min. of 2 test periods, depending on test data. **Unless the ring runs dry in less than 10 minutes, we should collect 1 to 2 hours of data (after pre-soak).** That means you will be running 2 to 12 tests per location. Call project manager after 2nd test period to determine if additional test periods are necessary. **Contact Project Manager after 2 test periods**. Have infiltration data readily available.
4. Test period can be terminated after 1 hour if four successive readings (water level drops) during a test period vary by ¼ inch or less (between the highest and lowest level drops) for rates greater than 2 in/hr., or vary by 1/8 inch for rates less than 2 in/hr. Note that test periods can run longer than 1 hour. Contact Project Manager if the water level changes don't meet the listed criteria after 1 hour of testing.
5. If ring runs dry in less than 10 minutes, contact project manager.

Example Readings:

Time	Change in Time	Water Level	Level Change
1:00	N/A	6 in	N/A
1:15	15 min	4.75	**1.25** *(6-4.75)*
1:30	15 min	3.625	**1.125** *(4.75-3.625)*
1:45	15 min	2.625	**1** *(3.625-2.625)*
2:00	15 min	1.625	**1** *(2.625-1.625)*

The difference between the greatest Level Change (1.25) and the least Level Change (1.00) is 0.25 (1.25 - 1.00 = 0.25). These readings meet the test criteria since the infiltration rate was more than 2 inches per hour, so the test period can be stopped.

Time	Change in Time	Water Level	Level Change
1:00	N/A	6 in	N/A
1:15	15 min	5.625	**0.375** *(6-5.625)*
1:30	15 min	5.375	**0.25** *(5.625-5.375)*
1:45	15 min	5.25	**0.125** *(5.375-5.25)*
2:00	15 min	5.125	**0.125** *(5.25-5.125)*

The difference between the greatest Level Change (0.375) and the least Level Change (0.125) is 0.25 (0.375 – 0.125 = 0.25). These readings **do not** meet the test criteria since the infiltration rate was less than 2 inches per hour, and the difference was more than 1/8 inch (0.125), so the test must continue.

Falling Head
Single Ring Infiltration Test
(Delaware)
12 inch

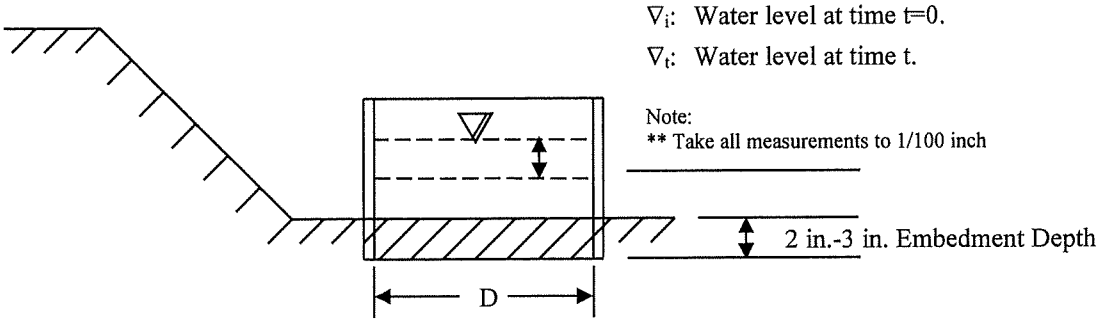
D: Diameter of Ring.

H_c: Distance from bottom of Drop Tube to Soil.

∇: Water level in infiltration Ring.

∇_i: Water level at time t=0.

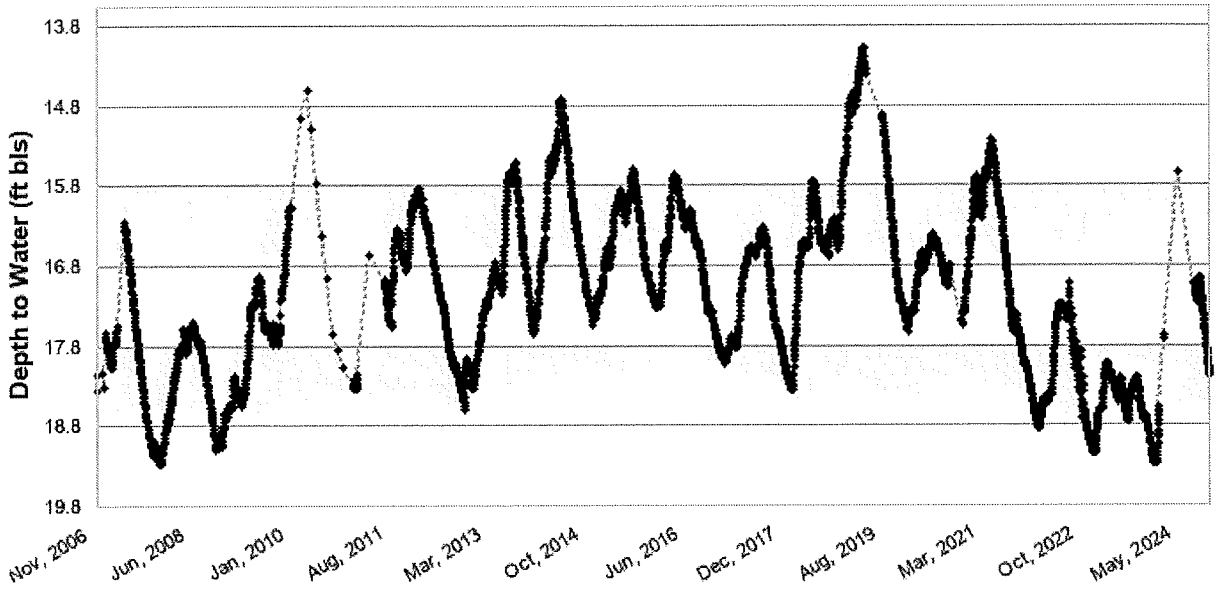
∇_t: Water level at time t.



Note:
** Take all measurements to 1/100 inch

Delaware Geological Survey

DGS Well ID Ca55-204



Created on: December 15, 2024, 6:37 pm

Ca55-204, Note: DM=Daily Mean Waterlevel; DEST=Estimated DM water level
Water levels reported in feet below land surface datum
Created on 12-14-2024 by Delaware Geological Survey (http://www.dgs.udel.edu)
DATE_MEASURED, TIME, WATER_LEVEL
11/29/2006,1130,18.36
11/30/2006,1130,18.16
01/03/2007,1430,18.14
01/11/2007,1310,18.32
01/17/2007,DM,17.64
01/18/2007,DM,17.63
01/19/2007,DM,17.63
01/20/2007,DM,17.67
01/21/2007,DM,17.69
01/22/2007,DM,17.69
01/23/2007,DM,17.73
01/24/2007,DM,17.74
01/25/2007,DM,17.75
01/26/2007,DM,17.76
01/27/2007,DM,17.77
01/28/2007,DM,17.78
01/29/2007,DM,17.80
01/30/2007,DM,17.81
01/31/2007,DM,17.83
02/01/2007,DM,17.84
02/02/2007,DM,17.85
02/03/2007,DM,17.87
02/04/2007,DM,17.87
02/05/2007,DM,17.88
02/06/2007,DM,17.89
02/07/2007,DM,17.90
02/08/2007,DM,17.92
02/09/2007,DM,17.95
02/10/2007,DM,17.96
02/12/2007,DM,18.00
02/13/2007,DM,18.00
02/14/2007,DM,17.99
02/15/2007,DM,18.01
02/16/2007,DM,18.02
02/17/2007,DM,18.04
02/18/2007,DM,18.06
02/19/2007,DM,18.04
02/20/2007,DM,18.05
02/21/2007,DM,18.08
02/22/2007,DM,18.05
02/23/2007,DM,18.05
02/24/2007,DM,18.03
02/25/2007,DM,18.01
02/26/2007,DM,18.03
02/27/2007,DM,18.07
02/28/2007,DM,18.02
03/01/2007,DM,17.98
03/02/2007,DM,17.95
03/03/2007,DM,17.91
03/04/2007,DM,17.88
03/05/2007,DM,17.84
03/06/2007,DM,17.83
03/07/2007,DM,17.80
03/08/2007,DM,17.78
03/09/2007,DM,17.78
03/10/2007,DM,17.78
03/11/2007,DM,17.80
03/12/2007,DM,17.79
03/13/2007,DM,17.78
03/14/2007,DM,17.77

```
12/11/2023,DM,19.24
12/12/2023,DM,19.22
12/13/2023,DM,19.18
12/14/2023,DM,19.14
12/15/2023,DM,19.10
12/16/2023,DM,19.07
12/17/2023,DM,19.03
12/18/2023,DM,18.95
12/19/2023,DM,18.93
12/20/2023,DM,18.87
12/21/2023,DM,18.80
12/22/2023,DM,18.74
12/23/2023,DM,18.69
12/24/2023,DM,18.64
12/25/2023,DM,18.61
12/26/2023,DM,18.58
01/17/2024,0856,17.71
01/17/2024,1326,17.68
01/18/2024,1246,17.67
04/09/2024,1140,15.65
07/17/2024,1519,17.05
07/18/2024,DM,17.03
07/19/2024,DM,17.04
07/20/2024,DM,17.05
07/21/2024,DM,17.06
07/22/2024,DM,17.07
07/23/2024,DM,17.09
07/24/2024,DM,17.11
07/25/2024,DM,17.12
07/26/2024,DM,17.14
07/27/2024,DM,17.16
07/28/2024,DM,17.17
07/29/2024,DM,17.19
07/30/2024,DM,17.20
07/31/2024,DM,17.22
08/01/2024,DM,17.24
08/02/2024,DM,17.26
08/03/2024,DM,17.25
08/04/2024,DM,17.21
08/05/2024,DM,17.23
08/06/2024,DM,17.24
08/07/2024,DM,17.25
08/08/2024,DM,17.25
08/09/2024,DM,17.18
08/10/2024,DM,17.11
08/11/2024,DM,17.06
08/12/2024,DM,17.02
08/13/2024,DM,16.99
08/14/2024,DM,16.97
08/15/2024,DM,16.96
08/16/2024,DM,16.96
08/17/2024,DM,16.95
08/18/2024,DM,16.95
08/19/2024,DM,16.95
08/20/2024,DM,16.98
08/21/2024,DM,17.01
08/22/2024,DM,17.04
08/23/2024,DM,17.07
08/24/2024,DM,17.09
08/25/2024,DM,17.11
08/26/2024,DM,17.12
08/27/2024,DM,17.14
08/28/2024,DM,17.16
08/29/2024,DM,17.19
08/30/2024,DM,17.22
```

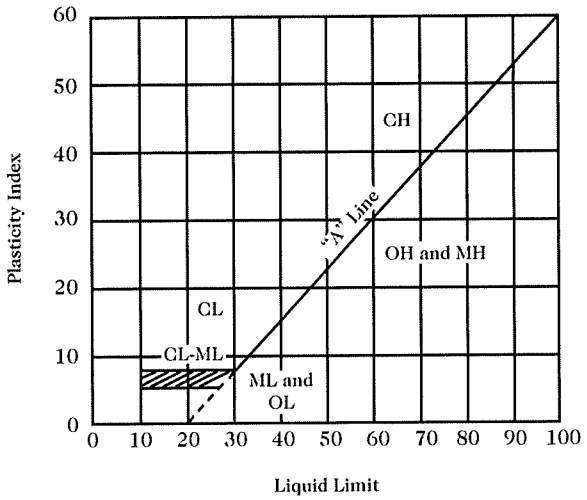
```
08/31/2024,DM,17.23
09/01/2024,DM,17.24
09/02/2024,DM,17.27
09/03/2024,DM,17.31
09/04/2024,DM,17.33
09/05/2024,DM,17.35
09/06/2024,DM,17.36
09/07/2024,DM,17.37
09/08/2024,DM,17.40
09/09/2024,DM,17.42
09/10/2024,DM,17.44
09/11/2024,DM,17.47
09/12/2024,DM,17.49
09/13/2024,DM,17.51
09/14/2024,DM,17.54
09/15/2024,DM,17.56
09/16/2024,DM,17.58
09/17/2024,DM,17.60
09/18/2024,DM,17.62
09/19/2024,DM,17.63
09/20/2024,DM,17.66
09/21/2024,DM,17.68
09/22/2024,DM,17.71
09/23/2024,DM,17.73
09/24/2024,DM,17.75
09/25/2024,DM,17.78
09/26/2024,DM,17.79
09/27/2024,DM,17.81
09/28/2024,DM,17.83
09/29/2024,DM,17.86
09/30/2024,DM,17.88
10/01/2024,DM,17.90
10/02/2024,DM,17.92
10/03/2024,DM,17.95
10/04/2024,DM,17.97
10/05/2024,DM,17.99
10/06/2024,DM,18.01
10/07/2024,DM,18.03
10/08/2024,DM,18.05
10/09/2024,DM,18.07
10/10/2024,DM,18.10
10/11/2024,DM,18.12
10/12/2024,DM,18.14
10/13/2024,DM,18.15
10/14/2024,1058,18.17
```

JOHN D. HYNES & ASSOCIATES, INC.

Geotechnical and Environmental Consultants
Monitoring Well Installation
Construction Inspection and Materials Testing

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions			*Group Symbols*	*Typical Names*	*Laboratory Classification Criteria*		
Coarse-grained soils (More than half of material is larger than No 200 sieve size)	Gravels (More than half of coarse fraction is larger than No 4 sieve size)	Clean gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No 200 sieve size), coarse grained soils are classified as follows: Less than 5 percent: GW, GP, SW, SP. More than 12 percent: GM, GC, SM, SC. 5 to 12 percent: *Borderline cases requiring dual symbols*[c]	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			GP	Poorly graded gravels, gravel sand mixtures, little or no fines		Not meeting all graduation requirements for GW	
		Gravels with fines (Appreciable amount of fines)	GM[a] d / u	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7	
	Sands (More than half of coarse fraction is smaller than No 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands,		$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			SP	Poorly graded sands, gravelly sands, little or no fines		Not meeting all graduation requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM[a] d / u	Silty sands, sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols.
			SC	Clayey sands, sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7	
Fine-grained soils (More than half material is smaller than No 200 sieve)	Silts and clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity			
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
			OL	Organic silts and organic silty clays of low plasticity			
	Silts and clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts			
			CH	Inorganic clays of high plasticity, fat clays			
			OH	Organic clays of medium to high plasticity, organic silts			
	Highly organic soils		Pt	Peat and other highly organic soils			



32185 Beaver Run Drive • Salisbury, Maryland 21804 • 410-546-6462 • Fax 410-548-5346
E-mail - jdh@jdhynesinc.com

HYNES

FIELD CLASSIFICATION SYSTEM FOR SOIL EXPLORATION

NON-COHESIVE SOILS
(Silt, Sand, Gravel and Combinations)

DENSITY

Very Loose	- 5 blows/ft. or less
Loose	- 6 to 10 blows/ft.
Medium Dense	- 11 to 30 blows/ft.
Dense	- 31 to 50 blows/ft.
Very Dense	- 51 blows/ft. or more

RELATIVE PROPORTIONS

Descriptive Term	Percent
Trace	1 - 10
Little	11 - 20
Some	21 - 35
And	36 - 50

PARTICLE SIZE IDENTIFICATION

Boulders	- 8 inch diameter or more
Cobbles	- 3 to 8 inch diameter
Gravel	- Coarse - 1 to 3 inch
	- Medium - 1/2 to 1 inch
	- Fine - 4.75 mm to 1/2 inch
Sand	- Coarse - 2.0 mm to 4.75 mm
	- Medium - 0.425 mm to 2.0 mm
	- Fine - 0.075 mm to 0.425 mm
Silt	- 0.075 mm to 0.002 mm

COHESIVE SOILS
(Clay, Silt and Combinations)

CONSISTENCY

Very Soft	- 3 blows/ft. or less
Soft	- 4 to 5 blows/ft.
Medium Stiff	- 6 to 10 blows/ft.
Stiff	- 11 to 15 blows/ft.
Very Stiff	- 16 to 30 blows/ft.
Hard	- 31 blows/ft. or more

PLASTICITY

Degree of Plasticity	Plasticity Index
None to Slight	0 - 4
Slight	5 - 7
Medium	8 - 22
High to Very High	over 22

Classification on logs are made by visual inspection of samples unless a sample has been subjected to laboratory classification testing.

Standard Penetration Test - Driving a 2.0" O.D., 1-3/8" I.D., splitspoon sampler a distance of 1.0 foot into undisturbed soil with a 140 pound hammer free falling a distance of 30.0 inches. It is customary to drive the spoon 6 inches to seat into undisturbed soil, then perform the test. The number of hammer blows for seating the spoon and making the test are recorded for each 6 inches of penetration on the drill log (Example - 6/8/9). The standard penetration test value (N - value) can be obtained by adding the last two figures (i.e. 8 + 9 = 17 blows/ft.). (ASTM D-1586)

Strata Changes - In the column "Soil Descriptions," on the drill log, the horizontal lines represent strata changes. A solid line (—) represents an actually observed change, a dashed line (----) represents an estimated change.

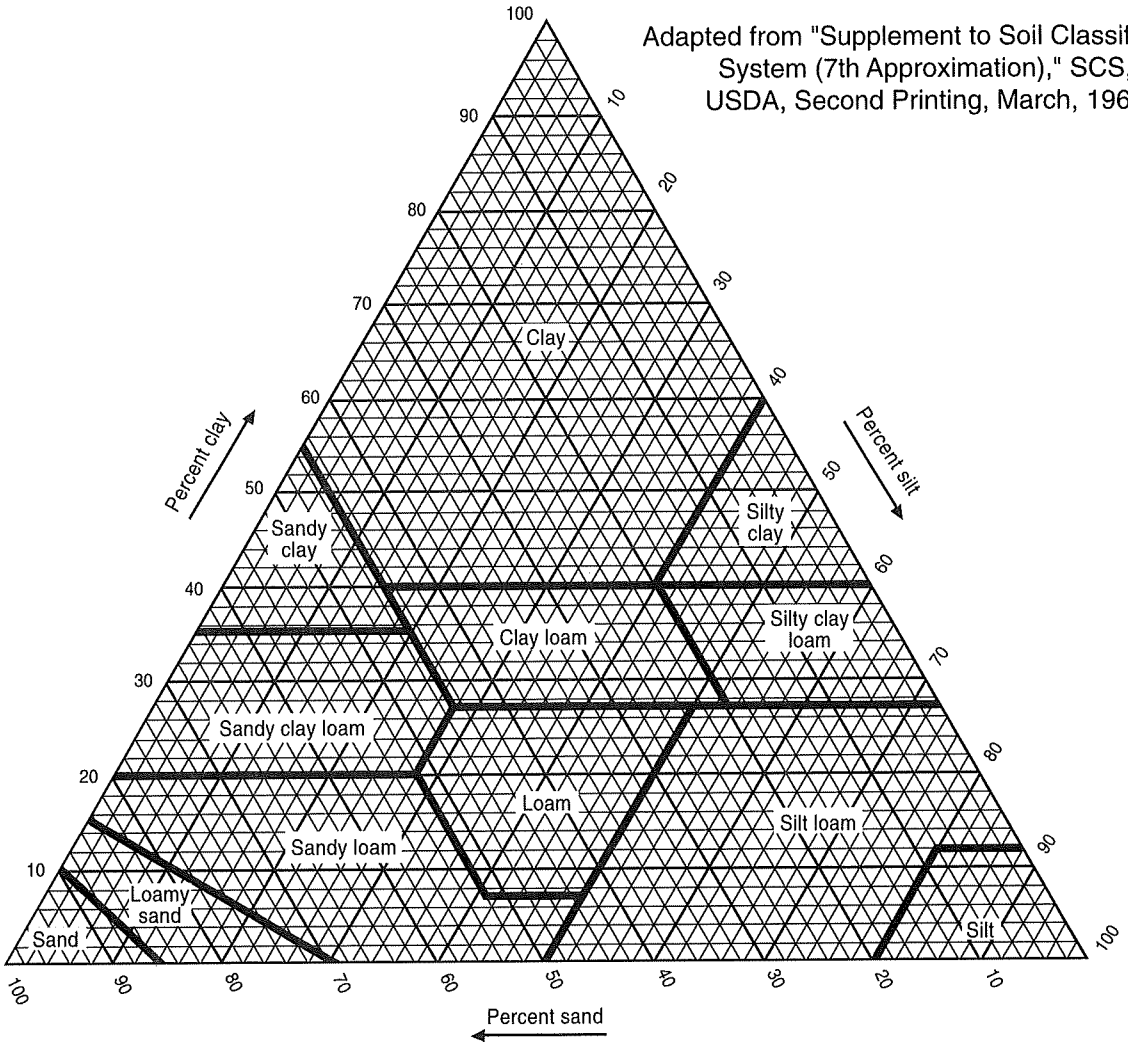
Groundwater - Observations were made at the times indicated. Porosity of soil strata, weather conditions, site topography, etc. may cause changes in the water levels indicated on the logs.

32185 Beaver Run Drive • Salisbury, Maryland 21804
410-546-6462 • Fax 410-548-5346

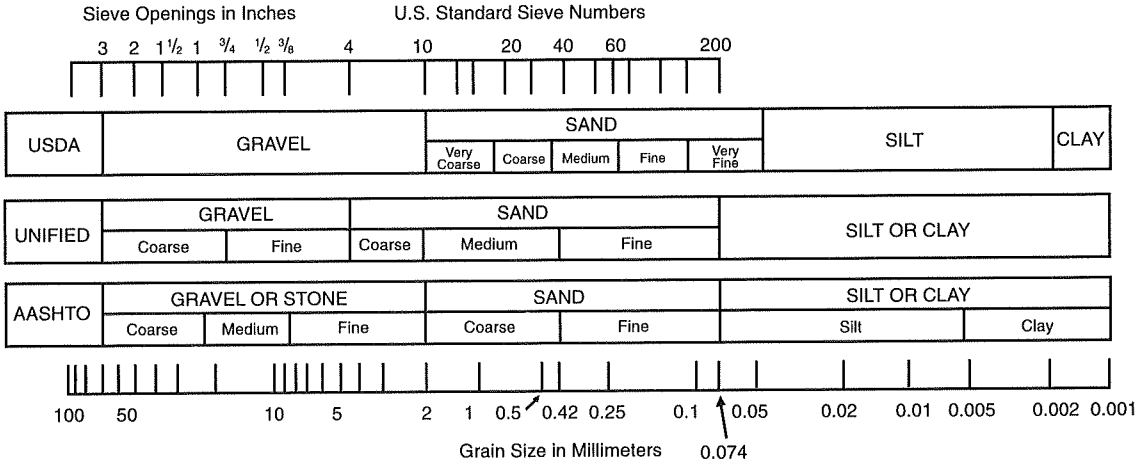
HYNES

USDA SOIL CLASSIFICATION SYSTEM

Adapted from "Supplement to Soil Classification System (7th Approximation)," SCS, USDA, Second Printing, March, 1967



COMPARISON OF PARTICLE - SIZE SCALES



Soil triangle of the basic soil textural classes. (U.S. Soil Conservation Service.) 288-D-2782.

☐ *Main Office* - 32185 Beaver Run Drive • Salisbury, Maryland 21804 • 410-546-6462 • Fax 410-548-5346
E-mail Salisbury jdhynes@aol.com

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

Copyright 2019 by Geoprofessional Business Association (GBA). Duplication, reproduction, or copying of this document, in whole or in part, by any means whatsoever, is strictly prohibited, except with GBA's specific written permission. Excerpting, quoting, or otherwise extracting wording from this document is permitted only with the express written permission of GBA, and only for purposes of scholarly research or book review. Only members of GBA may use this document or its wording as a complement to or as an element of a report of any kind. Any other firm, individual, or other entity that so uses this document without being a GBA member could be committing negligent or intentional (fraudulent) misrepresentation.

SECTION 02 41 00 - SELECTIVE DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Selective demolition of built site elements.

B. Selective demolition of building elements for alteration purposes.

1.2 DEFINITIONS

A. Existing to Remain: Existing items that are not to be removed or dismantled, except to the degree indicated for performing required Work.

B. Remove: To detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

C. Remove and Reinstall: To detach items from existing construction in a manner to prevent damage, to prepare for reuse, and to reinstall where indicated.

D. Retain: To keep and protect from damage existing items that are not to be removed or dismantled.

E. Salvage: To protect removed or dismantled items from damage and to deliver them to Owner ready for reuse.

1.3 REFERENCE STANDARDS

A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards.

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

1.4 MATERIALS OWNERSHIP

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

1.5 SUBMITTALS

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

B. 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.

C. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Submit before Work begins.

D. Project Record Documents:

1. Record Drawings: Accurately record actual locations of capped and active utilities and subsurface construction.

2. Inventory: Submit a list of items that have been removed and salvaged.

a. Include item description, item condition, number of items if more than one of a type, and tag number.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with notification regulations of authorities having jurisdiction before beginning removal and dismantling work. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.7 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

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

D. Hazardous Materials:

1. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCBs, and mercury.

2. Hazardous materials will be removed by Owner .

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

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.1 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.

1. Obtain required permits.

2. Comply with applicable requirements of NFPA 241.

3. Use of explosives is not permitted.

4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.

5. Provide, erect, and maintain temporary barriers and security devices.

6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.

7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.

8. Do not close or obstruct roadways or sidewalks without permit.

9. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.

10. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

B. Do not begin removal until receipt of notification to proceed from Owner.

C. Protect existing structures and other elements that are not to be removed.

1. Provide bracing and shoring.

2. Prevent movement or settlement of adjacent structures.

3. Stop work immediately if adjacent structures appear to be in danger.

D. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

E. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

3.2 EXISTING UTILITIES

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

3.3 SELECTIVE DEMOLITION, GENERAL

A. Remove existing work as indicated and as required to accomplish new work.

   1. Remove items indicated on drawings.

B. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.

   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.

   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.

   3. Verify that abandoned services serve only abandoned facilities before removal.

   4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.

C. Selective Demolition Procedures: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

   1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.

   2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

   3. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

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

E. Protection:

   1. Temporary Shoring:

a. Prevent movement of structure; provide shoring and bracing if necessary.

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

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

a. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.

b. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.

c. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.

d. Cover and protect furniture, furnishings, and equipment that have not been removed.

e. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01 50 00 - Temporary Facilities and Controls

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

F. Cutting and Patching:

1. Perform cutting to accomplish removals neatly and as specified for cutting new work.

2. Repair adjacent construction and finishes damaged during removal work.

3. Patch as specified for patching new work.

3.4 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Remove from site all materials not to be reused on site; comply with requirements of Section 01 74 19 - Waste Management.

C. Leave site in clean condition, ready for subsequent work.

D. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION 02 41 00

(This page intentionally left blank)

SECTION 02 41 16 - STRUCTURE DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of the Comfort Station building and site improvements.

2. Disconnecting, capping or sealing, removing, and abandoning in-place site utilities.

3. Salvaging items for reuse by Owner as indicated on the drawings.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse. Include fasteners or brackets needed for reattachment elsewhere.

1.3 REFERENCE STANDARDS

A. ANSI/ASSE A10.6 - Safety & Health Program Requirements for Demolition Operations.

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

1.4 MATERIALS OWNERSHIP

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

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be demolished.
2. Review structural load limitations of existing structures.
3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review and finalize protection requirements.
5. Review procedures for noise control.
6. Review procedures for protection of adjacent buildings.
7. Review items to be salvaged and returned to Owner.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

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

1. Adjacent Buildings: Detail special measures proposed to protect adjacent buildings to remain.

C. Schedule of Building Demolition Activities: Indicate the following:

1. Detailed sequence of demolition work, with starting and ending dates for each activity.
2. Temporary interruption of utility services.
3. Shutoff and capping of utility services.

D. Predemolition Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Comply with Section 01 3233 "Photographic Documentation." Submit before the Work begins.

1.7 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.8 FIELD CONDITIONS

A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.

B. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.

1. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings.

2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.

a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.

C. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.

2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. On-site storage or sale of removed items or materials is not permitted.

1.9 COORDINATION

A. Arrange demolition schedule so as not to interfere with Owner's on-site operations.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

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

2.2 SOIL MATERIALS

A. Satisfactory Soils: Comply with requirements in Section 31 2000 "Earth Moving."

PART 3 EXECUTION

3.1 EXAMINATION

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

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

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

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

E. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations. Comply with Section 01 3233 "Photographic Documentation.

3.2 PREPARATION

A. Salvaged Items: Comply with the following:

1. Clean salvaged items of dirt and demolition debris.

2. Pack or crate items after cleaning. Identify contents of containers.

3. Store items in a secure area until delivery to Owner.

4. Transport items to storage area designated by Owner.

5. Protect items from damage during transport and storage.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Utilities to be Disconnected: Locate, identify, disconnect, and seal or cap off utilities serving buildings and structures to be demolished.

1. Owner will arrange to shut off utilities when requested by Contractor.

2. Arrange to shut off utilities with utility companies.

3. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.

4. Cut off pipe or conduit a minimum of 24 inches (610 mm) below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.

5. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.4 PROTECTION

A. Existing Facilities: Protect adjacent walkways and roadways during demolition operations. Maintain exits from existing buildings.

B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of demolition.

C. Existing Utilities to Remain: Maintain utility services to remain and protect from damage during demolition operations.

1. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.

a. Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.

D. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Section 01 5000 "Temporary Facilities and Controls."

1. Protect adjacent buildings and facilities from damage due to demolition activities.
2. Protect existing site improvements, appurtenances, and landscaping to remain.
3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
5. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
6. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
7. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.

E. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.5 DEMOLITION, GENERAL

A. General: Demolish indicated buildings completely. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
2. Maintain fire watch during and for at least 72 hours after flame-cutting operations.
3. Maintain adequate ventilation when using cutting torches.
4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

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

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.

2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

C. Explosives: Use of explosives is not permitted.

3.6 DEMOLITION BY MECHANICAL MEANS

A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.

B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.

C. Salvage: Items to be removed and salvaged are indicated on Drawings.

D. Below-Grade Construction: Demolish foundation walls and other below-grade construction.

1. Remove below-grade construction, including basements, foundation walls, and footings, completely.

E. Existing Utilities: Demolish existing utilities and below-grade utility structures that are within 5 feet (1.5 m) outside footprint indicated for new construction. Abandon utilities outside this area.

1. Fill abandoned utility structures with satisfactory soil materials according to backfill requirements in Section 31 2000 "Earth Moving."

F. Existing Utilities: Demolish and remove existing utilities and below-grade utility structures.

3.7 SITE RESTORATION

A. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with satisfactory soil materials according to backfill requirements in Section 31 2000 "Earth Moving."

B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.8 REPAIRS

A. Promptly repair damage to adjacent buildings caused by demolition operations.

3.9 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and recycle or dispose of them according to Section 01 7419 "Construction Waste Management and Disposal."

1. Do not allow demolished materials to accumulate on-site.

2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Do not burn demolished materials.

3.10 CLEANING

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

1. Clean roadways of debris caused by debris transport.

END OF SECTION 02 41 16

SECTION 03 20 00 – CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Steel reinforcement bars.
   2. Welded-wire reinforcement.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Each type of steel reinforcement.
   2. Bar supports.
   3. Mechanical splice couplers.

B. Shop Drawings: Comply with ACI SP-066:
   1. Include placing drawings that detail fabrication, bending, and placement.
   2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.

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

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.
   1. Reinforcement to Be Welded: Welding procedure specification in accordance with AWS D1.4/D1.4M.

B. Material Certificates: For each of the following, signed by manufacturers:
   1. Epoxy-Coated Reinforcement: CRSI's "Epoxy Coating Plant Certification."

C. Material Test Reports: For the following, from a qualified testing agency:
   1. Steel Reinforcement:
      a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.
   2. Mechanical splice couplers.

D. Field quality-control reports.

E. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.4/D 1.4M.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60 (Grade 420) deformed.

B. Low-Alloy Steel Reinforcing Bars: ASTM A706/A706M, deformed.

C. Headed-Steel Reinforcing Bars: ASTM A970/A970M.

D. Galvanized Reinforcing Bars:
1. Steel Bars: ASTM A615/A615M, Grade 60 (Grade 420) deformed bars.
2. Zinc Coating: ASTM A767/A767M, Class I zinc coated after fabrication and bending.

E. Epoxy-Coated Reinforcing Bars:
1. Steel Bars: ASTM A615/A615M, Grade 60 (Grade 420) deformed bars.
2. Epoxy Coating: ASTM A775/A775M with less than 2 percent damaged coating in each 12-inch (305-mm) bar length.

F. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

G. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.

H. Galvanized-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from galvanized-steel wire into flat sheets.

I. Epoxy-Coated Welded-Wire Reinforcement: ASTM A884/A884M, Class A coated, Type 1, plain steel.

2.2 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.

1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
    a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.
    b. For epoxy-coated reinforcement, use CRSI Class 1A epoxy-coated or other dielectric-polymer-coated wire bar supports.
    c. For dual-coated reinforcement, use CRSI Class 1A epoxy-coated or other dielectric-polymer-coated wire bar supports.
    d. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.
    e. For stainless steel reinforcement, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.

B. Mechanical Splice Couplers: ACI 318 (ACI 318M) Type 1, same material of reinforcing bar being spliced; compression-only type, tension-compression type, dowel-bar type, or mechanical-lap type.

C. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch (1.2908 mm) in diameter.
    1. Finish: Galvanized ASTM A884/A884M, Class A, Type 1, epoxy coated, with less than 2 percent damaged coating in each 12-inch (305-mm) wire length.

D. Stainless Steel Tie Wire: ASTM A1022/A1022M, not less than 0.0508 inch (1.2908 mm) in diameter.

2.3 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection of In-Place Conditions:
    1. Do not cut or puncture vapor retarder.
    2. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.

B. Accurately position, support, and secure reinforcement against displacement.
   1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
   2. Do not tack weld crossing reinforcing bars.

C. Preserve clearance between bars of not less than 1 inch (25 mm), not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.

D. Provide concrete coverage in accordance with ACI 318 (ACI 318M).

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

F. Splices: Lap splices as indicated on Drawings.
   1. Bars indicated to be continuous, and all vertical bars to be lapped not less than 36 bar diameters at splices, or 24 inches (610 mm), whichever is greater.
   2. Stagger splices in accordance with ACI 318 (ACI 318M).
   3. Mechanical Splice Couplers: Install in accordance with manufacturer's instructions.
   4. Weld reinforcing bars in accordance with AWS D1.4/D 1.4M, where indicated on Drawings.

G. Install welded-wire reinforcement in longest practicable lengths.
   1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."
      a. For reinforcement less than W4.0 or D4.0, continuous support spacing to not exceed 12 inches (305 mm).
   2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches (50 mm) for plain wire and 8 inches (200 mm) for deformed wire.
   3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
   4. Lace overlaps with wire.

3.3 JOINTS

A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement.
   2. Continue reinforcement across construction joints unless otherwise indicated.
   3. Do not continue reinforcement through sides of strip placements of floors and slabs.

3.4 INSTALLATION TOLERANCES

A. Comply with ACI 117 (ACI 117M).

3.5 FIELD QUALITY CONTROL

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

B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:
   1. Steel-reinforcement placement.
   2. Steel-reinforcement mechanical splice couplers.
   3. Steel-reinforcement welding.

END OF SECTION 03 20 00

THIS PAGE LEFT INTENTIONALLY BLANK

SECTION 03 30 00 – CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes for the following:
   1. Footings.
   2. Foundation walls.
   3. Slabs-on-grade.
   4. Building frame members.
   5. Building walls.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

B. Integral Waterproofing Admixtures (IWPA): Concrete admixture that reacts with the calcium hydroxide created by the Portland cement reaction with water and the free water in concrete to eliminate the route of water ingress making the concrete impermeable.

C. Water Vapor Reducing Admixtures (WVRA): Concrete admixture that reacts with the calcium hydroxide created by the Portland cement reaction with water and the free water in concrete to eliminate the route of moisture migration and eliminate the free water chemically.

D. W/C Ratio: The ratio by weight of water to cementitious materials

1.4 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments. Do not start concrete production until data has been reviewed and approved by the engineer.

C. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

D. Welding Certificates: Copies of certificates for welding procedures and personnel.

E. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
   1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

F. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
   1. Cementitious materials and aggregates.
   2. Form materials and form-release agents.
   3. Steel reinforcement and reinforcement accessories.
   4. Admixtures.
   5. Curing materials.
   6. Floor and slab treatments.
   7. Vapor retarders.
   8. Epoxy joint filler.
   9. Joint-filler strips.
   10. Repair materials.
   11. Form liners
   12. Reglets
   13. Vapor retarder/barrier

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance. A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

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

C. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
   1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.

D. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548. Contractor shall provide a storage box for concrete cylinders.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

E. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

F. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

G. ACI Publications: Comply with the following, unless more stringent provisions are indicated:
   1. ACI 301, "Specification for Structural Concrete."
   2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials." CRSI

H. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."
   1. Before submitting design mixes, review concrete mix design and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixes.
      c. Ready-mix concrete producer.
      d. Concrete subcontractor.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   1. Plywood, metal, or other approved panel materials.
   2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
      a. High-density overlay, Class 1, or better.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of the exposed concrete surface.
   2. Furnish ties that, when removed, will leave holes not larger than 1 inch in diameter in concrete surface.
   3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast

concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.

B. Joint Dowel Bars: Plain-steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.

C. All hooks, unless otherwise noted, shall conform to "ACI Standard Hooks".

D. Tie-wire shall not be less than 16 gauge wire

2.4 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I/II.

B. Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:
1. Nominal Maximum Aggregate Size: 3/4 inch.

C. Fly Ash : ASTM C618, Type F

D. Water: Potable and complying with ASTM C 94.

2.5 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.

B. Air-Entraining Admixture: ASTM C 260.

C. Water-Reducing Admixture: ASTM C 494, Type A.

D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.

E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.

F. Water-Reducing and Retarding Admixture" ASTM C 494, Type D.

G. WVRA: ASTM C 494/C 494M, Type S; complex catalyzed hydrous silicate, water and vapor proofing liquid admixture.
1. Basis-of-Design Product: Subject to compliance with requirements, provide, Specialty Products Group; Vapor Lock 20/20™ or comparable product by one of the following:

a. Concure.
b. Moxie International

2.6 VAPOR BARRIER SYSTEM

A. Vapor Barrier System: ASTM E 1745, Class A, polyolefin sheet, not less than 10 mil.

B. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a No. 4 sieve and 10 to 30 percent passing a No. 100 sieve; meeting deleterious substance limits of ASTM C 33 for fine aggregates.

C. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

2.7 CURING MATERIALS

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

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Clear, Solvent-Borne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

F. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

G. Products: Subject to compliance with requirements, provide one of the following:
1. Evaporation Retarder:
   a. Sure Film; Dayton Superior Corporation.
   b. Eucobar; Euclid Chemical Co.
   c. E-Con; L&M Construction Chemicals, Inc.
   d. Confilm; Master Builders, Inc.
   e. Waterhold; Metalcrete Industries.
   f. Rich Film; Richmond Screw Anchor Co.
   g. SikaFilm; Sika Corporation.
   h. Finishing Aid; Symons Corporation.
2. Clear, Solvent-Borne, Membrane-Forming Curing Compound:
   a. Nitocure S; Fosroc.

b. Cure & Seal 309; Kaufman Products Inc.
c. L&M Dress & Seal 18; L&M Construction Chemicals, Inc.
d. CS-309; W. R. Meadows, Inc.
e. Seal N Kure; Metalcrete Industries.
f. Rich Seal 14 percent UV; Richmond Screw Anchor Co.
g. Kure-N-Seal; Sonneborn, Div. of ChemRex, Inc.
h. Clear Seal 150; Tamms Industries Co., Div. of LaPorte Construction Chemicals of North America, Inc.

3. Clear, Waterborne, Membrane-Forming Curing Compound:
   a. Safe Cure and Seal; Dayton Superior Corporation.
   b. Aqua Cure VOX; Euclid Chemical Co.
   c. Dress & Seal WB; L&M Construction Chemicals, Inc.
   d. Vocomp-20; W. R. Meadows, Inc.
   e. Metcure; Metalcrete Industries.
   f. Cure & Seal 150E; Nox-Crete Products Group, Kinsman Corporation.
   g. Cure & Seal 14 percent E; Symons Corporation.
   h. Seal Cure WB 150; Tamms Industries Co., Div. of LaPorte Construction Chemicals of North America, Inc.

2.8 RELATED MATERIALS

A. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Epoxy Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Shore A hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:
   1. Type II, non-load bearing, for bonding freshly mixed concrete to hardened concrete.
   2. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
   3. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Reglets: Fabricate reglets of not less than 0.0217-inch- thick galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

F. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.9 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
   1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
   4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Topping: Traffic-bearing, cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch.
   1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
   4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.10 CONCRETE MIXES

A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:
   1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.

C. Footings and Foundation Walls: Proportion normal-weight concrete mix as follows:
   1. Compressive Strength (28 Days): 5000 psi.
   2. Maximum Slump: 3 inches.
   3. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches after admixture is added to concrete with site-verified 2- to 3-inch slump.

D. Slab-on-Grade: Proportion normal-weight concrete mix as follows:

1. Compressive Strength (28 Days): 4000 psi.
2. Maximum Slump: 4 inches.

E. Elevated Slabs: Proportion normal-weight concrete mix as follows:
1. Compressive Strength (28 Days): 4000 psi.
2. Maximum Slump: 3 inches.
3. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches after admixture is added to concrete with site-verified 2- to 3-inch slump.

F. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash: 25 percent.

G. Maximum Water-Cementitious Materials Ratio: 0.40 for concrete required to have low water permeability. This includes walls below grade.

H. Maximum Water-Cementitious Materials Ratio: 0.40 for concrete exposed to deicers or subject to freezing and thawing while moist. This includes exterior slabs and walls.

I. Maximum Water-Cementitious Materials Ratio: 0.40 for corrosion protection of steel reinforcement in concrete exposed to chlorides from deicing chemicals, salt, saltwater, brackish water, seawater, or spray from these sources.

J. Maximum Water-Cementitious Materials Ratio: 0.40 for all interior slabs.

K. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus 1 or minus 1.5 percent, unless otherwise indicated:
1. Air Content: 6 percent for 1-inch- nominal maximum aggregate size.
2. Air Content: 6 percent for 3/4-inch- nominal maximum aggregate size.

L. Do not air entrain concrete to trowel-finished interior floors. Do not allow entrapped air content to exceed 3 percent.

M. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

N. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixes where indicated.
5. Use vapor proofing liquid admixture in concrete mixes at all concrete walls and slabs on grade.

2.11 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.12 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Only when specifically approved by the Architect. Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.
1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least one and one-half minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class A, 1/8 inch for surfaces exposed to view.
2. Class C, 1/2 inch all other surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.
1. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
1. Install anchor bolts, accurately located, to elevations required.
2. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.

B. Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until concrete has achieved the following:
1. At least 70 percent of 28-day design compressive strength.

C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORES AND RESHORES

A. Comply with ACI 318, ACI 301, and recommendations in ACI 347R for design, installation, and removal of shoring and reshoring.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR BARRIER SYSTEM

A. Vapor Barrier System: Place, protect, and repair vapor-barrier sheets according to ASTM E 1643 and manufacturer's written instructions. Lap joints 6 inches minimum and seal with manufacturer’s tape.

3.6 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor barrier. Repair damage and reseal vapor barrier before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
1. Shop- or field-weld reinforcement according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.7 JOINTS

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

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-third of concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete as soon as possible when cutting action will not dislodge aggregate or otherwise damage surface usually 1 to 2 hours depending on mix design, environmental conditions, etc. and before concrete develops random contraction cracks, typically 1 to 2 hours depending on mix design, environmental conditions, etc.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated.
1. Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 WATERSTOPS

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.9 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by Architect.

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

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

E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
   2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

F. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:
   1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
   2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
   3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.10 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch in height.
   1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.

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

3.11 FINISHING FLOORS AND SLABS

A. General: Comply with recommendations in ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes.
   1. Apply scratch finish to surfaces indicated and to surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, portland cement terrazzo, and other bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
   1. Apply a trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system
   2. Finish surfaces to the following tolerances, measured within 24 hours according to ASTM E 1155/E 1155M for a randomly trafficked floor surface:
      a. For thin-set flooring: Specified overall values of flatness, F(F) 35; and levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and levelness, F(L) 17.
      b. For carpet floors: Specified overall values of flatness, F(F) 25; and levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and levelness, F(L) 15.

E. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.

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

3.12 MISCELLANEOUS CONCRETE ITEMS

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

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

3.13 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods: Select curing method(s) from subparagraphs below. Delete options or restrict use of curing method(s) to specific locations or types of surfaces if required.
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      a. Water.
      b. Continuous water-fog spray.
      c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
      a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
      b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
      c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.
   3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

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

3.14 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
   1. Defer joint filling until concrete has aged at least six months. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid epoxy joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
   2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
   3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
   1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
   2. After concrete has cured at least 14 days, correct high areas by grinding.
   3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
   4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
   5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
   6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
   7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.16 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage and pay for a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during

concrete placement. Sampling and testing for quality control may include those specified in this Article.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
   1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
   2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.
      a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mix, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
   3. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
   4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
   5. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
   6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
   7. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
      a. Cast and field cure one set of four standard cylinder specimens for each composite sample.
   8. Compressive-Strength Tests: ASTM C 39; test two laboratory-cured specimens at 7 days and two at 28 days.
      a. Test two field-cured specimens at 7 days and two at 28 days.
      b. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.

C. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

D. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive

strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

E. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.

F. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

G. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION 03 30 00

SECTION 04 20 00 - UNIT MASONRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Concrete block.

B. Mortar and grout.

C. Reinforcement and anchorage.

D. Flashings.

E. Accessories.

1.2 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

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

C. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

D. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement.

E. ASTM C1019 - Standard Test Method for Sampling and Testing Grout for Masonry.

F. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50 mm [2 in.] Cube Specimens).

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

H. ASTM C1506 - Standard Test Method for Water Retention of Hydraulic Cement-Based Mortars and Plasters.

I. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.

J. ASTM C91/C91M - Standard Specification for Masonry Cement.

K. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units.

L. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.

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

N. ASTM C150/C150M - Standard Specification for Portland Cement.

O. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes.

P. ASTM C270 - Standard Specification for Mortar for Unit Masonry.

Q. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.

R. ASTM C476 - Standard Specification for Grout for Masonry.

S. ASTM C780 - Standard Test Methods for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.

T. ASTM D1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber.

U. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.

V. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

W. BIA Technical Notes No. 20 - Cleaning Brickwork.

X. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing.

Y. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls.

Z. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls.

AA. BIA Technical Notes No. 46 - Maintenance of Brick Masonry.

BB. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.

CC. NCMA TEK 8-2A - Removal of Stains from Concrete Masonry.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

1.4 SUBMITTALS

A. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.

B. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

C. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.

2. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.

D. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

E. Submit required submittals for 04 43 13 at the same time as the submittals for this specification section.

1.5 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

1. Maintain one copy of each document on project site.

B. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

A. Concrete Block (Keynote: 042000-A): Comply with referenced standards and as follows:

1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on drawings for specific locations.

2. Non-loadbearing Units: ASTM C129.

a. Hollow block, as indicated.

b. Lightweight.

2.3 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.

B. Hydrated Lime: ASTM C207, Type S.

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

D. Mortar Aggregate: ASTM C144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.

2. For joints less than 1/4 inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.

E. Grout Aggregate: ASTM C404.

F. Water: Clean and potable.

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

H. Integral Water Repellent Admixture for Mortar: Polymeric liquid admixture added to mortar at the time of manufacture.

1. Use only in combination with masonry units manufactured with integral water repellent admixture.

2. Use only water repellent admixture for mortar from the same manufacturer as water repellent admixture in masonry units.

3. Meet or exceed performance specified for water repellent admixture used in masonry units.

2.4 REINFORCEMENT AND ANCHORAGE

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi), deformed billet bars; galvanized.

B. Masonry Joint Reinforcement, General: ASTM A951/A951M.

C. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

D. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not less than 5/8 inch of mortar coverage from masonry face.

1. Steel frame: Crimped wire anchors for welding to frame, 0.25 inch thick, with trapezoidal wire ties 0.1875 inch thick, hot dip galvanized to ASTM A 153/A 153M, Class B.

E. Metal-to-Metal Fasteners: Self-drilling, self-tapping screws; corrosion resistant finish or hot dip galvanized to ASTM A153/A153M.

2.5 FLASHINGS

A. Metal Flashing Materials:

1. Stainless Steel Flashing (Keynote 042000-K): ASTM A666/A666M, Type 304, soft temper; 26 gauge, 0.0187 inch thick; finish 2B to 2D. Stainless Steel shall be DFARS (Defense Federal Acquisition Regulation Supplement).

B. Factory-Fabricated Flashing Corners and End Dams: Stainless steel. Stainless Steel shall be DFARS (Defense Federal Acquisition Regulation Supplement).

C. Flashing Sealant/Adhesives: Silicone, polyurethane, or silyl-terminated polyether/polyurethane or other type required or recommended by flashing manufacturer; type capable of adhering to type of flashing used.

D. Termination Bars (Keynote: 042000-R): manufacturer's standard continuous length 1" Stainless steel bar with sealant lip complete with stainless steel fasteners; compatible with membrane and adhesives.

E. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.

F. Locations:

1. Exterior door heads.
2. Window heads and sills.
3. Storefront and curtain wall heads.
4. Horizontal control joints.
5. Changes in veneer materials, vertically.
6. Other wall openings.
7. Other locations indicated.

2.6 ACCESSORIES

A. Compressible Filler (Keynote 042000-Q): Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane.

B. Cavity Mortar Control (Keynote: 042000-M): Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.

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

D. Weeps (Keynote: 042000-J):

1. Type: Molded PVC grilles, insect resistant.

2. Size: 3 1/2" x 3 1/2"

3. Color: As selected by Architect from manufacturer's full range.

E. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials. Use manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

2.7 MORTAR AND GROUT MIXES

A. Mortar for Unit Masonry: ASTM C270, using the Property Specification.

1. Masonry below grade and in contact with earth: Type M.

2. Exterior, loadbearing masonry: Type S.

3. Exterior, non-loadbearing masonry: Type N.

4. Interior, loadbearing masonry: Type N.

5. Interior, non-loadbearing masonry: Type O.

B. Grout (Keynote: : ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.

2. Proportion grout in accordance with ASTM C476, Table 1 or paragraph 4.2.2. for specified 28-day compressive strength indicated, but no less than 3000 psi.

3. Provide grout with a slump of 8 to 11 inches (203 to 279 mm) as measured according to ASTM C143/C143M.

C. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.

D. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

D. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

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

3.2 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.3 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.4 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:

1. Bond: Running, unless otherwise indicated.
2. Coursing: One unit and one mortar joint to equal 8 inches.
3. Mortar Joints: Concave.

3.5 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

D. Remove excess mortar and mortar smears as work progresses.

E. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.

F. Interlock intersections and external corners, except for units laid in stack bond.

G. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

H. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

I. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.

J. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.6 WEEPS/CAVITY VENTS

A. Install weeps in veneer and cavity walls at 24 inches on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.

3.7 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.

C. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.8 REINFORCEMENT AND ANCHORAGE - GENERAL AND CAVITY WALL MASONRY

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement not more than 8 inches on center in foundation walls and parapet walls.

C. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

D. Place continuous joint reinforcement in first and second joint below top of walls.

E. Lap joint reinforcement ends minimum 6 inches.

F. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 36 inches horizontally and 24 inches vertically.

3.9 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.

1. Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up flashing ends at least 1 inch, minimum, to form watertight pan at non-masonry construction.

2. Remove or cover protrusions or sharp edges that could puncture flashings.

3. Seal lapped ends and penetrations of flashing before covering with mortar.

B. Terminate flashing up 8 inches minimum on vertical surface of backing:

C. Extend metal flashings to within 1/2 inch of exterior face of masonry and adhere to top of stainless steel angled drip with hemmed edge.

D. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

3.10 CONTROL JOINTS IN CONCRETE MASONRY

A. Install control joints at locations indicated on the drawings in all concrete masonry walls.

B. Nonstructural reinforcement, such as horizontal joint reinforcement, shall not be continuous through control joints.

C. Structural reinforcement, such as bond beam reinforcement, shall be continuous through control joints.

D. Install preformed control joint gaskets in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

3.11 TOLERANCES

A. Maximum Variation from Alignment of Columns: 1/4 inch.

B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

F. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.12 CUTTING AND FITTING

A. Cut and fit for chases. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.13 FIELD QUALITY CONTROL

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

B. Inspections: Special inspections according to the International Building Code and the inspection tables indicated on the structural drawings.

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.

2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, laps, and locations of reinforcement.

3. Place grout only after inspectors have verified proportions of site-prepared grout.

4. Inspect all masonry vertical reinforcement.

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

D. Testing Frequency: One set of tests for each 1500 sq. ft. of wall area or portion thereof.

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

F. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C140/C140M for compressive strength.

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

H. Mortar Test (Property Specification): For each mix provided, according to ASTM C780. Test mortar for mortar air content and compressive strength.

I. Grout Test (Compressive Strength): For each mix provided, according to ASTM C1019.

3.14 REPAIRING, POINTING, AND CLEANING

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

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

C. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.

3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.

4. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes No. 20.

5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

7. Clean stone trim to comply with stone supplier's written instructions.

3.15 PROTECTION

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

2. Extend cover a minimum of 24 inches (600 mm) down both sides of walls and hold cover securely in place.

3. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe and hold cover in place.

B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.

2. Protect sills, ledges, and projections from mortar droppings.

3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.

4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

END OF SECTION 04 20 00

SECTION 04 43 13 - STONE MASONRY VENEER

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Anchored cut stone veneer at exterior walls.

B. Metal anchors and accessories for anchored veneer.

C. Setting mortar and pointing mortar.

1.2 REFERENCE STANDARDS

A. ASTM A580/A580M - Standard Specification for Stainless Steel Wire.

B. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

C. ASTM C270 - Standard Specification for Mortar for Unit Masonry.

D. ASTM C1528/C1528M - Standard Guide for Selection of Dimension Stone.

E. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry.

F. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.

1.3 SUBMITTALS

A. Product Data: Provide data on stone units, mortar, and reinforcement.

B. Samples: Submit six stone samples illustrating minimum and maximum stone sizes, color range, texture, and markings.

C. Samples: Submit mortar color samples.

D. Stone Fabricator's Qualification Statement.

E. Installer's Qualification Statement.

F. Submit required submittals for 04 20 00 at the same time as the submittals for this specification section.

1.4 QUALITY ASSURANCE

A. Stone Fabricator Qualifications: Company specializing in fabricating cut stone with minimum ten years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type required by this section, with minimum 3 years of documented experience.

1.5 MOCK-UP

A. Construct stone wall mock-up, 10 feet long by 10 feet wide; include stone anchor accessories, corner condition, typical control joint, and mortar in mock-up.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect stone from discoloration during storage on site.

1.7 FIELD CONDITIONS

A. Cold Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.1 STONE

A. Stone, General: See recommendations in ASTM C1528/C1528M.

B. Match existing stone on the Chamber's House in the location identified on the drawings.

2.2 MORTAR APPLICATIONS

A. At Contractor's option, mortar may be field-mixed from packaged dry materials, made from factory premixed dry materials with addition of water only, or ready-mixed.

B. Mortar Color: Custom color to match the existing adjacent Chambers House.

C. Pointing Mortars: Pointing or grouting mortars used to fill the joints between individual stone veneer units once the setting bed mortar has sufficiently cured.

2.3 MORTAR MIXES

A. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.

1. Color: Mineral pigments added as required to produce approved color sample.

B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.

2.4 ACCESSORIES - ANCHORED VENEER

A. Horizontal Joint Reinforcement (Keynote: 044313-B): Truss type; stainless steel wire complying with ASTM A580/A580M Type 304, 3/16 inch diameter side rods with 0.1483 inch diameter cross ties.

B. Wall Ties: Formed steel wire, at least 1/8 inch diameter, stainless steel complying with ASTM A580/A580M, eye and pintle type, with provision for vertical adjustment after attachment.

C. Other Anchors in Direct Contact with Stone: ASTM A666 Type 304, stainless steel, of sizes and configurations required for support of stone and applicable superimposed loads.

D. Setting Buttons and Shims: Plastic.

E. Weep/Cavity Vents: Molded PVC grille, insect resistant.

F. Cleaning Solution: Type that will not harm stone, joint materials, or adjacent surfaces.

2.5 FLASHINGS (KEYNOTE 044313-E)

A. Stainless Steel/Polymer Fabric Flashing: ASTM A240/A240M; 2 mil type 304 stainless steel sheet bonded on one side to one sheet of polymer fabric. Stainless Steel shall be DFARS (Defense Federal Acquisition Regulation Supplement).

1. Manufacturers:

2. Hohmann & Barnard, Inc; Mighty-Flash Stainless Flashing: www.h-b.com/#sle.

a. York Manufacturing, Inc; Multi-Flash SS: www.yorkmfg.com/#sle.

B. Factory-Fabricated Flashing Corners and End Dams: Stainless steel. Stainless Steel shall be DFARS (Defense Federal Acquisition Regulation Supplement).

C. Flashing Sealant/Adhesives: Silicone, polyurethane, or silyl-terminated polyether/polyurethane or other type required or recommended by flashing manufacturer; type capable of adhering to type of flashing used.

D. Termination Bars: manufacturer's standard continuous length 1" Stainless steel bar with sealant lip complete with stainless steel fasteners; compatible with membrane and adhesives.

E. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.

F. Locations:

1. Exterior door heads.
2. Window heads and sills.
3. Storefront and curtain wall heads.
4. Horizontal control joints.
5. Changes in veneer materials, vertically.
6. Other wall openings.
7. Other locations indicated.

2.6 STONE FABRICATION - ANCHORED VENEER

A. Nominal Thickness: 4 inch.

B. Size, Pattern and Coursing: existing historic Chambers House on site. Contractor shall base the stone patterning, shape distribution and variation on the Chambers House as directed by the Architect.

C. Fabricate for 3/8 inch beds and joints.

D. Backs: Sawn.

E. Form stone corners to irregular joint profile. Clean jagged corners from stone in preparation for setting.

F. Slope exposed top surfaces of stone and horizontal sill surfaces for shedding water.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that support work and site conditions are ready to receive work of this section.

3.2 PREPARATION - ANCHORED VENEER

A. Establish lines, levels, and coursing. Protect from disturbance.

B. Clean stone prior to installation. Do not use wire brushes or implements that mark or damage exposed surfaces.

C. Clean sawn surfaces of rust stains and iron particles.

3.3 INSTALLATION - ANCHORED VENEER

A. Install flashings of longest practical length and seal watertight to back-up. Lap end joints minimum 6 inches and seal watertight.

B. Size stone units to fit opening dimensions and perimeter conditions.

C. Wet absorptive stone in preparation for placement to minimize moisture suction from mortar.

D. Arrange stone pattern to provide color uniformity and minimize visual variations , and provide a uniform blend of stone unit sizes.

E. Arrange stone coursing in stack bond with consistent joint width.

F. Set stone in full mortar setting bed to fully support stone over bearing surface. Use setting buttons or shims to maintain correct joint width.

G. Install weep/cavity vents in vertical stone joints at 24 inches on center horizontally; immediately above horizontal flashings, above shelf angles and supports, and at top of each cavity space; do not permit mortar accumulation in cavity space.

3.4 REINFORCEMENT AND ANCHORAGE - ANCHORED VENEER

A. Install horizontal joint reinforcement 16 inches on center.

B. Place horizontal joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place joint reinforcement continuous in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

E. In addition, place wall ties at maximum 3 inches on center each way around perimeter of openings, within 12 inches of openings.

3.5 JOINTS - ANCHORED VENEER

A. Leave the following joints open for sealant; see Section 07 92 00:

1. Head joints in top courses, including copings, parapets, cornices, sills, and steps.

2. Joints in projecting units.

3. Joints between rigidly anchored units, including soffits, panels, and column covers.

4. Joints below lugged sills and stair treads.

5. Joints below ledge and relieving angles.

6. Joints labeled "expansion joint".

B. Rake out mortar joints 5/8 to 3/4 inch and brush joints clean to accommodate pointing mortar. Fill joints with pointing mortar.

C. Pack mortar into joints and work into voids. Neatly tool surface to concave joint.

D. At joints to be sealed, clean mortar out of joint before it sets. Brush joints clean.

3.6 CONTROL AND EXPANSION JOINTS

A. Form joints as detailed on drawings.

3.7 TOLERANCES

A. Maximum Variation of Joint Thickness: 1/8 inch in 3 feet.

3.8 CLEANING

A. Remove excess mortar as work progresses, and upon completion of work.

B. Clean soiled surfaces with cleaning solution.

C. Use non-metallic tools in cleaning operations.

3.9 PROTECTION

A. During temporary storage on site, at the end of working day, and during rainy weather, cover stone work exposed to weather with non-staining waterproof coverings, securely anchored.

END OF SECTION 04 43 13

(This page intentionally left blank)

SECTION 04 72 00 - CAST STONE MASONRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Architectural cast stone.

B. Units required are:

1. Exterior wall units, including wall caps.

1.2 REFERENCE STANDARDS

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

B. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.

C. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.

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

E. ASTM C33/C33M - Standard Specification for Concrete Aggregates.

F. ASTM C150/C150M - Standard Specification for Portland Cement.

G. ASTM C270 - Standard Specification for Mortar for Unit Masonry.

H. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.

I. ASTM C1364 - Standard Specification for Architectural Cast Stone.

1.3 SUBMITTALS

A. Product Data: Test results of cast stone components made previously by the manufacturer.

B. Shop Drawings: Include elevations, dimensions, layouts, profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, and piece numbers.

C. Mortar Color Selection Samples.

D. Verification Samples: Pieces of actual cast stone components not less than 6 inches square, illustrating range of color and texture to be anticipated in components furnished for the project.

1.4 QUALITY ASSURANCE

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

1.5 MOCK-UP

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver cast stone components secured to shipping pallets and protected from damage and discoloration. Protect corners from damage.

B. Number each piece individually to match shop drawings and schedule.

C. Store cast stone components and installation materials in accordance with manufacturer's instructions.

D. Store cast stone components on pallets with nonstaining, waterproof covers. Ventilate under covers to prevent condensation. Prevent contact with dirt.

E. Protect cast stone components during handling and installation to prevent chipping, cracking, or other damage.

F. Store mortar materials where contamination can be avoided.

G. Schedule and coordinate production and delivery of cast stone components with unit masonry work to optimize on-site inventory and to avoid delaying the work.

PART 2 PRODUCTS

2.1 ARCHITECTURAL CAST STONE

A. Cast Stone: Architectural concrete product manufactured to simulate appearance of natural granite, complying with ASTM C1364.

1. Compressive Strength: As specified in ASTM C1364; calculate strength of pieces to be field cut at 80 percent of uncut piece.

2. Freeze-Thaw Resistance: Demonstrated by laboratory testing in accordance with ASTM C1364.

3. Surface Texture: Fine grained texture, with no bugholes, air voids, or other surface blemishes visible from distance of 20 feet.

4. Color: Selected by Architect from manufacturer's full range.

5. Remove cement film from exposed surfaces before packaging for shipment.

B. Shapes: Provide shapes indicated on drawings.

1. Variation from Any Dimension, Including Bow, Camber, and Twist: Maximum of plus/minus 1/8 inch or length divided by 360, whichever is greater, but not more than 1/4 inch.

2. Unless otherwise indicated on drawings, provide:

a. Wash or slope of 1:12 on exterior horizontal surfaces.

b. Drips on projecting components, wherever possible.

c. Raised fillets at back of sills and at ends to be built in.

C. Reinforcement: Provide reinforcement as required to withstand handling and structural stresses; comply with ACI 318.

2.2 MATERIALS

A. Portland Cement: ASTM C150/C150M.

1. For Mortar: Type I or II, except Type III may be used in cold weather.

B. Coarse Aggregate: ASTM C33/C33M, except for gradation; granite, quartz, or limestone.

C. Fine Aggregate: ASTM C33/C33M, except for gradation; natural or manufactured sands.

D. Admixtures: ASTM C494/C494M.

E. Water: Potable.

F. Reinforcing Bars: ASTM A615/A615M, Grade 40 (40,000 psi), deformed bars, galvanized.

1. Galvanized in accordance with ASTM A767/A767M, Class I.

G. Steel Welded Wire Reinforcement: ASTM A1064/A1064M, galvanized or ASTM A884/A884M, epoxy coated.

H. Embedded Anchors, Dowels, and Inserts: Type 304 stainless steel, of type and size as required for conditions.

I. Mortar: Portland cement-lime, ASTM C270 Type N ; do not use masonry cement.

J. Sealant: As specified in Section 07 90 05.

K. Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine construction to receive cast stone components. Notify Architect if construction is not acceptable.

B. Do not begin installation until unacceptable conditions have been corrected.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Setting:

1. Drench cast stone components with clear, running water immediately before installation.

2. Set units in a full bed of mortar unless otherwise indicated.

3. Fill vertical joints with mortar.

4. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

3.3 TOLERANCES

A. Joints: Make all joints 3/8 inch, except as otherwise detailed.

1. Rake mortar joints 3/4 inch for pointing.
2. Remove excess mortar from face of stone before pointing joints.
3. Point joints with mortar in layers 3/8 inch thick and tool to a slight concave profile.
4. Leave the following joints open for sealant:
    a. Head joints in top courses, including copings, parapets, cornices, sills, and steps.
    b. Joints in projecting units.
    c. Joints between rigidly anchored units, including soffits, panels, and column covers.
    d. Joints below lugged sills and stair treads.
    e. Joints below ledge and relieving angles.
    f. Joints labeled "expansion joint".

B. Installation Tolerances:

1. Variation from Plumb: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet or more.
2. Variation from Level: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet, or 3/8 inch maximum.
3. Variation in Joint Width: Not more than 1/8 inch in 36 inches or 1/4 of nominal joint width, whichever is less.
4. Variation in Plane Between Adjacent Surfaces (Lipping): Not more than 1/16 inch difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.

3.4 REPAIR

A. Repair chips and other surface damage noticeable when viewed in direct daylight at 20 feet.

1. Repair with matching touch-up material provided by the manufacturer and in accordance with manufacturer's instructions.

2. Repair methods and results subject to Architect 's approval.

3.5 PROTECTION

A. Protect completed work from damage.

B. Clean, repair, or restore damaged or mortar-splashed work to condition of new work.

END OF SECTION 04 72 00

SECTION 05 12 00 – STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes structural steel.
B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 1 Section "Quality Control" for independent testing agency procedures and administrative requirements.
   2. Division 5 Section "Metal Fabrications" for loose steel bearing plates and miscellaneous steel framing.
   3. Division 9 Section "Painting" for surface preparation and priming requirements.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Engineer structural steel connections required by the Contract Documents to be selected or completed by the fabricator to withstand design loadings indicated.

B. Engineering Responsibility: Engage a fabricator who utilizes a qualified professional engineer to prepare calculations, Shop Drawings, and other structural data for structural steel connections.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of product specified.

C. Shop Drawings detailing fabrication of structural steel components.
   1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
   2. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
   3. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tension, or tensioned shear/bearing connections.

4. Include Shop Drawings signed and sealed by a qualified professional engineer responsible for their preparation.

D. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Mill test reports signed by manufacturers certifying that their products, including the following, comply with requirements.
1. Structural steel, including chemical and physical properties.
2. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
3. Direct-tension indicators.
4. Shop primers.
5. Nonshrink grout.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.

C. Comply with applicable provisions of the following specifications and documents:
1. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
2. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
3. AISC's "Seismic Provisions for Structural Steel Buildings."
4. ASTM A 6 "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use."
5. Research Council on Structural Connections' (RCSC) "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for projects with structural steel framing that are similar to that indicated for this Project in material, design, and extent.

E. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel."

1. Present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver structural steel to Project site in such quantities and at such times to ensure continuity of installation.

B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.
1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.7 SEQUENCING

A. Supply anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.1 MATERIALS AS INDICATED.

A. Structural Wide Flange Steel Shapes: ASTM A 992, Grade 50.

B. Structural steel channel, angles, plates and bars: ASTM A 36.

C. Hollow Structural Steel Section: ASTM A 500, Grade B.

D. Steel Pipe: ASTM A 53, Type E or S, Grade B.
1. Weight Class: Standard unless indicated otherwise.
2. Finish: Black, except where indicated to be galvanized.

E. Carbon-Steel Casings: ASTM A 27, Grade 65-35, medium-strength carbon steel.

F. High-Strength Steel Casings: ASTM A 148, Grade 80-50.

G. Shear Connectors: ASTM A 108, Grade 1015 through 1020, headed-stud type, cold-finished carbon steel, AWS D1.1, Type B.

H. Anchor Rods, Bolts, Nuts, and Washers: As follows:
1. Unheaded Rods: ASTM A 36.
2. Headed Bolts: ASTM A 307, Grade A; carbon-steel, hex-head bolts; and carbon-steel nuts.
3. Headed Bolts: ASTM A 325, Type 1, heavy hex steel structural bolts and heavy hex carbon-steel nuts. Use where high strength bolts are indicated.
4. Washers: ASTM A 36.

I. Nonhigh-Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A; carbon-steel, hex-head bolts; carbon-steel nuts; and flat, unhardened steel washers.
1. Finish: Hot-dip zinc-coating, ASTM A 153, Class C.

J. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers.
1. Finish: Hot-dip zinc-coating, ASTM A 153, Class C.

K. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
1. Finish: Mechanically deposited zinc coating.

L. Welding Electrodes: Comply with AWS requirements.

2.2 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.

B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds and repair painting galvanized steel, with dry film containing not less than 93 percent zinc dust by weight, and complying with DOD-P-21035A or SSPC-Paint 20.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, of consistency suitable for application, and a 30-minute working time.

2.4 FABRICATION

A. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in Shop Drawings.
   1. Camber structural steel members where indicated.
   2. Identify high-strength structural steel according to ASTM A 6 and maintain markings until steel has been erected.
   3. Mark and match-mark materials for field assembly.
   4. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.
   5. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.
   6. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.

B. Fabricate architecturally exposed structural steel with exposed surfaces smooth, square, and free of surface blemishes, including pitting, rust, scale, seam marks, roller marks, rolled trade names and roughness.
   1. Remove blemishes by filling or grinding, or by welding and grinding, prior to cleaning, treating, and shop priming.
   2. Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for architecturally exposed structural steel.

C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
   1. Plane thermally cut edges to be welded.

D. Finishing: Accurately mill ends of columns and other members transmitting loads in bearing.

E. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's printed instructions.

F. Holes: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on Shop Drawings.
   1. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.

2.5 SHOP CONNECTIONS

A. Shop install and tighten high-strength bolts according to RCSC's Allowable Stress Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
   1. Bolts: ASTM A 325 high-strength bolts, unless otherwise indicated.
   2. Connection Type: Snug tightened, unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.

B. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.
   1. Remove backing bars or runoff tabs, back gouge, and ground steel smooth.
   2. Assemble and weld built-up sections by methods that will maintain alignment of axes without warp.
   3. Verify that weld sizes, fabrication sequence, and equipment used will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2 inch and larger. Grind flush butt welds. Dress exposed welds.

2.6 SHOP PRIMING

A. Shop prime steel surfaces, except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
   2. Surfaces to be field welded.
   3. Surfaces to be high-strength bolted with slip-critical connections.
   4. Surfaces to receive sprayed-on fireproofing.
   5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC specifications as follows:
   1. SPC-SP 3 "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
   2. Apply 2 coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Apply a 1-coat, nonasphaltic primer complying with SSPC's "Painting System Guide No. 7.00" to provide a dry film thickness of not less than 1.5 mils.

2.7 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel indicated for galvanizing according to ASTM A 123.

2.8 SOURCE QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

1. Testing agency will conduct and interpret tests and state in each report whether test specimens comply with or deviate from requirements.
2. Provide testing agency with access to places where structural steel Work is being fabricated or produced so required inspection and testing can be accomplished.

B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

D. Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
1. Direct-tension indicator gaps will be verified to comply with ASTM F 959, Table 2.

E. In addition to visual inspection, shop-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.
1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before erection proceeds, and with the steel erector present, verify elevations of concrete and masonry bearing surfaces and locations of anchorages for compliance with requirements.

B. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.

B. Base and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
   1. Set base and bearing plates for structural members on leveling plates, wedges, shims, or setting nuts as required.
   2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
   3. Pack grout solidly between bearing surfaces and plates so no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
      a. Comply with manufacturer's instructions for proprietary grout materials.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
   1. Level and plumb individual members of structure.
   2. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.

E. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

F. Do not use thermal cutting during erection.

G. Splice members only where indicated.

H. Finish sections thermally cut during erection equal to a sheared appearance.

I. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. Install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
   1. Bolts: ASTM A 325 high-strength bolts, unless otherwise indicated.

2. Connection Type: Snug tightened, unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.

B. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.
1. Comply with AISC specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.
3. Verify that weld sizes, fabrication sequence, and equipment used will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2 inch and larger. Grind flush butt welds. Dress exposed welds.

3.5 FIELD QUALITY CONTROL

A. Owner will employ and pay for an independent testing and inspecting agency to perform field inspections and tests and to prepare test reports.
1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from requirements.

B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

C. Additional testing will be performed to determine compliance of corrected Work with specified requirements. Contractor will reimburse Owner for the costs of these additional tests.

D. Field-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
1. Direct-tension indicator gaps will be verified to comply with ASTM F 959, Table 2.

E. In addition to visual inspection, field-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.
1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.

3.6 CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.
   1. Apply by brush or spray to provide a minimum dry film thickness of 1.5 mils.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint according to ASTM A 780.

END OF SECTION 05 12 00

SECTION 05 12 13 - ARCHITECTURALLY-EXPOSED STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

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

1.2 DEFINITIONS

A. Architecturally Exposed Structural Steel: Structural Steel conforming to one of the categories of Architecturally Exposed Structural Steel or AESS Refer to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges".

B. AESS 1: Structural Steel designated as "AESS 1" in the contract documents and conforming to AISC 303, Chapter 10 definition of AESS 1. These are basic elements with workmanship requirements exceeding those in non AESS construction.

C. AESS 2: Structural Steel designated as "AESS 2" in the contract documents and conforming to AISC 303 Chapter 10 definition of AESS 2. These are feature elements viewed at a distance greater than 20 feet. The art of metalworking is intended to be visible to the viewer.

D. AESS 3: Structural Steel designated as "AESS 3" in the contract documents and conforming to AISC 303. Chapter 10 definition of AESS 3. These are feature elements viewed at a distance less than 20 feet. The art of metalworking is intended to be visible to the viewer.

E. AESS 4: Structural Steel designated as "AESS 4" in the contract documents and conforming to AISC 303. Chapter 10 definition of AESS4. These are showcase elements with special surface and edge treatment beyond fabrication. The intent is the form is the only feature showing in an element.

1.3 REFERENCE STANDARDS

A. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges.

B. AISC 360 - Specification for Structural Steel Buildings.

C. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.

D. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

E. ASTM A1085/A1085M - Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS).

F. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.

G. AWS D1.1/D1.1M - Structural Welding Code - Steel.

1.4 SUBMITTALS

A. Shop Drawings: Detailing for fabrication of AESS components.

1. Provide erection documents clearly indicating which members are AESS members and the AESS category of each part.

2. Include details that clearly identify AESS requirements found in this specification. Provide connections for AESS consistent with concepts shown on drawings.

3. Indicate welds by AWS A2.4 symbols, distinguishing between shop and field welds, and show size, length and type of each weld. Identify grinding, finish and profile of welds as defined by the designated AESS category.

B. AESS 4 Samples: Provide samples of specific AESS characteristics. Samples may be small size samples or components of conventional structural steel demonstrating specific AESS characteristics, including surface preparation, sharp edges ground smooth, continuous weld appearance, weld show through, and fabrication mark removal.

1.5 QUALITY ASSURANCE

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

B. Welder Qualifications: Welding processes and welding operators qualified within previous 12 months in accordance with AWS D1.1/D1.1M and dated no more than 12 months before start of scheduled welding work..

1.6 MOCK-UP

A. Provide mock-ups for AESS 4 of nature and extent indicated in Contract Documents.

B. Locate mock-ups on site. Mock-ups to be full-size unless Architect approves smaller models. Alternatively, when a mock-up is not practical, the first piece of an element or connection can be used to determine acceptability.

C. Notify Architect one week in advance of dates and times when mock-ups will be available for review.

D. Demonstrate applicable AESS characteristics for specified category of AESS on elements and joints in mock-up.

E. Build mock-ups using member sizes and materials indicated for final work.

F. Mock-up to demonstrate weld quality, contouring of welds at aligned walls of members, specified surface preparation, and finish coating.

G. HSS members to extend at least 6 inches from joint in mock-up.

H. Obtain Architect's written approval of mock-ups before starting fabrication.

I. Retain and maintain mock-ups during construction in an undisturbed condition as a standard for judging completed work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handle finished pieces in accordance with Section 10 of AISC 303, using nylon-type slings, or chains with softeners, or wire ropes with softeners such that they are not damaged.

B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration. Use special care in handling to prevent twisting or warping of AESS members.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Comply with Section 05 12 00, except as amended in this section for aesthetic purposes.

2.2 FABRICATION

A. Fabricate and assemble AESS in shop to greatest extent possible. Locate field joints in AESS assemblies at concealed locations or as approved by Architect. Detail AESS assemblies to minimize field handling and expedite erection.

B. Permissible tolerances for member depth, width, out of square, and camber and sweep to be as specified in ASTM A6/A6M, ASTM A500/A500M, and ASTM A1085/A1085M.

C. Use special care in handling and shipping of AESS both before and after shop painting to minimize damage to any shop finish. Use nylon-type slings or softeners when using chains or wire rope slings.

D. Fabricate AESS in accordance with categories defined in AISC 303, as follows:

1. AESS 4: Showcase elements with special surface and edge treatment beyond fabrication (showcase elements).

a. Fabricate to the requirements of AESS 3 and as follows:

b. Contouring and blending of welds: Where welds are indicated to be ground contoured or blended, oversize welds as required and grind to provide a smooth transition and match to conform to the approved mock-up.

c. Minimize Weld Show Through: At locations where welding on the opposite side of an exposed connection creates distortion, weld show through shall be minimized to conform to the approved mock-up.

d. Open holes shall be filled with weld metal or body filler and smoothed by grinding or filling to the standards applicable to the shop fabrication of the materials.

2.3 PAINT SYSTEM

A. Compatibility: All components/procedures of AESS paint system to comply with coating system specified, submitted, and approved per Sections 09 91 13, 09 91 23, 09 96 00, and 07 81 23. As a minimum, identify required surface preparation, primer, intermediate coat (if applicable), and finish coat. Primer, intermediate coating, and finish coating to be from a single manufacturer combined in a system documented by manufacturer with adequate guidance for fabricator to procure and execute.

B. Primer: As specified in Sections 09 91 13, 09 91 23, and 09 96 00. Primer to comply with all federal standards for VOC, lead and chromate levels.

2.4 MATERIALS

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

2.5 SOURCE QUALITY CONTROL

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

B. AESS 3,4, and C Acceptance: Architect to observe AESS in the shop at a viewing distance consistent with final installation and determine acceptability based on approved mock-up. Quality assurance agency has no responsibility for enforcing requirements related to aesthetic effect.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

A. Provide connections for temporary shoring, bracing and supports only where noted on approved fabrication documents. Temporary connections not shown are to be made at locations not exposed to view in final structure or as approved by Architect.

3.3 ERECTION

A. AESS 4: Showcase elements:

1. Erect to requirements of AESS 3 and as follows:

2. Grind welds smooth.

3. Minimize Weld Show Through: At locations where welding on far side of an exposed connection creates distortion, grind distortion and marking of steel to a smooth profile with adjacent material.

4. Filling of Weld Access Holes: Where holes must be cut in web at intersection with flanges on W shapes and structural tees to permit field welding of flanges, fill holes with joint filler.

5. Where welds are indicated to be ground, contoured, or blended, oversize welds as required and grind to provide a smooth transition and match profile on approved mock-up.

3.4 FIELD QUALITY CONTROL

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

B. AESS 4, and C Acceptance: Architect to observe AESS in place and determine acceptability based on qualification data and submittals as well as on approved mock-up. Quality assurance agency has no responsibility for enforcing requirements related to aesthetic effect.

3.5 CLEANING

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

END OF SECTION 05 12 13

SECTION 05 21 00 – STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. K-series steel joists.
2. K-series steel joist substitutes.
3. Steel joist accessories.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for installing bearing plates in concrete.
2. Section 051200 "Structural Steel Framing" for field-welded shear connectors.

1.2 DEFINITIONS

A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of joist, accessory, and product.

B. Shop Drawings:

1. Include layout, designation, number, type, location, and spacing of joists.
2. Include joining and anchorage details; bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.
3. Indicate locations and details of bearing plates to be embedded in other construction.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Welding certificates.

C. Manufacturer certificates.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

E. Mill Certificates: For each type of bolt.

F. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.

G. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications.

1. include providing professional engineering services for designing special joists to comply with performance requirements.

B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications.

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Nucor | Vulcraft (basis of design)

B. Any other manufacturer meeting the requirements of this Specification

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated on Drawings.

1. Use ASD; data are given at service-load level.
2. Design special joists to withstand design loads with live-load deflections no greater than the following:
   a. Roof Joists: Vertical deflection of [1/360] of the span.

2.3 STEEL JOISTS

A. K-Series Steel Joist: Manufactured steel joists of type indicated according to "Standard Specification for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.

1. Joist Type: K-series steel joists
2. K-Series Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.
3. Provide holes in chord members for connecting and securing other construction to joists.
4. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated on Drawings, complying with SJI's "Specifications."
5. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated on Drawings, complying with SJI's "Specifications."
6. Do not camber joists.
7. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches (1:48).

2.4 PRIMERS

A. Primer:

1. SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

2.5 STEEL JOIST ACCESSORIES

A. Bridging:
1. Schematically indicated. Detail and fabricate according to SJI's "Specifications. Furnish additional erection bridging if required for stability.

B. Fabricate steel bearing plates from ASTM A36/A36M steel with integral anchorages of sizes and thicknesses indicated on Drawings. Hot-dip zinc coat according to ASTM A123/A123M.

C. Steel bearing plates with integral anchorages are specified in Section 055000 "Metal Fabrications."

D. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction.

1. Extend ends to within 1/2 inch (13 mm) of finished wall surface unless otherwise indicated on Drawings.
2. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C

E. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, (ASTM A563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

1. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C

F. Welding Electrodes: Comply with AWS standards.

G. Galvanizing Repair Paint: [MPI#18, MPI#19, or SSPC-Paint 20] [ASTM A780/A780M].

H. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.6 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by power-tool cleaning, SSPC-SP 3.

B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.

C. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil (0.025 mm) thick.

D. Shop priming of joists and joist accessories is specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting**."**

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications". joist manufacturer's written instructions, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.

3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads are applied.

C. Field weld joists to supporting steel bearing plates. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Bolt joists to supporting steel framework using carbon-steel bolts.

E. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Visually inspect field welds according to AWS D1.1/D1.1M.

C. Visually inspect bolted connections.

D. Prepare test and inspection reports.

END OF SECTION 05 21 00

THIS PAGE LEFT INTENTIONALLY BLANK

SECTION 05 31 00 - STEEL DECKING

PART 1 - PRODUCTS

1.1 SUMMARY

A. Section Includes:

1. Roof deck.
2. Composite floor deck

B. Related Requirements:

1. Section 03 30 00 "Cast-in-Place Concrete" for normal-weight and lightweight structural concrete fill over steel deck.
2. Section 05 12 00 "Structural Steel Framing" for shop- and field-welded shear connectors.
3. Section 05 50 00 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Roof deck.
2. Composite floor deck

B. Shop Drawings:

1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Test and Evaluation Reports:

1. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

    a. Power-actuated mechanical fasteners.

2. Research Reports: For steel deck, from ICC-ES showing compliance with the building code.

D. Field Quality-Control Submittals:

1. Field quality-control reports.

E. Qualification Statements: For welding personnel and testing agency.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with SDI QA/QC and the following welding codes:

1. AWS D1.1/D1.1M.

2. AWS D1.3/D1.3M.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store products in accordance with SDI MOC3. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck in accordance with AISI S100.

B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from listings of another qualified testing agency.

2.2 ROOF DECK

A. Basis-of-Design Product: Subject to compliance with requirements, provide Vulcraft; Nucor Vulcraft Group; 1.5B-36 GR50 Roof Deck or comparable product by one of the following:

1. ASC Profiles, Inc.

2. Canam Steel Corporation; Canam Group, Inc.

3. Epic Metals Corporation.

4. Marlyn Steel Decks, Inc.

5. New Millennium Building Systems, LLC.

B. Fabrication of Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with SDI RD and with the following:

1. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 40 (275), G60 (Z180)zinc coating.

2. Deck Profile: As indicated

3. Profile Depth: As indicated.

4. Design Uncoated-Steel Thickness: As indicated.

5. Span Condition: Triple span or more.

6. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 COMPOSITE FLOOR DECK

A. Basis-of-Design Product: Subject to compliance with requirements, provide Vulcraft; Nucor Vulcraft Group; 2VLI-36 GR50 Composite Deck or comparable product by one of the following:

1. ASC Profiles, Inc.

2. Canam Steel Corporation; Canam Group, Inc.

3. Epic Metals Corporation.

4. Marlyn Steel Decks, Inc.

5. New Millennium Building Systems, LLC.

B. Fabrication of Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with SDI C, with the minimum section properties indicated, and with the following:

1. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 40 (275), G60 (Z180)zinc coating.

2. Deck Profile: As indicated

3. Profile Depth: As indicated.

4. Design Uncoated-Steel Thickness: As indicated.

5. Span Condition: Triple span or more.

6. Side Laps: Overlapped or interlocking seam at Contractor's option.

C.

2.4 ACCESSORIES

A. Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories in accordance with SDI C, SDI NC, and SDI RD, as applicable; manufacturer's written instructions; and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install in accordance with deck manufacturer's written instructions.

3.3 INSTALLATION OF ROOF DECK

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches (38 mm) long, and as follows:

1. Weld Diameter: 5/8 inch (16 mm) , nominal.

2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 18 inches (460 mm) apart, maximum apart in Zone 1 and 6 inches (150 mm) apart in Zones 2 and 3, based on roof-area definitions in FM Global Loss Prevention Data Sheet 1-28.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 36 inches (1 m), and as follows:

1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.

2. Mechanically clinch or button punch.

3. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:

1. End Joints: Lapped 2 inches (50 mm) minimum or butted at Contractor's option.

D. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels in accordance with deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

3.4 INSTALLATION OF FLOOR DECK

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:

1. Weld Diameter: 5/8 inch, nominal.

2. Weld Spacing:

a. Weld edge ribs of panels at each support. Space additional welds an average of 16 inches (400 mm) apart, but not more than 18 inches (460 mm) apart.
b. Space and locate welds as indicated.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 36 inches (1 m), and as follows:

1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.

2. Mechanically clinch or button punch.

3. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of [1-1/2 inches (38 mm)] , with end joints as follows:

1. End Joints: Lapped or butted at Contractor's option.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure in accordance with SDI recommendations unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, in accordance with SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Special inspections and qualification of welding special inspectors for cold-formed steel floor and roof deck in accordance with quality-assurance inspection requirements of SDI QA/QC.

a. Field welds will be subject to inspection.

2. Steel decking will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 05 31 00

THIS PAGE LEFT INTENTIONALLY BLANK

SECTION 05 40 00 – COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Interior non-load-bearing wall framing.
   2. Exterior and interior load-bearing wall framing.
   3. Exterior non-load-bearing wall framing.
   4. Ceiling joist framing.
   5. Diagonal strap bracing.

1.3 DEFINITIONS

A. Minimum Uncoated Steel Thickness: Minimum uncoated thickness of cold-formed framing delivered to the Project site shall be not less than 95 percent of the thickness used in the cold-formed framing design. Lesser thicknesses shall be permitted at bends due to cold forming.

B. Producer: Entity that produces steel sheet coil fabricated into cold-formed members.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
   1. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
      a. Interior Non-Load-Bearing Wall Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft.
      b. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height.
      c. Ceiling Joist Framing: Vertical deflection of 1/360 of the span.
   2. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg. F.
   3. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

a. Upward and downward movement of 1/2 inch.

B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

1.5 SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated.

B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

For cold-formed metal framing indicated to comply with design loads, include structural Analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Mill certificates signed by steel sheet producer or test reports from a qualified independent testing agency indicating steel sheet complies with requirements.

D. Welding Certificates: Copies of certificates for welding procedures and personnel.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

F. Product Test Reports: From a qualified testing agency indicating that each of the following complies with requirements, based on comprehensive testing of current products:
1. Expansion anchors.
2. Steel Sheet.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Miscellaneous structural clips and accessories.

G. Research/Evaluation Reports: Evidence of cold-formed metal framing's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed cold-formed metal framing similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Engineering Responsibility: Engage a qualified professional engineer to prepare design calculations, Shop Drawings, and other structural data.

C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

D. Mill certificates signed by steel sheet producer or test reports from a qualified independent testing agency indicating steel sheet complies with requirements, including uncoated steel thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and galvanized-coating thickness.

E. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

F. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

G. Fire-Test-Response Characteristics: Where metal framing is part of a fire-resistance-rated assembly, provide framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Fire-Resistance Ratings: Indicated by GA File Numbers in GA-600, "Fire Resistance Design Manual," or by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.

H. AISI Specifications: Comply with AISI's "Specification for the Design of Cold-Formed Steel Structural Members" for calculating structural characteristics of cold-formed metal framing:
   1. CCFSS Technical Bulletin: "AISI Specification Provisions for Screw Connections."

I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following or approved equal:
1. Allied Studco, Inc.
2. The Steel Network, Inc.
3. Dietrich Industries, Inc.
4. AllSteel Products, Inc.
5. Knorr Steel Framing Systems.
6. MarinoWare; Div. of Ware Industries, Inc.
7. Unimast, Inc.
8. United Metal Products, Inc.
9. Clark Steel Framing.
10. Steel Construction Systems.

2.2 MATERIALS

A. Steel Sheet: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
1. Grade: 33 minimum or as required by structural performance.
2. Coating: G60.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, complying with ASTM C 955, and as follows:
1. Minimum Uncoated-Steel Thickness: Matching steel studs.

C. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads, and as follows:.
   1. Minimum Uncoated-Steel Thickness: Matching steel studs.
   2. Flange Width: Manufacturer’s standard deep flange width

D. Vertical Deflection Clips: Manufacturer's standard clips, capable of accommodating upward and downward vertical displacement of primary structure.

2.3 EXTERIOR AND INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0428 inch
   2. Flange Width: 1-5/8 inches

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

   1. Minimum Base-Metal Thickness 0.0428 inch
   2. Flange Width: 1-1/4 inches

C. Vertical Deflection Clips: Manufacturer's standard head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. Dietrich Metal Framing; a Worthington Industries Company.
      b. MarinoWare, a division of Ware Industries.
      c. SCAFCO Corporation
      d. The Steel Network, Inc.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Dietrich Metal Framing; a Worthington Industries Company.
      b. MarinoWare, a division of Ware Industries.
      c. SCAFCO Corporation
      d. The Steel Network, Inc.
   2. Minimum Base-Metal Thickness: 0.0428

3. Flange Width: 1 inch plus the design gap for 1-story structures

E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
   1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
      a. Minimum Base-Metal Thickness: 0.0428 inch
      b. Flange Width: 1 inch plus the design gap for 1-story structures
   2. Inner Track: Of web depth indicated, and as follows:
      a. Minimum Base-Metal Thickness: 0.0428 inch
      b. Flange Width: Equal to sum of outer deflection track flange width plus 1 inch

F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.

2.4 CEILING JOIST FRAMING

A. Steel Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0428 inch
   2. Flange Width: 1-5/8 inches

2.5 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
   1. Supplementary framing.
   2. Bracing, bridging, and solid blocking.
   3. Web stiffeners.
   4. Anchor clips.
   5. End clips.
   6. Foundation clips.
   7. Gusset plates.
   8. Stud kickers, knee braces, and girts.
   9. Joist hangers and end closures.
   10. Hole reinforcing plates.
   11. Backer plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners: Corrosion-resistant-coated, self-drilling, self-threading steel drill screws.
   1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

D. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.8 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed metal framing members by welding. Wire tying of framing members is not permitted. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
4. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
    a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
5. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of

fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

C. Grout bearing surfaces uniform and level to ensure full contact of bearing flanges or track webs on supporting concrete or masonry construction.

D. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to ASTM C 1007, unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
   1. Bolt or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.
   1. Cut framing members by sawing or shearing; do not torch cut.
   2. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

E. Install framing members in one-piece lengths, unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

H. Install insulation in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
   1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 EXTERIOR AND INTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:
   1. Stud Spacing: 16 inches (Unless noted otherwise)

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
   1. Install single-leg deflection tracks and anchor to building structure.
   2. Install double deep-leg deflection tracks and anchor outer track to building structure.
   3. Connect vertical deflection clips to bypassing studs and anchor to building structure.
   4. Connect drift clips to cold formed metal framing and anchor to building structure.

E. Install horizontal bridging in curtain-wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
   1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
      a. Install sol id blocking at 96-inch centers or as indicated on Shop Drawings.

2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
3. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
4. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable curtain-wall-framing system.

3.5 JOIST INSTALLATION

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches
2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.

C. Space joists not more than 2 inches from abutting walls, and as follows:
1. Joist Spacing: As indicated on plan.

D. Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists if indicated.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on Shop Drawings.
1. Install web stiffeners to transfer axial loads of walls above.

F. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:
1. Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.6 GYPSUM SHEATHING INSTALLATION

A. General: Install gypsum sheathing to comply with GA-253 and manufacturer's written instructions.

B. Cut boards at penetrations, edges, and other obstructions of the work; fit tightly against abutting construction, except provide a 3/8-inch setback where non-load-bearing construction abuts structural elements.

C. Coordinate sheathing installation with flashing and joint sealant installation so these materials are installed in the sequence and manner that prevent exterior moisture from passing through completed exterior wall assembly.

D. Apply fasteners so screw heads bear tightly against face of sheathing boards but do not cut into facing.

E. Do not bridge building expansion joints with sheathing; cut and space edges to match spacing of structural support elements.

F. Horizontal Installation: Install 24-inch- wide gypsum sheathing boards horizontally with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of stud flanges and stagger end joints of adjacent boards not less than one stud spacing. Screw-attach boards at perimeter and within field of board to each steel stud at approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.

G. Vertical Installation: Install 48-inch wide gypsum sheathing boards vertically with vertical edges centered over flanges of steel studs. Abut ends and edges of each board with those of adjacent boards. Screw-attach boards at perimeter and within field of board to each steel stud at approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.

H. Air-Infiltration Barrier Application: Cover sheathing with air-infiltration barrier as follows:
   1. Cut back air-infiltration barrier 1/2 inch on each side of break in supporting members at expansion- or control-joint locations.
   2. Apply asphalt-saturated organic felt horizontally with 2-inch overlap and 6-inch end lap; fasten to sheathing with corrosion-resistant staples.
   3. Apply proprietary building wrap to comply with manufacturer's written installation instructions.

4. Apply air-infiltration barrier to cover vertical flashing with 4-inch overlap.

I. Sealing Sheathing Joints: Seal joints according to sheathing manufacturer's written recommendations and as follows:
   1. Apply elastomeric sealant on joints and fasteners and trowel flat. Apply sufficient quantity of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
   2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing board joints, and apply and trowel silicone emulsion sealant to embed sealant in entire face of tape. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

3.7 FIELD QUALITY CONTROL

A. Testing: Owner will employ and pay for a qualified independent testing agency to perform field quality-control testing.

B. Field and shop welds will be subject to inspection and testing.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace Work that does not comply with specified requirements.

E. Additional testing and inspecting will be performed to determine compliance of corrected Work with specified requirements. Contractor will reimburse Owner for the costs of these additional tests.

3.8 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: Wire brush, clean, and paint scarred areas, welds, and rust spots on fabricated and installed prime-painted, cold-formed metal framing. Paint framing surfaces with same type of shop paint used on adjacent surfaces.

C. Protect paper-surfaced gypsum sheathing that will be exposed to weather for more than 30 days by covering exposed exterior surface of sheathing with a securely fastened air-infiltration barrier. Apply covering immediately after sheathing is installed.

D. Protect cutouts, corners, and joints in sheathing by filling with a flexible sealant or by applying tape recommended by sheathing manufacturer at time sheathing is applied.

E. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 40 00

THIS PAGE LEFT INTENTIONALLY BLANK

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Shop fabricated steel and aluminum items.

B. Steel framing and supports for applications where framing and supports are not specified in other Sections.

C. Roof Mounted Fall-arrest anchors.

D. Support angles for elevator door sills.

E. Shelf and ledger angles.

F. Steel ladders.

1.2 REFERENCE STANDARDS

A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.

B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

E. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

F. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

G. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.

H. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

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

J. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

K. ASTM B210/B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes.

L. ASTM B211/B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire.

M. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

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

O. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric].

P. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

Q. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

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

S. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.

T. AWS D1.1/D1.1M - Structural Welding Code - Steel.

U. AWS D1.2/D1.2M - Structural Welding Code - Aluminum.

V. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172.

W. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.

X. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).

Y. SSPC-SP 2 - Hand Tool Cleaning.

1.3 SUBMITTALS

A. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1. Design data: Submit drawings and supporting calculations, signed and sealed by a qualified professional structural engineer.

a. Include the following, as applicable:

1) Design criteria.

2) Engineering analysis depicting stresses and deflections.

3) Member sizes and gauges.

4) Details of connections.

5) Support reactions.

6) Bracing requirements.

1.4 QUALITY ASSURANCE

A. Design metal fabrications under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

B. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

PART 2 PRODUCTS

2.1 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

E. Slotted Channel Framing: ASTM A653/A653M, Grade 33.

F. Slotted Channel Fittings: ASTM A1011/A1011M.

G. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.

H. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, galvanized to ASTM A153/A153M where connecting galvanized components.

I. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

J. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

K. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.2 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

B. Sheet Aluminum: ASTM B209/B209M, 5052 alloy, H32 or H22 temper.

C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210/B210M, 6063 alloy, T6 temper.

D. Aluminum-Alloy Bars: ASTM B211/B211M, 6061 alloy, T6 temper.

E. Bolts, Nuts, and Washers: Stainless steel.

F. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.3 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by continuous welds.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.4 FABRICATED ITEMS

A. Ledge Angles, Shelf Angles, Channels, and Plates not attached to Structural Framing including, but not limited to:

1. Elevator door sill support.

2. Loose bearing and leveling plates.

3. Curtainwall and storefront head, sill, and jamb locations as shown on drawings and required by design loads.

B. Elevator Sump Pit Grate (Keynote 055000-N):

1. Frame: Recessed.

2. Grate: 1/2" galvanized steel.

3. Size: Coordinate with sump pit.

C. Lintels: As detailed.

1. Exterior: Galvanized finish, unpainted.

2. Interior: Prime paint finish.

D. Interior Steel Ladders (Keynote: 055000-G): Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint finish. For elevator pit ladders, comply with ASME A17.1.

1. Side Rails: 3/8x 2 inches members spaces at 20 inces.

2. Rungs: One inch diameter solid round bar spaced 12 inches on center with non-slip surface on each rung.

3. Space rungs 7 inches from wall surface.

4. Provide cages for ladders over 20 feet in length.

E. Elevator Hoistway Divider Beams (Keynote: 055000-F): Beam sections; prime paint finish.

F. Slotted Channel Framing: Fabricate channels and fittings from structural steel complying with the referenced standards; factory-applied, rust-inhibiting thermoset acrylic enamel finish.

G. Roof Mounted Fall-Arrest Anchor (Keynote: 055000-R)

1. ASTM A36 Galvanized Steel Anchor
2. Height: 26 inches
3. Post Diameter: 4.5 inch
4. User Maximum Capacity: Minimum 420 pounds
5. Tensile Strength: 5000 lbf/22kN
6. U-loop cross section: 0.625 inch min

2.5 FINISHES - STEEL

A. Prime paint steel items.

1. Exceptions: Galvanize items to be embedded in concrete, items to be embedded in masonry, and any items which are located in exterior walls.
2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.

B. Prime Painting: One coat.

C. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements.

D. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.6 FINISHES - ALUMINUM

A. Exterior Aluminum Surfaces: superior performance organic coating.

B. Interior Aluminum Surfaces: high performance organic coating.

C. High Performance Organic Coating System: AAMA 2604 multiple coat, thermally cured fluoropolymer system; color as indicated.

D. Superior Performance Organic Coating System: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride system; color as indicated.

2.7 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

A. Clean and strip primed steel items to bare metal and aluminum where site welding is required.

B. Furnish setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.3 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Obtain approval prior to site cutting or making adjustments not scheduled.

D. After erection, prime welds, abrasionsand surfaces not shop primed or galvanized , except surfaces to be in contact with concrete.

3.4 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION 05 50 00

SECTION 05 51 00 - METAL STAIRS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Decorative, architectural stairs with terrazzo treads.

B. Structural steel stair framing and supports.

1.2 REFERENCE STANDARDS

A. AISC 207 - Standard for Certification Programs.

B. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.

F. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

G. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

H. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.

I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

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

K. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.

L. AWS D1.1/D1.1M - Structural Welding Code - Steel.

M. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.

N. SSPC-SP 2 - Hand Tool Cleaning.

1.3 SUBMITTALS

A. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

2. Include the design engineer's seal and signature on each sheet of shop drawings.

B. Design Data: As required by authorities having jurisdiction.

C. Designer's Qualification Statement.

D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is certified under AISC 207.

1.4 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.

B. Fabricator Qualifications:

1. A qualified steel fabricator that is certified by the American Institute for Steel Construction (AISC) under AISC 207.

C. A company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

PART 2 PRODUCTS

2.1 METAL STAIRS - GENERAL

A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.

1. Regulatory Requirements: Provide stairs and railings that comply with most stringent requirements of local, state, and federal regulations; where requirements of Contract Documents exceed those of regulations, comply with Contract Documents.

2. Structural Design: Provide complete stair and railing assemblies that comply with the applicable local code.

3. Dimensions: As indicated on drawings.

4. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.

5. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.

6. Separate dissimilar metals using paint or permanent tape.

B. Metal Jointing and Finish Quality Levels:

1. Architectural: All joints as inconspicuous as possible, whether welded or mechanical.

a. Welded Joints: Continuously welded and ground smooth and flush.

b. Mechanical Joints: Butted tight, flush, and hairline; concealed fastenings only.

c. Exposed Edges and Corners: Eased to small uniform radius.

d. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for highest quality gloss finish.

2. Industrial: All joints made neatly.

a. Welded Joints: Welded on back side wherever possible.

b. Welds Exposed to Touch: Ground smooth.

c. Bolts Exposed to Touch in Travel Area: No nuts or screw threads exposed to touch.

C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.2 METAL STAIRS WITH TERRAZZO TREADS

A. Jointing and Finish Quality Level: Architectural, as defined above.

B. Risers: Closed.

C. Decorative Metal Stairs: Provide stairs of the design specified, dimensioned, and detailed complete with landing platforms, fabricated stringers, and vertical and horizontal supports, fabricated accurately for achorage to each other, to the building structure, and able to support the loads of terrazzo and guardrails specified in other Sections.

D. Risers and Treads: Closed, bent metal plate wth mortared precast terrazzo as indicated. Thickness as required by design.

1. Pan Anchorage to Stringers: Continuously welded, from bottom.

E. Landings: Similar construction, using metal plate, supported and reinforced as required to achieve design load capacity.

F. Under Side of Stair: not exposed to view.

G. Stringers: Fabricated channels with square mitered corners, size as indicated with thickness as rquired to achieve design load capacity.

1. End Closure: Sheet steel of same thickness as risers welded across ends.

H. Finish: Shop or factory-prime painted. Coordinate with Division 09 High Performance Coatings.

2.3 MATERIALS

A. Steel Sections: ASTM A 36/A 36M.

B. Steel Tubing: ASTM A500/A500M or ASTM A501/A501M structural tubing, round and shapes as indicated.

C. Steel Plates: ASTM A6/A6M or ASTM A283/A283M.

D. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.

1. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).

2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).

2.4 ACCESSORIES

A. Steel Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.

B. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

C. Shop and Touch-Up Primer: SSPC-Paint 15, and comply with VOC limitations of authorities having jurisdiction.

2.5 SHOP FINISHING

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Do not prime surfaces in direct contact with concrete or where field welding is required.

C. Prime Painting: Use specified shop- and touch-up primer.

1. Preparation of Steel: In accordance with SSPC-SP 2 Hand Tool Cleaning.

2. Number of Coats: One.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

A. When field welding is required, clean and strip primed steel items to bare metal.

3.3 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.

D. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.

E. Obtain approval prior to site cutting or creating adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.4 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION 05 51 00

SECTION 05 52 13 - PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Exterior railings and guardrails.

1.2 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.

B. AISC 207 - Standard for Certification Programs.

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

F. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.

G. ASTM B429/B429M - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.

H. ASTM B483/B483M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Tubes for General Purpose Applications.

I. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.

J. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).

1.3 SUBMITTALS

A. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

1. Include the design engineer's seal and signature on each sheet of shop drawings.

1.4 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.

B. Welder Qualifications: Show certification of welders employed on the Work, verifying AWS qualification within the previous 12 months.

C. Fabricator Qualifications:

1. A qualified steel fabricator that is certified by the American Institute for Steel Construction (AISC) under AISC 207.

2. A company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

PART 2 PRODUCTS

2.1 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements applicable local code.

B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 75 pounds per linear foot applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E 935.

C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E 935.

D. Allow for expansion and contraction of members and building movement without damage to connections or members.

E. Dimensions: See drawings for configurations and heights.

F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.

G. Provide welding fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.2 ALUMINUM MATERIALS

A. Aluminum Pipe: Schedule 40; ASTM B429/B429M, ASTM B241/B241M, or ASTM B483/B483M.

B. Welding Fittings: No exposed fasteners; cast aluminum.

C. Straight Splice Connectors: Concealed spigot; cast aluminum.

2.3 STEEL RAILING SYSTEM

A. Steel Tube: ASTM A500/A500M Grade B cold-formed structural tubing.

B. Steel Pipe: ASTM A 53/A 53M Grade B Schedule 40, galvanized finish.

C. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

D. Straight Splice Connectors: Steel concealed spigots.

E. Galvanizing: In accordance with requirements of ASTM A123/A123M.

1. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic.

2.4 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

D. Welded Joints:

1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.

2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.

3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

2.5 ALUMINUM FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

B. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils thick.

C. Touch-Up Materials: As recommended by coating manufacturer for field application.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.

C. Apply one coat of bituminous paint to concealed aluminum surfaces that will be in contact with cementitious or dissimilar materials.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Anchor railings securely to structure.

D. Touch-up welds with primer. Grind welds smooth.

E. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.4 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION 05 52 13

(This page intentionally left blank)

SECTION 05 73 00 - DECORATIVE METAL RAILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Railing systems.

1.2 REFERENCE STANDARDS

A. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's product data, including description of materials, components, finishes, fabrication details, anchors, and accessories.

B. Shop Drawings: Indicate railing system elevations and sections, details of profile, dimensions, sizes, connection attachments, anchorage, size and type of fasteners, and accessories. Indicate anchor and joint locations, brazed connections, transitions, and terminations.

C. Samples: Submit one of each item below for each type and condition shown.

1. Railing: 12-inch long section of handrail showing color, finish, and connection detail.

D. Manufacturer's Instructions: Indicate installation.

E. Designer's qualification statement.

F. Maintenance Data: Manufacturer's instructions for care and cleaning.

G. Executed warranty.

1.4 COORDINATION

A. Coordinate installation of achorages for railings. Furnish setting drawings, templates and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.

1.5 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located or personnel under direct supervision of engineer.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in factory-provided protective coverings and packaging.

B. Protect materials against damage during transit, delivery, storage, and installation at site.

C. Inspect materials upon delivery for damage. Replace damaged items.

D. Prior to installation, store materials and components under cover in dry location.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer's standard 1-year warranty against defects in materials, fabrication, finishes, and installation commencing on Date of Substantial Completion; complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Basis of Design: VIVA Railings, LLC

a. CIRCA Picket or approved equal.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Division 01, to design decorative metal railings, including attachment to building construciton.

B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. Stainless Steel: 45 percent of minimum yield strength.

2. Steel: 72 percent of minimum yield strength.

C. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.

b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.

c. Uniform and concentrated loads need not be assumed to act concurrently.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes changes acting on exterior railings by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.3 METALS, GENERAL

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

B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.

1. Provide stainless steel wall brackets with flange tapped for concealed anchorage with vertical and horizontal adjustment capability.

2.4 STAINLESS STEEL

A. Tubing: ASTM A554, Grade MT 316.

B. Pipe: ASTM A312/A312M, Grade TP 316.

C. Castings: ASTM A743/A743M, Grade CF 8M or Grade CF 3M.

D. Sheet, Strip, Plate, and Flat Bar: ASTM A666 or ASTM A240/A240M, Type 316.

E. Bars and Shapes: ASTM A276/A276M, Type 316.

F. Posts: Tube, made from stainless steel.

1. Post top caps to be fully-welded to posts and ground smooth, leaving no seam marks.

G. Top Rail/Hand Rail: Wood and Stainless steel pipe with round cross-section shape.

H. Vertical Picket Infill Panels: 1/2-inch (38-mm) round stainless steel pickets.

2.5 WOOD RAILINGS

A. Description: Clear, straight-grained hardwood rails secured to exposed metal substrate.

1. Species: White Oak

2. Finish: Manufacturer's standard unfinished.

3. Staining: In accordance with Section 099123 "Interior Painting."

4. Top Rail profile: round, size as indicated on the drawings

5. Handrail profile: round, size as indicated on the drawings.

2.6 STEEL AND TOP RAIL/HAND RAIL: IRON

A. Bars: Hot-rolled, carbon steel complying with ASTM A29/A29M, Grade 1010.

2.7 RAILINGS

A. General: Comply with requirements in this Section for metal railings with welded connections.

B. Guard Top Rail: Stainless steel, round, size as indicated on the drawings.

C. Hand Rail: Stainless Steel, 1 1/2 inch outside diameter. Provide at all locations unless noted otherwise as illuminated units.

2.8 FASTENERS

A. Fastener Materials: Unless otherwise indicated, provide the following:

1. Stainless Steel Components: Type 316 stainless steel fasteners.

2. For Dissimilar Metal Railing Components: Type 316 stainless steel fasteners.

B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless otherwise indicated.

1. Provide square or hex socket flat-head machine screws for exposed fasteners unlessotherwise indicated.

D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to design load, in accordance with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193or ICC-ES AC308.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.

2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 (A4) stainless steel bolts, ASTM F593, and nuts; ASTM F594 (ASTM F836M).

2.9 MISCELLANEOUS MATERIALS

A. Handrail Brackets: Stainless steel with center of handrail; dimensions as noted on the drawings.

1. Provide brakcets with flange tapped for concealed anchorage to threaded hanger bolt.

2. Provide brackets with predrilled hole for exposed bolt anchorage.

3. Provide brackets with predrilled hole for bolted anchorage and with snap-on cover that matches rail finish and conceals bracket base and bolt head.

B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

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

D. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Anchoring Cement: At exterior locations provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

E. Railing Post Escutcheon Cover Plate (Keynote: 057300-J): Round; inside diameter to fit diameter or railing post. Material and finish to match railing system.

F. Pipe Sleeves (Keynote: 057300-K): 3" Diameter sch 40 Pipe sleeve, galvanized

2.10 FABRICATION OF METAL RAILINGS

A. Fabricate railings to comply with requirementuths indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation Use connectiosn that maintain structural value of joined pieces.

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

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

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

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

1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

H. Form changes in direction as follows:

1. By flush bends unless noted for a radius bend.

2. By radius bends of radius indicated.

I. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

J. Close exposed ends of hollow railing members with prefabricated end fittings.

K. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, handrail brackets, miscellaneous fittings, and anchors to interconnect railing members to other work where indicated.

L. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

M. For railing posts set in concrete, provide stainless steel sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with metal plate forming bottom closure.

2.11 METAL FINISH REQUIREMENTS, GENERAL

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.12 STAINLESS STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Dull Satin Finish: ASTM A480/A480M, No. 6.

PART 3 EXECUTION

3.1 INSTALLATION

A. Comply with Drawings and manufacturer's written instructions for installing glazed decorative metal railings, accessories, and other components.

B. Perform cutting, drilling, and fitting required for installing metal railings.

1. Fit exposed connections together to form tight, hairline joints.

2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.

3. Set railings accurately in location, alignment, and elevation; measured from established lifnes and levels.

4. Do not weld, cut, or abrade surfaces of metal railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.

5. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).

6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (5 mm in 3 m).

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.2 METAL RAILING CONNECTIONS

A. Expansion Joints: Install expansion joints not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches (50 mm) beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches (150 mm) of post.

B. METAL ANCHORING POSTS

1. Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted in sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

2. Form or core-drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

3. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.

4. Leave anchorage joint exposed with 1/8-inch (3-mm) buildup, sloped away from post.

5. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

    a. For stainless steel railings, weld flanges to posts and bolt to metal-supporting surfaces.

C. CLEANING

1. Clean aluminum and stainless steel by washing thoroughly with water and soap, rinsing with clean water, and wiping dry.

2. Clean and polish glass as recommended in writing by manufacturer. Wash both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion.

D. PROTECTION

1. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

2. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

E. Isolate dissimilar materials with bituminous coating, bushings, grommets, or washers to prevent electrolytic corrosion.

3.3 FIELD QUALITY CONTROL

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

B. Manufacturer Services: Provide services of manufacturer's field representative to observe railing installation.

3.4 CLEANING

A. Remove protective film from exposed metal surfaces.

B. Metal: Clean exposed metal finishes with potable water and mild detergent in accordance with manufacturer recommendations; do not use abrasive materials or chemicals, detergents, or other substances that may damage material or finish.

3.5 PROTECTION

A. Protect installed components and finishes from damage after installation.

B. Repair damage to exposed, making finishes indistinguishable from undamaged areas.

C. Replace finishes and components that have irreparable damage. Ensure damaged areas are indistinguishable from undamaged finishes and surfaces.

END OF SECTION 05 73 00

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nonstructural dimension lumber framing.

B. Sheathing.

C. Preservative treated wood materials.

D. Fire retardant treated wood materials.

E. Miscellaneous framing and sheathing.

F. Communications and electrical room mounting boards.

G. Concealed wood blocking, nailers, and supports.

H. Miscellaneous wood nailers, furring, and grounds.

1.2 REFERENCE STANDARDS

A. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

B. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing.

C. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

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

E. AWPA U1 - Use Category System: User Specification for Treated Wood.

F. PS 1 - Structural Plywood.

G. PS 20 - American Softwood Lumber Standard.

1.3 SUBMITTALS

A. Product Data: Provide technical data on insulated sheathing, wood preservative materials, and application instructions.

1.4 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.

1. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.

2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

2.2 DIMENSION LUMBER

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:

1. Lumber: S4S, No. 2.

2. Boards: Standard or No. 3.

2.3 CONSTRUCTION PANELS

A. Wall Sheathing: APA Rated Plywood, PS 1, Grade C-C, Exterior Exposure.

B. Wall Sheathing: Glass mat faced gypsum, ASTM C1177/C1177M, 1/2 inch.

1. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

2. Edges: Square.

3. Products:

    a. CertainTeed Corporation; GlasRoc Brand: www.certainteed.com/#sle.

    b. Georgia-Pacific Gypsum; DensGlass Sheathing: www.gpgypsum.com/#sle.

    c. USG Corporation; Securock Brand UltraLight Glass-Mat Sheathing Regular 5/8 in. (15.9 mm): www.usg.com/#sle.

C. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

D. Other Applications:

1. Plywood Concealed From View But Located Within Exterior Enclosure: APA Rated Plywood, PS 1, C-C Plugged or better, Exposure 1.

2. Plywood Exposed to View But Not Exposed to Weather: APA Rated Plywood, PS 1, A-D, or better.

3. Other Locations: APA Rated Plywood, PS 1, C-D Plugged or better.

2.4 ACCESSORIES

A. Fasteners and Anchors:

1. Metal and Finish:

    a. Electroplated complying with ASTM F1941, unless noted otherwise.

    b. Hot-dipped galvanized steel complying with ASTM B695, Class 55 for fire retardant-treated wood locations.

    c. Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations.

2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.

3. Anchors: Expansion shield and lag bolt type for anchorage to solid masonry or concrete.

2.5 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.

2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Fire Retardant Treatment:

1. Products:

a. Hoover Treated Wood Products, Inc: www.frtw.com/#sle.

b. Koppers, Inc: www.koppersperformancechemicals.com/#sle.

c. Viance, LLC: www.treatedwood.com/#sle.

2. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.

a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.

b. Treat exterior rough carpentry items.

c. Do not use treated wood in direct contact with the ground.

3. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.

a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.

b. Interior rough carpentry items are to be fire retardant treated.

c. Do not use treated wood in applications exposed to weather or where the wood may become wet.

C. Preservative Treatment:

1. Products:

a. Koppers Performance Chemicals, Inc: www.koppersperformancechemicals.com/#sle.

b. Viance, LLC: www.treatedwood.com/#sle.

2. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.

a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.

b. Treat lumber exposed to weather.

c. Treat lumber in contact with roofing, flashing, or waterproofing.

d. Treat lumber in contact with masonry or concrete.

e. Treat lumber less than 18 inches above grade.

f. Treat lumber in other locations as indicated.

3. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative.

a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.

b. Treat plywood in contact with roofing, flashing, or waterproofing.

c. Treat plywood in contact with masonry or concrete.

d. Treat plywood less than 18 inches above grade.

e. Treat plywood in other locations as indicated.

f. Treat plywood _____.

4. Preservative Pressure Treatment of Lumber in Contact with Soil: AWPA U1, Use Category UC4A, Commodity Specification A using waterborne preservative.

    a. Preservative for Field Application to Cut Surfaces: As recommended by manufacturer of factory treatment chemicals for brush-application in the field.

    b. Restrictions: Do not use lumber or plywood treated with chromated copper arsenate (CCA) in exposed exterior applications subject to leaching.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.2 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to authorities having jurisdiction may be used in lieu of solid wood blocking.

C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

F. Provide the following specific nonstructural framing and blocking:

1. Cabinets and shelf supports.

2. Wall brackets.
3. Handrails.
4. Grab bars.
5. Towel and bath accessories.
6. Wall-mounted door stops.
7. Tack boards and marker boards.
8. Wall paneling and trim.
9. Joints of rigid wall coverings that occur between studs.
10. Other locations as indicated on drawings.

3.3 INSTALLATION OF CONSTRUCTION PANELS

A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using screws.

1. Fastening: #10 bugle head screws, 6" o.c. at panel edges, 12" o.c. at intermediate supports.

B. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.

1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
3. Install adjacent boards without gaps.

3.4 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Variation from Plane, Other than Floors: 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.5 CLEANING

A. Waste Disposal: See Section 01 74 19 - Construction Waste Management and Disposal.

1. Comply with applicable regulations.

2. Do not burn scrap on project site.

3. Do not burn scraps that have been pressure treated.

4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION 06 10 00

SECTION 06 41 00 - ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Countertops.

C. Hardware.

1.2 REFERENCE STANDARDS

A. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use.

B. AWI (QCP) - Quality Certification Program.

C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards.

D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0.

E. BHMA A156.9 - American National Standard for Cabinet Hardware.

1.3 SUBMITTALS

A. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.

2. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

3. Include certification program label.

B. Product Data: Provide data for hardware accessories.

C. Samples: For each finish product specified, minimum 8 inches square, representing actual product, color, and patterns.

D. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.

B. Quality Certification:

1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.

2. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.

3. Provide designated labels on shop drawings as required by certification program.

4. Provide designated labels on installed products as required by certification program.

5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

6. Replace, repair, or rework all work for which certification is refused.

1.5 MOCK-UPS

A. Provide mock-up of typical base cabinet, wall cabinet, and countertop, including hardware, finishes, and plumbing accessories.

B. Locate where directed.

C. Mock-up may remain as part of the work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.7 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.1 CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Plastic Laminate Faced Cabinets: Custom grade.

C. Cabinets at Classrooms:

1. Finish - Exposed Exterior Surfaces: Decorative laminate.
    a. Basis of Design: Wilsonart; Cherry PB Sienna
2. Finish - Exposed Interior Surfaces: Decorative laminate.
    a. Basis of Design: Wilsonart, Cherry PB Sienna
3. Finish - Semi-Exposed Surfaces: Decorative laminate
4. Finish - Concealed Surfaces: Manufacturer's option.
5. Finish - Countertop: Solid Surface
    a. Basis of Design: Corian, Linen
6. Door and Drawer Front Edge Profiles: Square edge with thin applied band.
7. Casework Construction Type: Type B - Face-frame.
8. Interface Style for Cabinet and Door: Style 1 - Overlay; reveal overlay.
9. Grained Face Layout for Cabinet and Door Fronts: Flush panel.
    a. Custom Grade: Doors, drawer fronts and false fronts wood grain to run and match vertically within each cabinet unit.
10. Adjustable Shelf Loading: 50 psf.
11. Cabinet Style: Flush overlay.
12. Cabinet Doors and Drawer Fronts: Flush style.

D. Casework at Mudroom:

1. Finish - Exposed Exterior Surface: Solid Surface
    a. Basis of Design: Corian, Linen
2. Finish - Semi-Exposed Surfaces: Solid Surface
    a. Basis of Design: Corian, Linen
3. Finish - Exposed Exterior Surface: Solid Surface
    a. Basis of Design: Corian, Linen
4. Finsh - Countertop: Solid Surace
    a. Basis of Design: Corian, Linen

E. Cabinets at [Offices, Flex Office and Lactation/Quiet Room]:
1. Finish - Exposed Exterior Surfaces: Decorative laminate.
    a. Basis of Design: Wilsonart, Cherry PB Sienna
2. Finish - Semi-Exposed Surfaces: Decorative Laminate
3. Finish - Exposed Interior Surfaces: Decorative laminate.
    a. Basis of Design: Wilsonart, Cherry PB Sienna
4. Finish - Concealed Surfaces: Manufacturer's option.
5. Finish - Countertop: Solid Surface
    a. Basis of Design: Corian, Lin
6. Door and Drawer Front Edge Profiles: Square edge with thin applied band.
7. Casework Construction Type: Type B - Face-frame
8. Interface Style for Cabinet and Door: Style 1 - Overlay; reveal overlay.
9. Grained Face Layout for Cabinet and Door Fronts: Flush panel.
    a. Custom Grade: Doors, drawer fronts and false fronts wood grain to run and match vertically within each cabinet unit.
10. Adjustable Shelf Loading: 50 psf.

11. Cabinet Style: Flush overlay.
12. Cabinet Doors and Drawer Fronts: Flush Style.

F. Cabinets at [Reception Desk in Lobby]:

1. Finish - Exposed Exterior Surfaces: Decorative laminate.
    a. Basis of Design: Wilsonart, Carbon Mesh
2. Finish - Semi-Exposed Surfaces: Decorative laminate.
3. Finish - Exposed Interior Surfaces: Decorative laminate.
    a. Basis of Design: Wilsonart, Carbon Mesh
4. Finish - Concealed Surfaces: Manufacturer's option.
5. Finish - Countertop: Solid Surface
    a. Basis of Design: Corian, Excavage
6. Door and Drawer Front Edge Profiles: Square edge with thin applied band.
7. Casework Construction Type: Type B - Face-frame
8. Interface Style for Cabinet and Door: Style 1 - Overlay; reveal overlay
9. Grained Face Layout for Cabinet and Door Fronts: Flush Panel
    a. Custom Grade: Doors, drawer fronts and false fronts wood grain to run and match vertically within each cabinet unit.
10. Adjustable Shelf Loading: 50 psf.
11. Cabinet Style: Flush overlay
12. Cabinet Doors and Drawer Fronts: Flush Style

2.2 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.3 PANEL CORE MATERIALS

A. Medium Density Fiberboard (MDF): Composite panel composed of cellulosic fibers, additives, and bonding system; cured under heat and pressure; comply with ANSI A208.2.

1. Grade: 115; moisture resistance: MR10.

2.4 LAMINATE MATERIALS

A. Manufacturers:

1. Formica Corporation: www.formica.com/#sle.

2. Panolam Industries International, Inc: www.panolam.com/#sle.

3. Wilsonart LLC: www.wilsonart.com/#sle.

B. Provide specific types as indicated.

1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, colors as indicated, finish as indicated.

2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, colors as indicated, finish as indicated.

3. Post-Formed Horizontal Surfaces: HGP, 0.039 inch nominal thickness, through color, colors as indicated, finish as indicated.

4. Post-Formed Vertical Surfaces: VGP, 0.028 inch nominal thickness, colors as indicated, finish as indicated.

5. Cabinet Liner: CLS, 0.020 inch nominal thickness, through color, color as selected, finish as indicated.

2.5 COUNTERTOPS

A. Solid Surfacing Countertops (Keynote: 064100-F): Solid surfacing sheet or plastic resin casting over continous substrate:

1. Flat Sheet Thickness: 1/2 inch, minimum.

2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard working tools; no surface coating; color and pattern consistent throughout thickness.

a. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.

b. Finish on Exposed Surfaces: Semi-gloss, gloss rating of 25 to 50.

c. Color and Pattern: As indicated.

3. Other Components Thickness: 1/2 inch, minimum.

4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; edge profile as indicated on the drawings.

5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.

6. Fabricate in accordance with manufacturer's standard requirements.

2.6 BENCH

A. Plastic Lumber (Keynote:064100-X): Custom engineered extruded shapes manufacturered from purified blends of post consumer, post industrial, and virgin HPDE base resins.

1. Product: Polytuf Dimensional by Tangent Materials; www.tangentusa.com

2. Size: 3/4"x3"

3. Texture: Smooth on all sides. No embossed pattern. Uniform finish.

4. Color: Milwaukee Brown

5. Recycled Content: 95% minimum

2.7 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Fasteners: Size and type to suit application.

C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

D. Concealed Joint Fasteners: Threaded steel.

E. Grommets (Keynote: 064100-Q): Standard plastic grommets for cut-outs, in color to match adjacent surface.

F. Under desk open wire form cable organizer. Black. (Keynote: 064100-S)

1. Basis of Design: Mockett or approved equal.

G. Heavy Duty metal shelf and two rods (Keynote: 064100-W): Length as indicated on drawings.

H. Bench Support Bracket (Keynote: 064100-Z): Steel, minimum 12" deep. Spacing as noted on the drawings. Concrete screws to provide anchorage.

2.8 HARDWARE

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.

B. Metal Z-Shaped Wall Cabinet Support Clips: Paired, cleated, structural anchorage components applied to back of cabinets and walls for wall cabinet mounting.

C. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.

D. Countertop Support Brackets (Keynote: 064100-N): Fixed, L-shaped, face-of-stud mounting.

1. Materials: Steel; T-shape cross-section.

a. Finish: Manufacturer's standard, factory-applied, powder coat.

b. Color: Black.

2. Products:

a. Rakks/Rangine Corporation; Eclipse Brackets: www.rakks.com/#sle.

E. Drawer and Door Pulls: "U" shaped wire pull, aluminum with satin finish, 4 inch centers.

F. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish.

G. Cabinet Catches and Latches:

1. Type: Push latch.

H. Drawer Slides:

1. Type: Full extension with overtravel.
2. Static Load Capacity: Heavy Duty grade.
3. Mounting: Bottom mounted.
4. Stops: Integral type.
5. Features: Provide self closing/stay closed type.

I. Drawer Systems: Integrated drawers and slides.

1. Side Type: Single wall.
2. Extension Type: Full extension.
3. Mounting: Side mounted.
4. Stops: Integral type.

J. Soft-Close, Door and Drawer Adjustable Dampers:

1. Manufacturers:
   a. Grass America Inc: www.grassusa.com/#sle.
   b. Titus Cabinet Hardware; Slidix: www.titusplus.com/us/en/#sle.
   c. Titus Cabinet Hardware; Titusoft Dampers for Drawers: www.titusplus.com/us/en/#sle.

K. Hinges: European style concealed self-closing type, steel with satin finish.

2.9 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.

E. Matching Wood Grain: Comply with requirements of quality standard for specified Grade and as follows:

1. Provide center matched panels at each elevation.

2. Provide sequence matching across each elevation.

F. Mechanically fasten back splash to countertops as recommended by laminate manufacturer at 16 inches on center.

G. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

H. Solid Surfacing: Fabricate tops up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

2.10 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify adequacy of backing and support framing.

3.2 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

C. Use fixture attachments in concealed locations for wall mounted components.

D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

E. Secure cabinets to floor using appropriate angles and anchorages.

F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.3 ADJUSTING

A. Adjust installed work.

B. Adjust moving or operating parts to function smoothly and correctly.

3.4 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION 06 41 00

(This page intentionally left blank)

SECTION 06 42 00 - WOOD PANELING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Reclaimed wood paneling.

B. Shop finishing.

1.2 REFERENCE STANDARDS

A. AWI (QCP) - Quality Certification Program.

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards.

C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0.

1.3 SUBMITTALS

A. Product Data: Provide data on fire-retardant treatment materials and application instructions.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.

2. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

C. Samples: Submit two samples of finished plywood, 8x8 inch in size, illustrating wood grain and specified finish.

D. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.

2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.

3. Single Source Responsibility: Provide and install this work from single fabricator.

B. Quality Certification: Provide AWI (QCP) inspection report and quality certification of completed work.

1. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.

2. Provide designated labels on shop drawings as required by certification program.

3. Provide designated labels on installed products as required by certification program.

4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.5 MOCK-UP

A. Construct mock-up, 6 feet long by 6 feet wide, illustrating full panel sheet, edge trim, joint trim, applied finish .

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect work from moisture damage.

PART 2 PRODUCTS

2.1 PANELING

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless otherwise indicated.

B. Reclaimed Wood Paneling:

1. Thickness: 3/4 inch.

2. Face Width: 4 inches.

3. Length: 1 foot.
4. Species: to match the reclaimed wood provided by the Owner.
5. Milling Options: Nickel gap.
6. Application: Horizontal.
7. Manufacturers:
    a. Centennial Woods LLC; Reclaimed Wood Paneling: www.centennialwoods.com/#sle.
    b. Or approved equal.

2.2 WOOD-BASED MATERIALS - GENERAL

2.3 ADHESIVES AND FASTENERS

A. Adhesives: Type suitable for intended purpose, complying with applicable air quality regulations.

2.4 FABRICATION

A. Prepare panels for delivery to site, permitting passage through building openings.

B. Finish exposed edges of panels as specified by grade requirements.

2.5 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. Apply wood filler in exposed nail and screw indentations.

C. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:

1. Transparent:
    a. System - 1, Lacquer, Nitrocellulose.
    b. Stain: As selected by Architect.
    c. Sheen: Flat.
    d. Products:

1) Sherwin-Williams; Sher-Wood F3 Hi-Bild Precat Lacquer, Transparent, AWI Finishing System 2: www.sherwin-williams.com/#sle.

2) Or approved equal

D. Wood Sealer: Factory-applied, water-based polymer, water-repellent sealer that reacts chemically with untreated, natural wood surfaces.

2.6 ACCESSORIES

A. Lumber for Shimming, Blocking: Softwood lumber of same species.

B. Wood Filler: Tinted to match surface finish color.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Do not begin installation until wood materials have been fully acclimated to interior conditions.

C. Set and secure materials and components in place, plumb and level, using concealed fasteners wherever possible.

3.2 PREPARATION FOR FIELD FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

3.3 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

END OF SECTION 06 42 00

SECTION 07 13 00 - SHEET WATERPROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Self-adhered sheet membrane waterproofing.

1.2 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension.

B. ASTM D570 - Standard Test Method for Water Absorption of Plastics.

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

D. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

E. ASTM D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.

F. ASTM D5295/D5295M - Standard Guide for Preparation of Concrete Surfaces for Adhered (Bonded) Membrane Waterproofing Systems.

G. ASTM D5385/D5385M - Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes.

H. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.

I. NRCA (WM) - The NRCA Waterproofing Manual.

1.3 SUBMITTALS

A. Product Data: Provide data for membrane.

B. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.

C. Manufacturer's Installation Instructions: Indicate special procedures.

D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

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

1.5 MOCK-UPS

A. Construct mock-up consisting of 100 sq ft of horizontal and vertical sheet waterproofing panel; to represent finished work including internal and external corners, seam jointing, and attachment method.

B. Locate where directed.

C. Mock-up may remain as part of work.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until liquid or mastic accessories have cured.

1.7 WARRANTY

A. Contractor to correct defective Work within period of five years after Date of Substantial Completion; remove and replace materials concealing waterproofing at no extra cost to Owner.

B. Provide five year manufacturer warranty for waterproofing failing to resist penetration of water, except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

PART 2 PRODUCTS

2.1 SHEET WATERPROOFING APPLICATIONS

A. Self-Adhered Modified Bituminous Sheet Membrane:

1. Location: Below grade applications as shown on drawings.

2. Cover with rigid insulation board with drainage channel and filter fabric where shown on drawings.

B. Self-Adhered Modified Bituminous High Temperature Sheet Membrane:

1. Location: Metal copings and trims, and other locations as shown on the drawings.

2.2 SHEET WATERPROOFING MATERIALS

A. Self-Adhered Modified Bituminous Sheet Membrane (Keynote 071300-A):

1. Thickness: 60 mil, 0.060 inch, minimum.

2. Sheet Width: 36 inches, minimum.

3. Tensile Strength:

a. Film: 5,000 psi, minimum, measured in accordance with ASTM D882 and at grip-separation rate of 2 inches per minute.

b. Membrane: 325 psi, minimum, measured in accordance with ASTM D412 Method A, using die C and at spindle-separation rate of 2 inches per minute.

4. Elongation at Break: 300 percent, minimum, measured in accordance with ASTM D412.

5. Water Vapor Permeance: 0.05 perm, maximum, measured in accordance with ASTM E96/E96M.

6. Low Temperature Flexibility: Unaffected when tested in accordance with ASTM D1970/D1970M at minus 20 degrees F, 180 degree bend on 1 inch mandrel.

7. Adhesion: 150 psi, minimum, measured in accordance with ASTM D4541.

8. Water Absorption: 0.1 percent increase in weight, maximum, measured in accordance with ASTM D570, 24 hour immersion.

9. Hydrostatic Pressure Resistance: Membrane resists leakage for at least one hour from pressure equivalent to 200 feet head of water applied in accordance with test method ASTM D5385/D5385M.

10. Adhesives, Sealants, Tapes, and Accessories: As recommended by membrane manufacturer.

11. Products:

a. Carlisle Coatings & Waterproofing Inc; MiraDRI 860/861: www.carlisleccw.com/#sle.

b. Henry Company; Blueskin WP 200: www.henry.com/#sle.

c. W.R. Meadows, Inc; MEL-ROL: www.wrmeadows.com/#sle.

d. Or approved equal.

B. High Temperature Self-Adhered Modified Bituminous Sheet Membrane (Keynote 071300-B):

1. Thickness: 40 mil, 0.040 inch, minimum.

2. Sheet Width: 36 inches, minimum.

3. Tensile Strength:

a. Film: 5,000 psi, minimum, measured in accordance with ASTM D882 and at grip-separation rate of 2 inches per minute.

b. Membrane: 600 psi, minimum, measured in accordance with ASTM D412 Method A, using die C and at spindle-separation rate of 2 inches per minute.

4. Elongation at Break: 250 percent, minimum, measured in accordance with ASTM D412.

5. Water Vapor Permeance: 0.05 perm, maximum, measured in accordance with ASTM E96/E96M.

6. Low Temperature Flexibility: Unaffected when tested in accordance with ASTM D1970/D1970M at minus 20 degrees F, 180 degree bend on 1 inch mandrel.

7. Adhesion: 150 psi, minimum, measured in accordance with ASTM D4541.

8. Water Absorption: 0.1 percent increase in weight, maximum, measured in accordance with ASTM D570, 24 hour immersion.

9. Hydrostatic Pressure Resistance: Membrane resists leakage for at least one hour from pressure equivalent to 200 feet head of water applied in accordance with test method ASTM D5385/D5385M.

10. Adhesives, Sealants, Tapes, and Accessories: As recommended by membrane manufacturer.

11. Products:

    a. Henry Company; Henry PE200HT; www.herny.com

    b. GCP Applied Technologies; Grace Ice & Water Shield; www.gcpat.com

    c. Or approved equal.

2.3 ACCESSORIES

A. Primer: As recomended by membrane manufacturer.

B. Seaming Materials: As recommended by membrane manufacturer.

C. Membrane Sealant: As recommended by membrane manufacturer.

D. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrates and waterproofing materials.

E. Drainage Panel: Drainage layer with geotextile filter fabric on earth side.

1. Composition: Dimpled polystyrene core; polypropylene filter fabric.

2. Thickness: As indicated on drawings.

    a. Products:

        1) Mar-flex Waterproofing & Building Products; ArmorDrain 110: www.mar-flex.com/#sle.

        2) W.R. Meadows, Inc; Mel-Drain 5012: www.wrmeadows.com/#sle.

        3) Or approved equal.

F. Flexible Flashings: Type recommended by membrane manufacturer.

G. Termination Bars: Stainless steel; compatible with membrane and adhesives.

H. Surface Conditioner: Spray or roller type, compatible with membrane.

I. Adhesives: As recommended by membrane manufacturer.

J. Thinner and Cleaner: As recommended by adhesive manufacturer, compatible with sheet membrane.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions are acceptable prior to starting work.

B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.

C. Verify that items penetrating surfaces to receive waterproofing are securely installed.

D. Where existing conditions are responsibility of another installer, notify Architect of unsatisfactory conditions.

E. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect adjacent surfaces from damage not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.

C. Do not apply waterproofing to surfaces unacceptable to membrane manufacturer.

D. Fill nonmoving joints and cracks with a filler compatible with waterproofing materials.

E. Seal moving cracks with sealant and nonrigid filler, using procedures recommended by sealant and waterproofing manufacturers.

F. Prepare building expansion joints at locations as indicated on drawings.

G. Surfaces for Adhesive Bonding: Apply surface conditioner at a rate recommended by manufacturer, and protect conditioner from rain or frost until dry.

H. Concrete Surfaces for Adhesive Bonding: Prepare concrete substrate in accordance with ASTM D5295/D5295M.

1. Remove substances that inhibit adhesion including form release agents, curing compounds admixtures, laitance, moisture, dust, dirt, grease and oil.

2. Repair surface defects including honeycombs, fins, tie holes, bug holes, sharp offsets, rutted cracks, ragged corners, deviations in surface plane, spalling and delaminations, as described in reference standard.

3. Remove and replace areas of defective concrete; see Section 03 30 00.

4. Prepare concrete for adhesive bonded waterproofing using mechanical or chemical methods described in referenced standard.

5. Test concrete surfaces as described in referenced standards, and verify surfaces are ready to receive adhesive bonded waterproofing membrane system.

3.3 INSTALLATION - MEMBRANE

A. Install membrane waterproofing in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.

B. Roll out membrane, and minimize wrinkles and bubbles.

C. Self-Adhering Membrane: Remove release paper layer, and roll out onto substrate with a mechanical roller to provide full contact bond.

D. Overlap edges and ends, minimum 3 inches, seal permanently waterproof by method recommended by manufacturer, and apply uniform bead of sealant to joint edge.

E. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.

F. Weather lap joints on sloped substrate in direction of drainage, and seal joints and seams.

G. Coordinate with foundation drain installation as shown on drawings.

H. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.

I. Seal membrane and flashings to adjoining surfaces.

1. Install termination bar along edges.

2. Install counterflashing over exposed edges.

3.4 FIELD QUALITY CONTROL

A. Engage a site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish daily reports to Architect.

B. Prepare test and inspection reports.

3.5 PROTECTION

A. Do not permit traffic over unprotected or uncovered membrane.

END OF SECTION 07 13 00

SECTION 07 21 00 - THERMAL INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Board insulation with integrated structural sheathing and air and water-resistive barrier at exterior wall construction.

B. Board insulation at perimeter foundation wall, underside of floor slabs, and wall parapets.

C. Batt insulation in wall construction.

D. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.2 REFERENCE STANDARDS

A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

C. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

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

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.4 SUBMITTALS

A. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

B. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection required by ABAA QAP.

C. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

D. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of contractor accreditation and installer certification on project site during and after installation. Present on-site documentation upon request.

1.5 QUALITY ASSURANCE

A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); www.airbarrier.org/#sle:

1. Installer Qualification: Use accredited contractors, certified installers, evaluated materials, and third-party field quality control audit.

2. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture. Use secondary materials approved in writing by primary material manufacturer.

1.6 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.1 APPLICATIONS

A. Insulation Under Concrete Slabs on Deck: Polyisocyanurate board.

B. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.

C. Insulation for Protection Board and Drainage Panel: Extruded polystyrene (XPS) board with drainage channel and filter fabric.

D. Insulation at Parapets Walls (Back and Top Sides): Polyisocyanurate board.

E. Insulation Inside Masonry Cavity Walls, Continuous: Polyisocyanurate Structural Insulated Sheathing board.

F. Insulation Over Concrete Walls, Continuous: Polyisocyanurate Structural Insulated Sheathing board.

G. Insulation Over Metal Stud Framed Walls, Continuous: Polyisocyanurate Structural Insulated Sheathing board.

H. Insulation in Metal Framed Walls: Batt insulation with no vapor retarder.

2.2 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene (XPS) Board Insulation: Comply with ASTM C578 with either natural skin or cut cell surfaces.

1. Perimeter of Foundations, Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum.

2. Protection Board and Drainage Panel (Keynote 072100-D), Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum, with filter fabric covered cut drain channels.

a. Products:

1) Owens Corning Corporation; FOAMULAR TYPE NGX INSUL-DRAIN Extruded Polystyrene (XPS) Insulation: www.ocbuildingspec.com.

2) Or approved equal.

3. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.

4. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.

5. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88), minimum, per 1 inch thickness at 75 degrees F mean temperature.

B. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, comply with ASTM C1289.

1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.

2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.

3. Board Size: 48 inch by 96 inch.

C. Polyisocyanurate (ISO) Structural Insulated Sheating (SIS) with Factory Applied Air and Water-Resistive Membrane Coating (Keynote: 072100-J):

1. Type: UL Classified and Audited Production:

a. Magnesium Oxide (MgO) Board Facer; 1/2” (12 mm) thickness.

2. Fused Rigid Foam Insulation:

a. Class 1 Rated Urethane Insulation.

b. Fused directly to rear face of sheathing layer.

1) Laminations are not acceptable.

c. Closed Cell Content equal to or greater than 90%.

3. Air and Water-Resistive Barrier:

a. Factory applied vapor permeable:

1) ASTM E96 Method B Water Vapor Transmission: 18 perms at 10 mils.

2) ASTM E2178 Air Permeance: 0.0005 cfm/sf at 1.57 psf.

4. Panel Size:

a. 4 feet by 8 feet (1220 mm by 2440 mm).

5. Thickness / R-Value per ASTM C518:

a. 2 ¾ inches (69.85 mm) composite thickness with R-Value of R-15.

6. Products:

a. DuPont de Nemours, Inc; ArmorWall Plus FR SIS: building.dupont.com.

b. Or approved equal.

2.3 MINERAL FIBER BLANKET INSULATION MATERIALS

A. Mineral Wool Blanket Thermal Insulation (Keynote 072100-B): Flexible or semi-rigid preformed insulation, complying with ASTM C665.

1. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.

2. Thickness: As shown on drawings.

3. Compliance with California Department of Public Health (CDPH) Standard Method v1.2–2017 or compliance with GREENGUARD Gold certification.

2.4 ACCESSORIES

A. Self-Adhered Transition Flashing: Multipurpose, self-adhered flashing with modified butyl adhesive, polyester fiber top sheet, and polypropylene interlayer.

1. Application: Primerless adhesion for use as through-wall flashings and wall transitions to roof and below-grade systems.

2. Thickness: 45 mil, 0.045 inch, nominal.

3. Size: 6 inches wide, in rolls 75 feet long.

4. Products:

a. DuPont de Nemours, Inc; DuraGard CM Transition Flashing: building.dupont.com/#sle.

b. Or approved equal.

B. Tape joints of rigid insulation in accordance with insulation manufacturers' instructions.

C. Insulation Fasteners: Appropriate for purpose intended.

1. Length as required for thickness of insulation material and penetration of substrate.

D. Fastners for SIS Panels (Keynote: 072100-J):

1. Fasteners shall be approved ArmorWall panel fasteners. Fasteners are corrosion resistant type with oversized heads. Length of fasteners shall be as determined by the panel manufacturer.

a. ArmorWall panels require Concealor Low Profile Fasteners #14-13 DP1 with Tri-Seal Long-Life Coating.

1) For use in 18-gauge or higher steel:

(a) Minimum fastener penetration of through the steel with a minimum of three (3) threads showing on the opposite face.

2) For use in concrete substrates:

(a) Pre-drill panel and concrete substrate using a 3/16" (0.187") masonry drill bit.

(b) Install fastener using a 2,000 RPM hammer drill.

(c) Minimum embedment depth into substrate of one-inch.

(d) Do not exceed one one-half inch embedment.

b. ArmorWall panels require Concealor Low Profile Fasteners ¼-14 DP3 with Tri-Seal Long-Life Coating.

1) For use in 18-gauge steel to ¼" plate steel:

(a) Minimum fastener penetration of through the steel with a minimum of three (3) threads showing on the opposite face.

E. Accessories for SIS Panels (Keynote: 072100-J):

1. Joints and Fastener Heads shall be covered with manufacturer required sealant and/or

a. ArmorSeal Sealant gunnable grade polyether sealant.

2. Window and Door Sills shall be coated with manufacturer required coating.

a. ArmorSeal Sealant trowel grade polyether sealant.

3. (Keynote: 072100-M) Gaps and Penetrations shall be coated with manufacturered required coating.

a. Dupont LiquidArmor FJ Flashing and Joint Compound or approved equal.

F. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation and adhesive.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.2 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Apply adhesive to back of boards: Per manufacturer's recommendations.

B. Install boards horizontally on foundation perimeter.

1. Place boards to maximize adhesive contact.

2. Install in running bond pattern.

3. Butt edges and ends tightly to adjacent boards and to protrusions.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.3 BOARD INSTALLATION AT CAVITY WALLS AND EXTERIOR WALLS

A. Install in accordance with manufacturer’s instructions.

B. Install without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within plane of insulation.

E. Exposed insulation must always be protected from open flame and kept dry.

F. Fasten structural insulated sheathing to the structural base wall.

G. Exterior wall insulation layer is not intended to be left exposed for extended periods of time in excess of fifteen (15) days without adequate protection. If extended exposure is anticipated all exposed foam surfaces including corners, window and door openings, should be covered with a compatible waterproof tape.

H. Install ArmorSeal sealant gunnable grade at all fastener heads, seams, inside and outside corners providing a one-inch seal in either direction of each seam or opening.

3.4 BATT INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

3.5 FIELD QUALITY CONTROL

A. Coordination of Air Barrier Association of America (ABAA) Tests and Inspections:

1. Provide testing and inspection required by ABAA Quality Assurance Program (QAP).

2. Notify ABAA in writing of schedule for air barrier work, and allow adequate time for testing and inspection.

3. Cooperate with ABAA testing agency.

4. Allow access to air barrier work areas and staging.

5. Do not cover air barrier work until tested, inspected, and accepted.

3.6 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION 07 21 00

SECTION 07 21 63 - FLUID-APPLIED INSULATIVE COATING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Spray-applied insulative coating including primer, insulative coating and topcoat for the following applications:

1. As indicated on the drawings.

1.2 REFERENCES

A. American Institute of Steel Construction (AISC)

1. AISC 303, Section 10 – Erection and storage of coated material during shipment and site handling shall be protected to minimize field touch up.

B. ASTM International

1. ASTM B117 – Standard Practice for Operating Salt Spray (Fog) Apparatus

2. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

3. ASTM C1057 – Standard Practice for Determination of Skin Contact Temperature from Heated Surfaces Using a Mathematical Model and Thermesthesiometer.

4. ASTM D870 – Standard Practice for Testing Water Resistance of Coatings Using Water Immersion.

5. ASTM D4060 – Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.

6. ASTM D4541 – Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.

7. ASTM D4585 – Standard Practice for Testing Water Resistance of Coatings Using Controlled Condensation.

8. ASTM D4587 – Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings.

9. ASTM D4624/ISO 4624 – Standard Test Method for Bond Strength

10. ASTM D5894 – Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet).
11. ASTM D695 – Standard Test Method for Compressive Strength
12. ASTM D790 – Standard Test Method for Flexural Strength
13. ASTM D2240 – Standard Test Method for Determining Durometer Hardness
14. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
15. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials.

C. Association of the American Walls and Ceilings Industries (AWCI)

D. Underwriters Laboratory (UL):

1. UL 263: Standard for Fire Tests of Building Construction and Materials.

E. The Society of Protective Coatings (SSPC)

1. SSPC-SP6: Commercial Blast Cleaning Standard
2. SSPC-SP12: Surface Preparation and Cleaning of Metals by. Waterjetting Prior to Recoating.
3. SSPC-PA1: Shop, Field, and Maintenance Painting of Steel.
4. SSPC-PA2: Procedure for Determining Conformance to Dry Coating Thickness Requirements.

1.3 SYSTEM DESCRIPTION

A. The liquid applied thermal break acrylic material shall be applied at the required thickness specified by the manufacturer in order to mitigate thermal bridging. In no case shall the K-value of the liquid applied thermal break be more than 0.040 W/mK.

1.4 SUBMITTALS

A. Product Data: Submit product data including manufacturers technical data indicating product performance characteristics, performance and limitation criteria.

B. Applicator Qualifications: Submit applicators current certification as a manufacturer trained applicator.

1.5 QUALITY ASSURANCE

A. Manufacturer:

1. Company specializing in manufacturing product in this section with a minimum of 2 years documented experience in manufacturing insulative technology.

2. Applicator: Company specializing in applying the work of this section with documented experience and trained by the manufacturer.

3. Fluid-Applied Thermal Break Acrylic system shall be the complete system from a sole source consisting of primer, acrylic thermal break material and topcoat.

B. Mock-up:

1. Minimum thirty days prior to application in any area, provide mock-up Samples of thermal break materials in accordance with the following requirements:

a. Provide minimum two square feet (.18 square meter) on representative substrate, where directed by the Architect, for each different thickness and finish of required for the work.

b. Provide mock-up areas that comply with thickness, density application, finish texture, and color.

c. Inspect mock-up areas within one hour of application for variance due to shrinkage, temperature, and humidity.

d. Where shrinkage and cracking are evident, adjust mixture and method of application as necessary to meet required installation, finish, and color requirements.

e. Continue to provide mock-up areas until acceptable areas are produced.

f. Acceptable areas shall constitute standard of acceptance for method of application, thickness, finish texture, and color requirements, for fluid applied thermal break material applications.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and label

B. Storage: Materials shall be stored in strict accordance with manufacturers documented instructions.

C. Documentation: All batch number, product identification and quantities shall be recorded on appropriate QC documents. A copy of the transport document and manufacturers conformance certificate shall be attached to the material delivery on site.

1.7 FIELD CONDITIONS

A. Project Environmental Requirements: Substrate and air temperature shall be in accordance with the manufacturers' requirements.

1. Protect work area from windblown dust and rain. Protect adjacent areas from over spray of material.

2. Provide ventilation in areas to receive work of this section during application and minimum 24 hours after application.

B. Temperature and Humidity Requirements: Maintain air temperature and relative humidity in areas where products will be applied for a time period before during and after application as recommended by manufacturer.

1. Do not apply Fluid Applied Acrylic Thermal Break when temperature of substrate and/or surrounding ambient air temperature is below 45° F (7° C). Temporary protection and heat shall be maintained at this minimum temperature for 24 hours before, during and 24 hours after material application.

2. Steel substrate temperature shall be a minimum of 5° F (3° C) above the dew point of the surrounding air for a period of 24 hours prior, during the application of the material and 24 hour cure period.

3. If necessary for job schedule, the General Contractor shall provide enclosures and heat to maintain proper temperatures and humidity levels in the application areas.

4. The relative humidity of the application area shall not exceed a maximum of 85% 24 hours prior, during and 24 hours after the application of the material. The relative humidity shall not exceed 75% throughout the application and curing of the decorative top coat finish.

1.8 WARRANTY

A. Provide manufacturer's standard 1 year warranty and applicators workmanship 1 year

PART 2 PRODUCTS

2.1 FLUID-APPLIED INSULATIVE COATING GENERAL

A. Materials Compatibility:

1. Provide shop and field primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

2. Provide products of same manufacturer for each coat in a coating system.

2.2 MANUFACTURERS

A. Provide all paint and coating products from the same manufacturer to the greatest extent possible.

1. In the event that a single manufacturer cannot provide all specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.

B. Insulation Coating:

1. Basis of Design Manufacturer: Tnemec Company Inc., www.tnemec.com

2. Sherwin Williams Company, www.sherwin-williams.com

3. Carboline Company, www.carboline.com

4. Or approved equal.

2.3 FLUID-APPLIED INSULATIVE COATING SYSTEM (KEYNOTE 072163-A)

A. Prime Coat:

1. Zinc-Rich Aromatic Urethane:

a. Tnemec Series 90-97 Tneme-Zinc

1) VOC Content: 321 grams/liter

2) Color: 90-97 Reddish Gray

3) Requirements:

(a) Adhesion to Steel (ASTM D4541): No less than 2,083 psi.

(b) Salt Spray (ASTM B117): No blistering, cracking or delamination of film. No more than 1/8" rust creepage at scribe and no more than 1% rusting on plane after 50,000 hours exposure.

B. Intermediate Coat:

1. Fluid-Applied Acrylic Insulative Coating

a. Tnemec Series 971 Aerolon Acrylic

1) VOC Content: 1.9 grams/liter

2) Solids by Volume: 76 percent.

3) Colors: 1278 Insulation Yellow

4) Requirements:

(a) Abrasion (ASTM D4060): No more than 50.2 mg loss after 1,000 cycles.

(b) Cyclic Salt Fog/UV Exposure (ASTM D5894): No blistering, cracking, rusting or delamination of film after 5,000 hours.

(c) Humidity Resistance (ASTM D4585): No blistering, cracking, rusting, or delamination after 2,000 hours.

(d) Immersion (ASTM D870): No blistering, cracking, rusting, or delamination after six months continuous tap water immersion.

(e) Surface Burning Characteristics (ASTM E84): Class A

(f) Thermal Conductivity (ASTM C518): No greater than 0.0356 W/m-°K or 0.2468 BTU-in/ft2-hr-°F.

(g) NORSOK M-501 ISO 20340: Passed 25 cycles.

(h) CDPH Compliant: Passes the California Department of Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1-2010 (also known as Section 01350).

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.

C. All surfaces to receive the specified Fluid Applied Insulation Coating shall follow the manufacturer's printed instructions and be clean, dry and free of oil, grease, loose mill scale, dirt, dust or other foreign substances which would impair bond of the material to the substrate.

D. Other corrections of the surfaces to receive the Fluid Applied Insulation Coating material shall be the responsibility of the Contractor, at no additional cost to the Owner.

E. Application of the primer, Fluid Applied Insulation Coating, and topcoat shall not commence until the contractor, applicator and inspector have examined the surfaces to receive the primer and determined the surfaces are acceptable to receive the primer and coating. Commencement of application means acceptance of substrate.

F. Verify that substrate and workspace temperature and humidity conditions are in accordance with manufacturers recommendations.

3.2 SURFACE PREPARATION

A. Prepare surfaces in accordance with manufacturer's instructions.

B. Provide masking, drop cloths or other suitable coverings to prevent overspray onto surfaces not intended to be coated with thermal break coating.

C. Weld spatter and defects shall be ground smooth prior to commencement of primer and fluid applied thermal break material.

D. Primer shall not be applied to prepared substrate until the area has been adequately vented to remove all airborne dust. Prior to the application of any coating material, the blast products, dust and debris shall be removed by vacuuming.

E. Steel Substrates: Remove rust and loose mill scale.

1. Fabrication defects:

a. Correct steel and fabrication defects revealed by surface preparation.

b. Remove weld spatter and slag.

c. Round sharp edges and corners of welds to a smooth contour.

d. Smooth weld undercuts and recesses.

e. Grind down porous welds to pinhole-free metal.

f. Remove weld flux from surface.

2. Ensure surfaces are dry.

3. Remove visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter in accordance with SSPC-SP 6/NACE 3, unless otherwise specified.

F. Abrasive Blast-Cleaned Surfaces: Coat abrasive blast-cleaned surfaces with primer before visible rust forms on surface. Do not leave blast-cleaned surfaces uncoated for more than 8 hours.

1. Shop Primer: Prepare shop primer to receive field coat in accordance with manufacturer's instructions.

3.3 COATING APPLICATION

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

1. Mix and thin coatings, including multi-component materials, in accordance with manufacturer's instructions.

2. Keep containers closed when not in use to avoid contamination.

3. Do not use mixed coatings beyond pot life limits.

4. Use application equipment, tools, pressure settings, and techniques in accordance with manufacturer's instructions.

B. Uniformly apply coatings at spreading rate required to achieve specified DFT.

C. Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems.

D. Apply primer at thickness recommended by manufacturer.

E. Apply Thermal Insulative Coating as specified in Section 3 Coating Schedule.

F. Apply topcoat at thickness recommended by the manufacturer.

G. Final Dry Film Thickness (DFT) shall be measured with a dry film thickness gauge.

H. The steel deck is not to be sprayed unless otherwise indicated.

I. Feather edges to minimize appearance of start/stop point when finish coating is applied.

3.4 REPAIR

A. Materials and Surfaces Not Scheduled to Be Coated: Repair or replace damaged materials and surfaces not scheduled to be coated.

B. Damaged Coatings: All patching and repair to material, due to damage by other trades, shall be performed under this section and paid for by the trade responsible for the damage. Patching shall be performed by applicators certified by the manufacturer and applied in accordance with the manufacturer application instructions.

C. Coating Defects: Repair in accordance with manufacturer's instructions coatings that exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems.

3.5 FIELD QUALITY CONTROL

A. The installer will engage an independent testing laboratory inspect and verify the application of material in accordance with the provisions of the manufacturer.

1. Material inspection and testing shall be performed 24 hours after completion of final application coat.

2. The results of the above tests shall be made available to all parties at the completion of each pre-designated area and approval.

3. In-place material not in compliance with the specified thickness requirements shall be corrected prior to final acceptance.

B. The dry film thickness (DFT) of the applied material shall be measured with a non-destructive coating thickness gage after material has completely cured. All measurements shall be documented in writing and furnished to the Owner.

C. Manufacturer's Technical Services: Coordinate with coating manufacturer's technical service department or independent sales representative for current technical data and instructions.

3.6 CLEANING AND PROTECTION

A. Remove overspray materials from surfaces not required to be thermally protected.

B. Protect shop applied coatings prior to installation.

C. Protect surfaces of coating systems from damage during construction.

D. Touch-up, or repair damaged products before Substantial Completion.

3.7 FLUID-APPLIED INSULATIVE COATING SCHEDULE

A. Steel Members Penetrating Exterior Building Envelope/Inside Face of Metal Framing at locations as indicated on drawings:

1. Fluid-Applied Thermal Break System, Zinc-Rich MCU Primer:

a. Surface Preparation: SSPC-SP6/NACE 3

b. Prime Coat (Shop applied): Series 90-97 Tneme-Zinc, DFT of 2.5 to 3.5 mils (65 to 90 microns) per coat.

c. Intermediate Coat (Shop or Field) – Two Coats: Series 971 Aerolon Acrylic, DFT of 40.0 to 50.0 mils (1000 to 1250 microns) per coat. Total thickness of Series 971: 80 to 100 mils (2000 to 2500 microns). Smooth Finish.

END OF SECTION 07 21 63

SECTION 07 25 00 - WEATHER BARRIERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Water-resistive barriers.

1.2 REFERENCE STANDARDS

A. ABAA - Air BarrierAssociation of America.

B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

C. ASTM D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.

D. ASTM E1186 - Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems.

E. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.

1.3 SUBMITTALS

A. Product Data: Provide data on material characteristics.

B. Shop Drawings: Provide drawings of special joint conditions.

1.4 QUALITY ASSURANCE

A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); www.airbarrier.org/#sle:

1.5 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

PART 2 PRODUCTS

2.1 VAPOR RETARDER MATERIALS (AIR BARRIER AND WATER-RESISTIVE)

A. Vapor Retarder and Air Barrier Sheet (Keynote 072500-A): ASTM D1970/D1970M.

1. Type: Rubberized asphalt bonded to thermoplastic sheet, self-adhesive.

2. Thickness: 40 mil, 0.040 inch, nominal.

3. Water Vapor Permeance: 0.05 perm, maximum, when tested in accordance with ASTM E96/E96M.

4. Air Permeance: 0.004 cubic feet per minute per square foot, maximum, when tested in accorance with ASTM E2178.

5. Seam and Perimeter Tape: As recommended by sheet manufacturer.

6. Products:

a. Henry Company; Blueskin SA: www.henry.com.

b. Or approved equal.

2.2 ACCESSORIES

A. Sealants, Tapes, and Accessories Used for Sealing Water-Resistive Barrier and Adjacent Substrates: As indicated or complying with water-resistive barrier manufacturer's installation instructions.

B. Primer: As recommended by membrane manufacturer.

C. Thinners and Cleaners: As recommended by water-resistive barrier manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and conditions comply with requirements of this section.

3.2 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Clean and prime substrate surfaces to receive adhesives in accordance with manufacturer's installation instructions.

3.3 INSTALLATION

A. Install materials in accordance with manufacturer's installation instructions.

B. Self-Adhered Sheets:

1. Prepare substrate in accordance with sheet manufacturer's installation instructions; fill and tape joints in substrate and between dissimilar materials.

2. Lap sheets shingle-fashion to shed water and seal laps airtight.

3. Upon placement of sheets, firmly press onto substrate with resilient hand roller; ensure that laps are firmly adhered with no gaps or fishmouths.

4. Use same material, or other material approved by sheet manufacturer, to seal sheets to adjacent substrates, and as flashing.

3.4 FIELD QUALITY CONTROL

A. Owner’s Inspection and Testing: Cooperate with Owner’s testing agency.

1. Allow access to work areas and staging.

2. Notify Owner’s testing agency in writing of schedule for work of this section to allow sufficient time for testing and inspection.

3. Do not cover work of this section until testing and inspection is accepted.

B. Coordination of ABAA Tests and Inspections:

1. Cooperate with ABAA testing agency.

C. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

D. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:

1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.

2. Continuous structural support of air-barrier system has been provided.

3. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.

4. Site conditions for application temperature and dryness of substrates have been maintained.

5. Maximum exposure time of materials to UV deterioration has not been exceeded.

6. Surfaces have been primed.

7. Laps in sheet materials have complied with the minimum requirements and have been shingled in the correct direction (or mastic applied on exposed edges), with no fishmouths.

8. Termination mastic has been applied on cut edges.

9. Air barrier has been firmly adhered to substrate.

10. Compatible materials have been used.

11. Transitions at changes in direction and structural support at gaps have been provided.

12. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.

13. All penetrations have been sealed.

E. Tests: As determined by Owner's testing agency from among the following tests:

1. Qualitative Air-Leakage Testing: Air-barrier assemblies will be tested for evidence of air leakage according to SMACNA (Phenolic) chamber pressurization or depressurization with smoke tracers.

2. Quantitative Air-Leakage Testing: Air-barrier assemblies will be tested for air leakage according to ASTM E783.

3. Adhesion Testing: Air-barrier assemblies will be tested for minimum air-barrier adhesion of 16 lbf/sq. in. (110 kPa) according to ASTM D4541 for each 600 sq.ft. (56 sq. m) of installed air barrier or part thereof.

F. Air barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.

2. Remove and replace deficient air-barrier components for retesting as specified above.

G. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

3.5 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION 07 25 00

(This page intentionally left blank)

SECTION 07 41 13 - METAL ROOF PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal roof panel system of preformed steel panels.

1.2 REFERENCE STANDARDS

A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

C. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.

D. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.

E. ASTM E1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.

F. ASTM E1680 - Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems.

G. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies.

1.3 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used and manufacturer's standard detail drawings applicable to this project, including:

1. Summary of test results, indicating compliance with specified requirements.

B. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.

1. Show work to be field-fabricated or field-assembled.

C. Selection Samples: For each roofing system specified, submit color chips representing manufacturer's full range of available colors and patterns.

D. Verification Samples: For each roofing system specified, submit samples of minimum size 12 inches square, representing actual roofing metal, thickness, , color, and texture.

1. Include typical panel joint in sample.

2. Include typical fastening detail.

E. Test Reports: Indicate compliance of metal roofing system to specified requirements.

F. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Owner's name and are registered with manufacturer.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section and with at least three years of documented experience.

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

1.5 DELIVERY, STORAGE, AND HANDLING

A. Provide strippable plastic protection on prefinished roofing panels for removal after installation.

B. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

1.6 FIELD CONDITIONS

A. Do not install metal roof panels, eave protection membrane or underlayment when surface, ambient air, or wind chill temperatures are below 45 degrees F.

1.7 WARRANTY

A. Finish Warranty: Provide manufacturer's special warranty covering failure of factory-applied exterior finish on metal roof panels and agreeing to repair or replace panels that show evidence of finish degradation, including significant fading, chalking, cracking, or peeling within specified warranty period of twenty years from Date of Substantial Completion.

B. Waterproofing Warranty: Provide manufacturer's warranty for weathertightness of roofing system, including agreement to repair or replace roofing that fails to keep out water within specified warranty period of twenty years from Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Architectural Metal Roof Panel Manufacturers:

1. ATAS International, Inc; Field-Lok 1 1/2": www.atas.com/#sle.

2. Morin Corporation; SLR Standing Seam: www.morincorp.com/#sle.

3. Petersen Aluminum Corporation; PAC-150 180 Degree Double Lock: www.pac-clad.com/#sle.

4. Or approved equal.

2.2 PERFORMANCE REQUIREMENTS

A. Metal Roof Panels: Provide complete roofing assemblies, including roof panels, clips, fasteners, connectors, and miscellaneous accessories, tested for compliance with the following minimum standards:

1. Overall: Complete weathertight system tested and approved in accordance with ASTM E1592.

2. Wind Uplift: Class 90 wind uplift resistance of UL 580.

3. Air Infiltration: Maximum 0.06 cfm/sq ft at air pressure differential of 6.24 lbf/sq ft, when tested according to ASTM E1680.

4. Water Penetration: No water penetration when tested in accordance with procedures and recommended test pressures of ASTM E1646; perform test immediately following air infiltration test.

5. Thermal Movement: Design system to accommodate without deformation anticipated thermal movement over ambient temperature range of 100 degrees F.

2.3 METAL ROOF PANELS

A. Metal Roof Panels: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.

B. Metal Panels (Keynote 074113-A): Factory-formed panels with factory-applied finish.

1. Steel Panels:

a. Steel Thickness: Minimum 24 gauge, 0.024 inch.

2. Profile: Standing seam, with minimum 1-1/2-inch seam height; concealed fastener system for field seaming with special tool.

3. Texture: Smooth.

4. Length: Maximum possible length to minimize lapped joints. Where lapped joints are unavoidable, space laps so that each sheet spans over three or more supports.

5. Width: Maximum panel coverage of 16 inches.

2.4 ATTACHMENT SYSTEM

A. Concealed System: Provide manufacturer's standard stainless steel concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.

2.5 FABRICATION

A. Panels: Provide factory fabricated panels with applied finish and accessory items, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.

B. Joints: Provide captive gaskets, sealants, or separator strips at panel joints to ensure weathertight seals, eliminate metal-to-metal contact, and minimize noise from panel movements.

2.6 FINISHES

A. Fluoropolymer Coating System: Manufacturer's standard Polyvinylidene fluoride (PVDF) two-coat thermoplastic fluoropolymer coating system, including minimum 70 percent fluoropolymer color topcoat with minimum total dry film thickness of 0.9 mil; color and gloss as selected from manufacturer’s standards.

2.7 ACCESSORIES

A. Miscellaneous Sheet Metal Items: Provide flashings, trim, moldings, closure strips, and similar sheet metal items of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.

B. Rib and Ridge Closures: Provide prefabricated, close-fitting components per roof manufacturer's standards.

C. Sealants:

1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.

2. Concealed Sealant: Non-curing butyl sealant or tape sealant.

D. Underlayment (Keynote 074113-D): Self-adhering polymer modified asphalt sheet complying with ASTM D1970/D1970M, with strippable release film and top surface of woven polyolefin.

1. Sheet Thickness: 40 mil, 0.040 inch minimum total thickness.

2. Self Sealability: Nail sealability in accordance with ASTM D1970/D1970M.

3. Low Temperature Flexibility: Comply with ASTM D1970/D1970M.

4. Water Vapor Permeance: 0.1 perm, maximum, when tested in accordance with ASTM E96/E96M using Desiccant Method (Method A).

5. Products:

a. Certainteed Roofing; WinterGuard HT - High Temperature Waterproofing Underlayment: www.certainteed.com/#sle.

b. Henry Company; Blueskin PE200HT: www.henry.com/#sle.

c. Petersen Aluminum Corporation; PAC-CLAD HT: www.pac-clad.com/#sle.

d. Polyglass USA, Inc; Polystick MTS Self-Adhered High Temperature Roof Underlayment: www.polyglass.us/#sle.

e. Or approved equal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation of preformed metal roof panels until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Broom clean wood sheathing prior to installation of roofing system.

B. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to ensure that completed roof will be free of leaks.

C. Remove protective film from surface of roof panels immediately prior to installation; strip film carefully to avoid damage to prefinished surfaces.

D. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by metal roof panel manufacturer.

E. Protect surrounding areas and adjacent surfaces from damage during execution of this work.

F. At locations where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.3 INSTALLATION

A. Overall: Install roofing system in accordance with approved shop drawings and metal roof panel manufacturer's instructions and recommendations, as applicable to specific project conditions; securely anchor components of roofing system in place allowing for thermal and structural movement.

1. Install roofing system with concealed clips and fasteners.

2. Minimize field cutting of panels. Where field cutting is required, use methods that will not distort panel profiles. Use of torches for field cutting is prohibited.

B. Accessories: Install necessary components that are required for complete roofing assembly, including flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, equipment curbs, rib closures, ridge closures, and similar roof accessory items.

C. Install roofing underlayment on roof substrate before installing preformed metal roof panels. Secure by methods acceptable to roof panel manufacturer, minimizing use of metal fasteners. Apply from eaves to ridge in shingle fashion, overlapping horizontal joints a minimum of 2 inches and side and end laps a minimum of 3 inches. Offset seams in underlayments.

D. Roof Panels: Install metal roof panels in accordance with manufacturer's installation instructions, minimizing transverse joints except at junction with penetrations.

1. Form weathertight standing seams incorporating concealed clips, using an automatic mechanical seaming device approved by panel manufacturer.

3.4 FIELD QUALITY CONTROL

A. Require site attendance of roofing material manufacturers daily during installation of the Work.

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

C. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

3.5 CLEANING

A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

3.6 PROTECTION

A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.

B. Touch-up, repair, or replace damaged roof panels or accessories before Date of Substantial Completion.

END OF SECTION 07 41 13

(This page intentionally left blank)

SECTION 07 42 13 - METAL SOFFIT PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Manufactured metal panels for soffit panels, with accessory components.

1.2 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

1.3 SUBMITTALS

A. Submittals for this Section are to be made concurrently with the submittals for Division 07 Section "Metal Plate Column Covers".

B. Product Data - Soffit System: Manufacturer's data sheets on each product to be used, including:

1. Physical characteristics of components shown on shop drawings.

2. Storage and handling requirements and recommendations.

3. Installation instructions and recommendations.

C. Shop Drawings: Indicate dimensions, layout, joints, construction details, support clips, and methods of anchorage.

D. Samples:

1. Selection samples: Submit actual metal samples with full range of colors available for Architect's selection.

2. Verification Samples: Submit two samples of each type of metal panel required, not less than 12 inches by 12 inches, illustrating finish color, sheen and texture.

E. Manufacturer's qualification statement.

F. Installer's qualification statement.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in installing products specified in this section with minimum 5 years of documented experience.

1.5 MOCK-UPS

A. Construct mock-up, 8 feet long by 8 feet wide; include soffit system, attachments to building frame, associated vapor retarder and air seal materials, weep drainage system, sealants and seals, and related insulation in mock-up.

B. Locate as directed by Architect.

C. Mock-up may remain as part of work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.

B. Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.

C. Prevent contact with materials that may cause discoloration or staining of products.

1.7 FIELD CONDITIONS

A. Do not install soffit panels when air temperature or relative humidity are outside manufacturer's limits.

1.8 WARRANTY

A. Finish Warranty: Provide 20-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Metal Wall and Soffit Panels - Concealed Fasteners:

1. Basis of Design: Pure + Freeform Flush Metal Walls & Ceilings.
2. Centria: www.centria.com/#sle.
3. Petersen Aluminum Corporation; Flush Wall Panels: www.pac-clad.com/#sle.
4. or approved equal.

2.2 FLUSH METAL WALL/SOFFIT PANEL SYSTEM

A. Concealed-fastener, flush soffit metal wall panel system: Factory fabricated prefinished metal soffit plank panel system to be field assembled.

1. Provide soffit panels and exterior trim.
2. Design and size components to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.
3. Maximum Allowable Deflection of Panel: L/180 for length(L) of span.
4. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
5. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
6. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.
7. Corners: Factory-fabricated in one continuous piece with minimum 2-inch returns.

B. Soffit Plank Panels (Keynote: 074213-A):

1. Profile: Soffit Metal Wall Panel, with venting not provided.
    a. Factory-formed metal wall panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels. Formed with vertical panel edges and a flat face of panel.
2. Material: Precoated aluminum sheet, 12 gauge, 2 mm minimum thickness.
3. Color: As selected by Architect from manufacturer's standard line.

a. Basis of Design: Pure + Freeform Deco Bronze 2.

4. Concealed Panel Clips: Manufacturer's standard stainless steel type.

C. Exterior Wall Trim (Keynote: 074213-B):

1. Profile: Custom shape, as indicated on the drawings

2. Material: Precoated aluminum sheet, 12 gauge, 2mm minimum thickness

3. Color: To match soffit panels.

4. Width: As indicated on the drawings.

5. Concealed panel fasteners.

D. Subgirt Framing Assembly:

1. Profile as indicated; to attach panel system to building.

E. Internal and External Corners (Keynote: 074213-C): Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.

F. Expansion Joints: Same material, thickness and finish as exterior sheets; 12 gauge, 2mm thick; manufacturer's standard brake formed type, of profile to suit system.

G. Closure Pieces: (Keynote: 074213-D) Same material, thickness and finish as exterior sheets; brake formed to required profiles.

H. Anchors: Stainless steel.

2.3 MATERIALS

A. Precoated Aluminum Sheet: ASTM B209/B209M, with smooth surface texture; continuous-coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.

1. Alloy: 3004 HW32

2.4 FINISHES

A. Fluoroethylene Vinyl Ether (FEVE) Coating: Superior performing resin based organic powder coatings system complying with AAMA 2605; single coat applications when applied to aluminum with dry film thickness (DFT) of 2 to 3 mil, 0.002 to 0.003 inch; color and gloss to match sample.

1. Apply coating to exposed metal surfaces with proper preparation and pretreatment in accordance with resin manufacturer's instructions.

2.5 ACCESSORIES

A. Cladding Support Clips: Thermally-broken, thermal spacer clips for support of cladding z-girts, angles, channels, and other framing.

1. Thermal Spacer Clip: Pultruded glass fiber and thermoset polyester resin clip; 3/16 inch thick at top, base, and web.

2. Clip Depth: As indicated on drawings.

B. Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant.

C. Concealed Sealants: Non-curing butyl sealant or tape sealant, see Section 07 92 00

D. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.

E. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers, steel, hot dip galvanized. Fastener cap same color as exterior panel.

F. Field Touch-up Paint: As recommended by panel manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that building framing members are ready to receive panels.

3.2 PREPARATION

A. Install subgirts perpendicular to panel length, securely fastened to substrates and shimmed and leveled to uniform plane, and spaced at intervals indicated.

B. Protect surrounding areas and adjacent surfaces from damage during execution of this work.

3.3 INSTALLATION

A. Install panels on soffits in accordance with manufacturer's instructions.

B. Fasten panels to structural supports; aligned, level, and plumb. Use fasteners of size and length as required for compatibility with substrate.

C. Locate joints over supports.

D. Lap panel ends 2 inches, minimum.

E. Provide expansion and control joints where indicated.

F. Use concealed fasteners unless otherwise indicated by Architect.

G. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.4 TOLERANCES

A. Offset From True Alignment Between Adjacent Members Abutting or In Line: 1/16 inch, maximum.

B. Variation from Plane or Location As Indicated on Drawings: 1/4 inch, maximum.

3.5 CLEANING

A. Remove site cuttings from finish surfaces.

B. Remove protective material from wall panel surfaces.

3.6 PROTECTION

A. Protect metal wall panels until completion of project.

B. Touch-up, repair, or replace damaged wall panels or accessories before Date of Substantial Completion.

END OF SECTION 07 42 13

SECTION 07 42 13.16 - METAL PLATE COLUMN COVERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal plate panels for Column covers, with related flashings and accessory components.

1. Pressure equalized rain screen (PERS) based system.

1.2 REFERENCE STANDARDS

A. AAMA 508 - Voluntary Test Method and Specification for Pressure Equalized Rainscreen Wall Cladding Systems.

B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

C. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

1.3 SUBMITTALS

A. Submittals for this Section are to be made concurrently with the submittals for Division 07 Section "Metal Soffit Panels".

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Physical characteristics of components shown on shop drawings.

2. Storage and handling requirements and recommendations.

3. Installation instructions and recommendations.

C. Shop Drawings: Indicate dimensions, layout, joints, construction details, support clips, and methods of anchorage.

D. Samples:

1. Selection samples: Submit actual metal samples with full range of colors available for Architect's selection.

2. Verification Samples: Submit two samples of each type of metal plate required, not less than 12 inches by 12 inches, illustrating finish color, sheen and texture.

E. Manufacturer's qualification statement.

F. Installer's qualification statement.

G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than three years of documented experience.

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

1.5 MOCK-UPS

A. Construct mock-up to be one column cover; include metal panel , attachments to building frame, associated air/water barrier materials, weep drainage system, sealants and seals.

B. Locate where directed.

C. Mock-up may remain as part of work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.

B. Store prefinished material off ground and protected from weather; prevent twisting, bending, or abrasion, and provide ventilation to stored materials; slope metal sheets to ensure drainage.

1.7 FIELD CONDITIONS

A. Do not install panels when air temperature or relative humidity are outside manufacturer's limits.

1.8 WARRANTY

A. Finish Warranty: Provide 20-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Aluminum Plate Wall Panels:

1. Basis of Design: Pure + Freeform Metal Plate Colum Covers panels

2. Or approved equal.

2.2 PERFORMANCE REQUIREMENTS

A. Concealed-fastened, aluminum plate, dry joint, factory-formed prefinsihed aluminum panels, design to be field assembled.

1. Type of Wall Panel System: Pressure Equalized Rain Screen (PERS) in compliance with AAMA 508.

2. Provide exterior wall panels and subgirt framing assembly.

3. Design and size components to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.

4. Wind Load Testing: In compliance with ASTM E330/E330M to obtain the following results:

a. Maximum Allowable Deflection of Non-Exposed Panels: L/60 for length(L) of span; no permanent deformation of panel system is allowed.

b. Maximum Allowable Deflection of Highly Visible Panels: L/175 for length(L) of span or 3/4 inch whichever is less, normal to plane of wall between supports of secured perimeter framing members.

5. Intermediate Panel Stiffeners: Provide as required by design loads applied to panels, and secured to rear face of panel with silicone based adhesive and of size and strength to maintain panel flatness; stiffener material is compatible with silicone.

6. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when subject to 100 degrees F seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.

7. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.

8. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.

9. Corners: Factory-fabricated in one continuous piece with minimum 2 inch returns.

10. Provide continuity of air/water barrier (AWB) seal at wall panel substrate and/or wall sheathing in coordination with material requirements; see Section 07 25 00 and Section 06 10 00.

2.3 METAL PLATE COLUMN COVERS

A. Metal Plate Column Covers:

1. Square Column Cover System.

2. Orientation: Vertical.

3. Joint Layout: Reveal As indicated on Drawings.

4. Panel Width: As indicated on drawings.

5. Design: As indicated on drawings.

6. Color:

a. Basis of Design: Pure + Freeform Deco Bronze

b. Color to match soffit panels.

B. Subgirts: C-shaped furring channel; to attach wall panel system to face of building structural wall.

2.4 MATERIALS

A. Aluminum Sheet: Tension-leveled, smooth aluminum sheet, ASTM B209/B209M, 3004 alloy, H32 temper.

1. Surface Texture: Smooth.
2. Thickness: 2.0 mm
3. AAMA 2605 rated, Class A material only, non combustible, non-laminated

2.5 FINISHES

A. Fluoroethylene Vinyl Ether (FEVE) Coating: Superior performing resin based organic powder coatings system complying with AAMA 2605; single coat applications when applied to aluminum with dry film thickness (DFT) of 2 to 3 mil, 0.002 to 0.003 inch; color and gloss to match sample.

1. Apply coating to exposed metal surfaces with proper preparation and pretreatment in accordance with resin manufacturer's instructions.
2. Color to match finish of Metal Soffit Panels.

2.6 ACCESSORIES

A. Cladding Support Clips: Thermally-broken, galvanized steel clips for support of cladding z-girts, angles, channels and other framing.

1. Galvanized Steel Sheet: ASTM A653/A653M, with G90/Z275 galvanized coating.

B. Fasteners: Manufacturer's standard type to suit application; cadmium coated metal with soft neoprene washers.

C. Field Touch-up Paint: As recommended by panel manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify substrate framing members are ready to receive panels.

3.2 INSTALLATION

A. Install column covers in accordance with manufacturer's instructions and approved shop drawings.

3.3 CLEANING

A. Remove site cuttings from finish surfaces.

B. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

3.4 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION 07 42 13.16

SECTION 07 42 13.23 - METAL COMPOSITE MATERIAL WALL PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Exterior cladding consisting of formed metal composite material (MCM) sheet, secondary supports, and anchors to structure, attached to solid backup.

B. Matching flashing and trim.

1.2 SUBMITTALS

A. Product Data - MCM Sheets: Manufacturer's data sheets on each product to be used, including thickness, physical characteristics, and finish, and:

1. Finish manufacturer's data sheet showing physical and performance characteristics.

2. Storage and handling requirements and recommendations.

3. Fabrication instructions and recommendations.

4. Specimen warranty for finish, as specified herein.

B. Product Data - Wall System: Manufacturer's data sheets on each product to be used, including:

1. Physical characteristics of components shown on shop drawings.

2. Storage and handling requirements and recommendations.

3. Installation instructions and recommendations.

4. Specimen warranty for wall system, as specified herein.

C. Shop Drawings: Show layout and elevations, dimensions and thickness of panels, connections, details and location of joints, sealants and gaskets, method of anchorage, support clips, exposed fasteners, number of anchors, supports, reinforcement, trim, flashings, and accessories.

1. Indicate panel numbering system.

2. Differentiate between shop and field fabrication.

3. Indicate substrates and adjacent work with which the wall system must be coordinated.

4. Include large-scale details of anchorages and connecting elements.

5. Include large-scale details or schematic, exploded or isometric diagrams to fully explain flashing at a scale of not less than 1-1/2 inches per 12 inches.

D. Installer's qualification statement.

E. Maintenance Data: Care of finishes and warranty requirements.

1.3 QUALITY ASSURANCE

A. Field Measurements: Verify actual dimensions by field measurement before fabrication; show recorded measurements on shop drawings.

B. Installer Qualifications: Company specializing in performing work of type specified in this section.

1. With minimum three years of documented experience.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.

1. Protect finishes by applying heavy-duty removable plastic film during production.

2. Package for protection against transportation damage.

3. Provide markings to identify components consistently with drawings.

4. Exercise care in unloading, storing, and installing panels to prevent bending, warping, twisting, and surface damage.

B. Store products protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

1. Store in well-ventilated space out of direct sunlight.

2. Protect from moisture and condensation with tarpaulins or other suitable weathertight covering installed to provide ventilation.

3. Store at a slope to ensure positive drainage of accumulated water.

4. Do not store in enclosed space where ambient temperature can exceed 120 degrees F.

5. Avoid contact with other materials that might cause staining, denting, or other surface damage.

1.5 WARRANTY

A. Finish Warranty: Provide 5-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Metal Composite Material (MCM) Sheet Manufacturers:

1. ALUCOBOND USA; ALUCOBOND PLUS: www.alucobondusa.com/#sle.

2. ALPOLIC Materials; ALPOLIC/fr (Fire Retardant core): www.alpolic-americas.com/#sle.

3. Alcoa, Inc; Reynobond: www.alcoa.com

4. Or approved equal.

2.2 PANELS (KEYNOTE 074213.13-A)

A. Panels: 1 inch deep pans formed of metal composite material sheet by routing back edges of sheet, removing corners, and folding edges.

1. Reinforce corners with riveted aluminum angles.

2. Provide concealed attachment to supporting structure by adhering attachment members to back of panel; attachment members may also function as stiffeners.

3. Maintain maximum panel bow of 0.8 percent of panel dimension in width and length; provide stiffeners of sufficient size and strength to maintain panel flatness without showing local stresses or read-through on panel face.

4. Secure members to back face of panels using structural silicone sealant approved by MCM sheet manufacturer.

5. Fabricate panels under controlled shop conditions.

6. Where final dimensions cannot be established by field measurement before commencement of manufacturing, make allowance for field adjustments without requiring field fabrication of panels.

7. Fabricate as indicated on drawings and as recommended by MCM sheet manufacturer.

    a. Make panel lines, breaks, curves, and angles sharp and true.

    b. Keep plane surfaces free from warp or buckle.

    c. Keep panel surfaces free of scratches or marks caused during fabrication.

8. Provide joint details providing a watertight and structurally sound wall panel system that allows no uncontrolled water penetration on inside face of panel system.

2.3 MATERIALS

A. Metal Composite Material (MCM) Sheet: Two sheets of aluminum sandwiching a core of extruded thermoplastic material; no foamed insulation material content.

1. Overall Sheet Thickness: 0.118 inch, minimum.

2. Face Sheet Thickness: 0.019 inch, minimum.

3. Bond and Peel Strength: No adhesive failure of the bond between the core and the skin nor cohesive failure of the core itself below 22.4 inch-pound/inch with no degradation in bond performance, when tested in accordance with ASTM D1781, simulating resistance to panel delamination, after 8 hours of submersion in boiling water and after 21 days of immersion in water at 70 degrees F.

4. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.

5. Flammability: Self-ignition temperature of 650 degrees F or greater when tested in accordance with ASTM D1929.

B. Metal Framing Members (Keynote: 074213.23-C): Include sub-girts, zee-clips, base and sill angles and channels, hat-shaped and rigid channels, and furring channels required for complete installation.

1. Provide material strength, dimensions, configuration as required to meet applied loads and in compliance with applicable building code.

2. Sheet Steel Components: ASTM A653/A653M galvanized to G90/Z275 or zinc-iron alloy-coated to A60/ZF180; or ASTM A792/A792M aluminum-zinc coated to AZ60/AZM180.

3. Stainless Steel Sheet Components: ASTM A480/A480M.

4. Aluminum Components: ASTM B209/B209M; or ASTM B221 (ASTM B221M).

2.4 FINISHES

A. Factory Finish: Two coat fluoropolymer resin coating, approved by coating manufacturer for length of warranty specified for project, and applied by coil manufacturing facility that specializes in coil applied finishes.

1. Coating Flexibility: Pass ASTM D4145 minimum 1T Bend at time of manufacturing.

2. Long-Term Performance: Not less than that specified under WARRANTY in PART 1.

3. Color: To match the Metal Soffit.

4. Texture: Smooth

2.5 ACCESSORIES

A. Flashing: Sheet aluminum; 0.040 inch thick, minimum; finish and color to match MCM sheet; see Section 07 62 00 for additional requirements.

B. Cladding Support Clips: Thermally-broken, galvanized steel clips for support of cladding z-girts, angles, channels and other framing.

C. Fasteners:

1. Exposed Fasteners: Stainless steel; permitted only where absolutely unavoidable and subject to prior approval of the Architect.

2. Screws: Self-drilling or self-tapping Type 410 stainless steel or zinc-alloy steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal wall panels.

3. Bolts: Stainless steel.

4. Fasteners for Flashing and Trim: Blind fasteners of high-strength aluminum or stainless steel.

D. Joint Sealer: Provide color to match wall panels silicone sealant of type approved by MCM sheet manufacturer, and in compliance with ASTM C920.

E. Provide panel system manufacturer's and installer's standard corrosion resistant accessories, including fasteners, clips, anchorage devices, and attachments.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine dimensions, tolerances, and interfaces with other work.

B. Examine substrate on-site to determine that conditions are acceptable for product installation in accordance with manufacturer's written instructions.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

D. Notify Architect in writing of conditions detrimental to proper and timely completion of work, and do not proceed with erection until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect adjacent work areas and finish surfaces from damage during installation.

3.3 INSTALLATION

A. Do not install products that are defective, including warped, bowed, dented, and broken members, and members with damaged finishes.

B. Comply with instructions and recommendations of MCM sheet manufacturer and wall system manufacturer, as well as with approved shop drawings.

C. Install wall system securely allowing for necessary thermal and structural movement; comply with wall system manufacturer's instructions for installation of concealed fasteners.

D. Do not handle or tool products during erection in manner that damages finish, decreases strength, or results in visual imperfection or failure in performance. Return component parts that require alteration to shop for refabrication, if possible, or for replacement with new parts.

E. Do not form panels in field unless required by wall system manufacturer and approved by the Architect; comply with MCM sheet manufacturer's instructions and recommendations for field forming.

F. Separate dissimilar metals; use gasket fasteners, isolation shims, or isolation tape where needed to eliminate possibility of electrolytic action between metals.

G. Install flashings as indicated on shop drawings. At flashing butt joints, provide a lap strap under flashing and seal lapped surfaces with a full bed of non-hardening sealant.

H. Install square, plumb, straight, and true, accurately fitted, with tight joints and intersections maintaining the following installation tolerances:

1. Variation From Plane or Location: 1/2 inch in 30 feet of length and up to 3/4 inch in 300 feet, maximum.

2. Deviation of Vertical Member From True Line: 0.1 inch in 25 feet run, maximum.

3. Deviation of Horizontal Member From True Line: 0.1 inch in 25 feet run, maximum.

4. Offset From True Alignment Between Two Adjacent Members Abutting End To End, In Line: 0.03 inch, maximum.

I. Replace damaged products.

3.4 CLEANING

A. Ensure weep holes and drainage channels are unobstructed and free of dirt and sealants.

B. Remove protective film after installation of joint sealers, after cleaning of adjacent materials, and immediately prior to completion of work.

C. Remove temporary coverings and protection of adjacent work areas.

D. Clean installed products in accordance with manufacturer's instructions.

END OF SECTION 07 42 13.23

(This page intentionally left blank)

SECTION 07 46 46 - FIBER-CEMENT SIDING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fiber-cement siding.

1.2 REFERENCE STANDARDS

A. ASTM C1186 - Standard Specification for Flat Fiber-Cement Sheets.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's data sheets on each product to be used, including:

1. Manufacturer's requirements for related materials to be installed by others.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Installation methods, including nail patterns.

B. Shop Drawings: Indicate dimensions, layout, joints, construction details, support clips, and methods of anchorage.

C. Manufacturer's qualification statement.

D. Installer's qualification statement.

E. Maintenance Instructions: Periodic inspection recommendations and maintenance procedures.

F. Warranty: Submit copy of manufacturer’s warranty, made out in Owner’s name, showing that it has been registered with manufacturer.

G. Samples for Initial Selection:

1. For siding and trim including related accessories.
2. Color charts for sealants to match siding and trim.
3. Color samples to match colors where field painting is required.

H. Samples for Verification: For each type, color, texture and pattern required.

1. 24"x36" sample panel assembled on plywood backing including battens.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified in this section with not less than three years of experience.

C. Mockup: Build mock-ups to verify initial selections and to demonstrate aesthetic effects and set quality standards for materials and execution. Mockup can be in place.

1. Construct mock-up in location as directed by Architect.

2. Location as indicated on the drawings.

3. Approval of mock-ups is for color, texture, and aesthetic qualities of workmanship.

1.5 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.

B. Deliver and store materials in manufacturer's unopened packaging, with labels intact, until ready for installation.

C. Store materials under dry and waterproof cover, well ventilated, and elevated above grade on a flat surface.

1.6 FIELD CONDITIONS

A. Do not install panels when air temperature or relative humidity are outside manufacturer's limits.

1.7 WARRANTY

A. Manufacturer Warranty: Provide manufacturer warranty for years as indicated under Fiber-Cement Siding article sub-headings for "Warranty". Complete forms in Owner's name and register with manufacturer.

B. Installation Warranty for Building Rainscreen Assembly: Installer of exterior rainscreen assembly (including air/vapor barrier and attachments, framing, and exterior panels) to provide 10-year warranty that includes coverage for defective materials and/or workmanship. This warranty will also clearly include materials, labor, necessary activity to access these areas, and removal of any materials to effect repairs and restore to watertight conditions. www.edacontractors.com/#sle

1.8 EXTRA MATERIALS

A. Furnish extra materials that matches products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish full lengths of siding and trim including related accessories, in a quantity equal to 2 percent of amount installed.

PART 2 PRODUCTS

2.1 FIBER-CEMENT SIDING

A. Panel Siding: Vertically oriented panels made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.

1. Texture: Smooth.

2. Length (Height): 120 inches, nominal.

3. Width: 48 inches.

4. Thickness: 5/16 inch, nominal.

5. Finish: Factory applied topcoat.

6. Color: As selected by Architect from manufacturers standard range of available colors.

a. Basis of Design: James Hardie Khaki Brown with Colorplus Technology (Statement Collection) or approved equal.

7. Warranty: 30 year limited; transferable.

8. Products:

a. James Hardie Building Products, Inc; HardiePanel Vertical Siding : www.jameshardie.com/#sle.

b. Or approved equal.

B. Factory Finish: Monochromic topcoat.

2.2 ACCESSORIES

A. Flashing: Provide flashing complying with Division 7 Section at door heads and windows and where indicted.

B. Furring Strips (Keynote: 074646-D), FRT Wood. Thickness as indicated.

C. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items recommended by siding manufacturer for building configuration.

1. Provide accessories made from same material as, and matching color and texture of, adjacent siding unless otherwise indicated.

D. Batten Trim (Keynote: 074646-E): Same material and texture as siding.

1. Width: 2-1/2 inches

2. Thickness: 3/4 inch, nominal.

3. Length (Height): 120 inches, nominal.

4. Texture: Smooth

5. Finish: Factory applied topcoat to match panels.

6. Color: As selected by Architect from manufacturers standard range of available colors.

a. Basis of Design: James Hardie Khaki Brown with Colorplus Technology (Statement Collection) or approved equal.

7. Warranty: 30 year limited, transferable.

8. Products:

a. James Hardie Building Products, Inc; [Hardie Trim Battens]; www.jameshardie.com/#sle.

b. Or approved equal.

E. Fasteners: Stainless steel; length as required to penetrate, 1-1/4 inches, minimum.

1. As recommended by the siding manufacturer.

F. Joint Sealer: As specified in Section 07 9200.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrate, clean and repair as required to eliminate conditions that would be detrimental to proper installation.

B. Do not begin until unacceptable conditions have been corrected.

C. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Protect surrounding areas and adjacent surfaces during execution of this work.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions and recommendations.

1. Read warranty and comply with terms necessary to maintain warranty coverage.

2. Install in accordance with conditions stated in model code evaluation report applicable to location of project.

3. Use trim details as indicated on drawings.

4. Touch up field cut edges before installing.

5. Pre-drill nail holes if necessary to prevent breakage.

B. Unless otherwise indicted, countersink fasteners, fill surface flush, and finish per manufacturer's instructions where face fastening is unavoidable.

C. Over Wood: Fasten siding through sheathing into studs.

D. Allow space for thermal movement between both ends of siding panels that butt against trim; seal joint between panel and trim with specified sealant.

E. Joints in Horizontal Siding: Avoid joints in lap siding except at corners; where joints are inevitable stagger joints between successive courses.

F. Joints in Vertical Siding: Install Z-flashing in horizontal joints between successive courses of vertical siding.

G. Do not install siding less than 6 inches from ground surface, or closer than 1 inch to roofs, patios, porches, and other surfaces where water may collect.

H. After installation, seal joints except lap joints of lap siding; seal around penetrations, and paint exposed cut edges.

I. Install battens and corner trim as indicated.

1. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.

J. Seal butt joints at inside and outside corners and at trim locations.

K. Where possible install fasteners such that they will be hidden by battens.

L. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced and with adjacent rows staggered.

1. Comply with approved fastener patterns where applicable. Before fastening, mark fastener locations using a template made of sheet metal, plastic or cardboard.

M. Install siding and trim level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Cut siding and trim to fit adjoining work. Refinish and seal cuts as recommended by manufacturer. Revise tolerances in subparagraph below to suit Project.

2. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining materials with 1/32-inch (0.8-mm) maximum offset for flush installation and 1/16-inch (1.5-mm) maximum offset for reveal installation.

3. Coordinate siding and trim with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate siding and trim.

N. Install trim with minimum number of joints practical, using full-length pieces from maximum lengths available. Do not use pieces less than 24 inches (610 mm) long except where necessary.

O. Finish: Apply field touch-up finishes within two weeks of installation.

3.4 CLEANING

A. Clean faced panels in accordance with manufacturer's maintenance instructions, using cleaning materials and methods acceptable to manufacturer.

3.5 PROTECTION

A. Protect installed products until Date of Substantial Completion.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 07 46 46

(This page intentionally left blank)

SECTION 07 54 00 - THERMOPLASTIC MEMBRANE ROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Adhered system with thermoplastic roofing membrane.

B. Insulation, flat.

C. Vapor retarder.

D. Cover boards.

E. Flashings.

F. Roofing stack boots.

1.2 REFERENCE STANDARDS

A. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

B. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

C. ASTM D6754/D6754M - Standard Specification for Ketone Ethylene Ester Based Sheet Roofing.

D. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.

E. NRCA (RM) - The NRCA Roofing Manual.

F. NRCA (WM) - The NRCA Waterproofing Manual.

G. UL (FRD) - Fire Resistance Directory.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1. Review preparation and installation procedures and coordinating and scheduling required with related work.

2. Review structural loading limitations of roof deck during and after roofing.

3. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.

4. Review temporary protection requirements for roofing system during and after installation.

5. Review roof observation and repair procedures after roofing installation.

1.4 SUBMITTALS

A. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.

B. Shop Drawings: Submit drawings that indicate joint or termination detail conditions and conditions of interface with other materials.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures, humidity, wind velocity during application, and supplementary instructions given.

E. Manufacturer's qualification statement.

F. Installer's qualification statement.

G. Warranty Documentation:

1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

2. Submit installer's written verification that installation complies with warranty conditions for waterproof membrane.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of this section with at least three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact, unless otherwise indicated.

B. Store materials in weather protected environment, clear of ground and moisture.

C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

D. Protect foam insulation from direct exposure to sunlight.

1.7 FIELD CONDITIONS

A. Do not apply roofing membrane during unsuitable weather.

B. Do not apply roofing membrane when ambient temperature is below 40 degrees F or above 100 degrees F.

C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

E. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.8 WARRANTY

A. Installers Warranty: Submit roofing Installer's warranty, on warranty form, signed by Installer, covering the Work of this Section and related Sections indicated below, including all components of fluid-applied membrane roofing.

1. Warranty Period: Two years from date of Substantial Completion.

B. System Warranty: Provide manufacturer's system warranty agreeing to repair or replace roofing that leaks or is damaged due to wind or other natural causes.

1. Warranty Term: 30 years after Date of Substantial Completion.

2. For repair and replacement include costs of both material and labor in warranty.

3. Warranty shall include membrane roofing, base flashings, roof insulation, fasteners, cover boards, substrate board, roofing accessories, roof pavers, and other components of membrane roofing system.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Thermoplastic Ketone Ethylene Ester (KEE) Membrane Roofing Materials:

1. FiberTite: www.fibertite.com.

2. Garland Company: www.garlandco.com.

3. Tremco Roofing & Building Maintenance; TremPly KEE: www.tremcoroofing.com.

4. Or approved equal.

B. Source Limitations: Obtain components for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

2.2 ROOFING

A. Thermoplastic Membrane Roofing: One ply membrane, fully adhered, over vapor retarder and insulation with cover board.

B. Roofing Assembly Requirements:

1. Roof Covering External Fire Resistance Classification: UL (FRD) Class A.

C. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

2.3 MEMBRANE ROOFING AND ASSOCIATED MATERIALS

A. Membrane Roofing Materials (Keynote 075400-A):

1. KEE: Ketone ethylene ester (KEE) complying with ASTM D6754/D6754M, sheet reinforced with fabric.

a. Thickness: 60 mil, 0.060 inch, minimum.

2. Sheet Width: Factory fabricated into widest possible sheets.

3. Breaking Strength, minimum, ASTM D751: Machine direction, 500 lbf (87 kN/m); Cross machine direction, 400 lbf (70 kN/m).

4. Tear Strength, minimum, ASTM D751: Machine direction,125 lbf (21 kN/m); Cross machine direction, 145 lbf (25 kN/m).

5. Elongation at Break, ASTM D751: 20 percent.

6. Dynamic Impact/Puncture Resistance, ASTM D5635: Pass.

7. Color: As selected by Architect from manufacturer's full color range.

B. Seaming Materials: As recommended by membrane manufacturer.

C. Vapor Retarder (075400-B): Material approved by roof manufacturer; compatible with roofing and insulation materials.

1. Vapor Permeability: 0.1 perm inch or less, measured in accordance with ASTM E96/E96M.

2. Metal Deck Substrate Preparation: Provide minimum 22 ga., 6 inch wide, sheet-metal sheets of appropriate length securely fastened to the metal deck at all locations required by vapor retarder manufacturer.

D. Flexible Flashing Material: Same material as membrane.

2.4 COVER BOARDS

A. Cover Boards (075400-D): Glass-mat faced gypsum panels complying with ASTM C1177/C1177M.

1. Thickness: 1/2 inch, fire-resistant.

2.5 INSULATION

A. Polyisocyanurate (ISO) Board Insulation (075400-C): Rigid cellular foam, complying with ASTM C1289.

1. Classifications:

a. Type II: Faced with either cellulosic facers or glass fiber mat facers on both major surfaces of the core foam.

1) Class 1 - Faced with glass fiber reinforced cellulosic facers on both major surfaces of the core foam.

2) Compressive Strength: Classes 1-2-3, Grade 2, 20 psi (138 kPa), minimum.

3) Thermal Resistance, R-value: At 1-1/2 inches thick; Class 1, Grades 1-2-3, 8.4 (1.48), minimum, at 75 degrees F.

2. Board Size: 48 by 96 inches.

3. Board Thickness: 3.0 inches.

4. Board Edges: Square.

2.6 ACCESSORIES

A. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.

B. Termination Bars: manufacturer's standard aluminum bars approximately 1 inch by 1/8 inch thick with predrilled holes, and manufacturer's recommended fasteners.

C. Insulation Joint Tape: Glass fiber reinforced type as recommended by insulation manufacturer, compatible with roofing materials; 6 inches wide; self adhering.

D. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.

1. Length as required for thickness of insulation material and penetration of deck substrate, with metal washers.

E. Membrane Adhesive: As recommended by membrane manufacturer.

F. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.

G. Thinners and Cleaners: As recommended by adhesive manufacturer, compatible with membrane.

H. Insulation Adhesive: As recommended by insulation manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secure.

C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.

D. Verify deck surfaces are dry and free of snow or ice.

E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and reglets are in place.

3.2 INSTALLATION, GENERAL

A. Perform work in accordance with manufacturer's instructions, NRCA (RM), and NRCA (WM) applicable requirements.

B. Do not apply roofing membrane during cold or wet weather conditions.

C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.

D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

F. Coordinate this work with installation of associated counterflashings installed by other sections as the work of this section proceeds.

3.3 VAPOR RETARDER AND INSULATION - UNDER MEMBRANE

A. Install vapor retarder to deck surface with adhesive in accordance with manufacturer's instructions.

1. Extend vapor retarder under blocking to deck edge.

2. Install flexible flashing from vapor retarder to air seal material of wall construction, lap and seal to provide continuity of the air barrier plane.

B. Ensure vapor retarder is clean and dry, continuous, and ready for application of insulation.

C. Attachment of Insulation:

1. Mechanically fasten first layer of insulation to deck in accordance with roofing manufacturer's instructions.

2. Embed second layer of insulation into full bed of adhesive in accordance with roofing and insulation manufacturers' instructions.

D. Cover Boards: Adhere cover boards in accordance with roofing manufacturer's instructions.

1. Set cover board in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

E. Lay subsequent layers of insulation with joints staggered minimum 6 inches from joints of preceding layer.

F. On metal deck, place boards parallel to flutes with insulation board edges bearing on deck flutes.

G. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

H. Tape joints of insulation in accordance with roofing and insulation manufacturers' instructions.

I. Do not install more insulation than can be covered with membrane in same day.

3.4 INSTALLATION - MEMBRANE

A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.

B. Shingle joints on sloped substrate in direction of drainage.

C. Fully Adhered Application: Apply adhesive to substrate at rate required to achieve uplift requirements. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.

D. Overlap edges and ends and seal seams by heat welding, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.

E. At intersections with vertical surfaces:

1. Extend membrane up a minimum of 8 inches onto vertical surfaces.

2. Fully adhere flexible flashing over membrane and up to nailing strips or as indicated on drawings

3. Clean splice areas, heat weld and firmly roll side and end laps of overlapping sheets according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing termination.

F. At gravel stops, extend membrane under gravel stop and to the outside face of the wall.

G. Around roof penetrations, seal flanges and flashings with flexible flashing.

H. Coordinate installation of roof gutter and related flashings.

3.5 FIELD QUALITY CONTROL

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

B. Provide daily on-site attendance of roofing and insulation manufacturer's representative during installation of this work.

C. Testing Agency: Engage a qualified testing agency to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish reports to Architect.

D. Flood Testing: Flood test each roofing area for leaks, according to recommendations in ASTM D 5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.

1. Flood to an average depth of 2-1/2 inches (65 mm) with a minimum depth of 1 inch (25 mm) and not exceeding a depth of 4 inches (100 mm). Maintain 2 inches (50 mm) of clearance from top of base flashing.

2. Flood each area for 24 hours.

3. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.

E. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

F. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

G. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.6 CLEANING

A. Remove bituminous markings from finished surfaces.

B. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.

C. Repair or replace defaced or damaged finishes caused by work of this section.

3.7 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION 07 54 00

SECTION 07 55 56 - FLUID-APPLIED PROTECTED MEMBRANE ROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fluid-applied membrane roofing and base flashings.

B. Protected with filter fabric and roof insulation over drainage panel.

1.2 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

B. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

C. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics.

D. ASTM D1777 - Standard Test Method for Thickness of Textile Materials.

E. ASTM D4491/D4491M - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.

F. ASTM D4716/D4716M - Standard Test Method for Determining the (In-Plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.

G. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings.

H. NRCA (RM) - The NRCA Roofing Manual.

I. NRCA (WM) - The NRCA Waterproofing Manual.

J. UL (DIR) - Online Certifications Directory.

K. UL 790 - Standard for Standard Test Methods for Fire Tests of Roof Coverings.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of associated flashings installed under other sections.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to start of this work; attendance required by each affected installer.

1. Review installation procedures and coordination required with related work.

1.4 SUBMITTALS

A. Product Data: Provide membrane materials, base flashing materials, insulation, and drainage panel and filter fabric.

B. Shop Drawings: Indicate setting plan for insulation, layout of seams, direction of laps, base flashing details.

C. Manufacturer's Field Reports: Submit inspection reports.

1. Reports: Indicate procedures followed, ambient temperatures and wind velocity during application.

D. Manufacturer's Qualification Statement.

E. Installer's Qualification Statement.

F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified and with not less than three years of documented experience.

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

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact.

B. Store materials in weather protected environment, clear of ground and moisture, and stand roll material on end only a single roll high with selvage edge up.

C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

D. Protect foam insulation from direct exposure to sunlight.

1.7 FIELD CONDITIONS

A. Do not apply roofing membrane during inclement weather, or at ambient temperatures below 40 degrees F.

B. Do not apply roofing membrane to damp or frozen deck surface.

C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

D. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.8 WARRANTY

A. Correct defective Work within a two year period after Date of Substantial Completion.

B. Provide thirty year manufacturer warranty for repair or replace components of roofing system that fail in materials or workmanship within warranty period including sheet metal details and termination details installed by the roof system Installer and approved by the Roof System Manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Fluid-Applied Roofing:

1. Henry Company: www.henry.com.

2. Kemper System: www.kemper-system.com.

3. Sika Roofing & Waterproofing: usa.sika.com.

4. Tremco Roofing & Building Maintenance; Alphaguard BIO IRMA: www.tremcoroofing.com.

5. Or approved equal.

2.2 REGULATORY REQUIREMENTS

A. Comply with applicable building codes for fire resistance rating of roofing system.

B. UL Fire Rated Assembly: Provide products listed and labeled with UL (DIR) and in compliance with Class A fire test rating of roof coverings in compliance with UL 790 or ASTM E108.

2.3 SYSTEM DESCRIPTION

A. Protected fluid-applied membrane roofing assembly consisting of fluid-applied membrane, reinforcing fabric, drainage course, insulation, and filter fabric.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

2.4 ROOFING SYSTEM COMPONENTS

A. Fluid-Applied Roofing (Keynote 075556-A): White, cold-applied, bio-based; two-component; polyurethane, two-coat fluid-applied roofing membrane formulated for application over prepared roof substrate.

1. Dry Film Thickness (DFT): 40 mils, minimum, applied in two coats, base coat and top coat, with reinforcing fabric between each coat.

2. Suitable for installation over concrete and single-ply sheet roofing substrates.

3. VOC Content: 1 g/L maximum.

4. Tensile Strength: 600 psi, minimum, measured in accordance with ASTM D412.

5. Ultimate Elongation: 62 percent, measured in accordance with ASTM D412.

6. Durometer Hardness, Type A: 80, minimum, in accordance with ASTM D2240.

7. Application: Provide inverted membrane roofing assembly as shown on drawings.

B. Reinforcing Fabric: Polyester, as recommended by fluid-applied roofing manufacturer.

C. Primer: As recommended by fluid-applied roofing manufacturer.

D. Composite Drainage Panel (Keynote 075556-B): Three-dimensional, crush-resistant, dimple-type drainage core layer with geotextile filter fabric on front side.

1. Width: 4 ft, minimum.

2. Length: 50 ft, minimum.

3. Physical Properties, Drainage Core Layer Material:

    a. Compressive Strength: 15,000 psf, minimum, when tested in accordance with ASTM D1621.

    b. Thickness: 0.40 inch, minimum, in accordance with ASTM D1777.

    c. Core Flow: 6 gal per minute per ft width, minimum, when tested in accordance with ASTM D4716/D4716M at 3,600 psf.

4. Physical Properties, Filter Fabric Material:

    a. Fabric Flow: 150 gal per minute per sq ft, minimum, when tested in accordance with ASTM D4491/D4491M.

E. Extruded Polystyrene (XPS) Board Insulation (Keynote 075556-C): Complies with ASTM C578, Type VII, with skin surface on both faces.

1. Compressive Strength: 60 psi, minimum, when tested in accordance with ASTM D1621.

2. Board Density: 2.20 lb per cu ft, minimum.

3. Board Thickness: 2 inches.

4. Thermal Resistance, R-value: 5.0 (0.88) per 1 inch at 75 degrees F mean temperature using ASTM C177 test method.

F. Flashings: Types required for specified system and as indicated on drawings.

G. Pavers and Pedestals: See Section 07 76 00.

2.5 ACCESSORIES

A. Water Pervious Filter Fabric (075556-D): Black open weave polyolefin.

B. Adhesive: As recommended by fluid-applied roofing manufacturer.

C. Transition Membrane: (075556-F): Basis of Design: Tremco, ExoAir110AT or Approved Equal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secured.

C. Verify deck is clean and smooth, free of depressions, waves, or projections, properly sloped to drains, valleys, or scuppers.

D. Verify roof openings, curbs, pipes, conduit, sleeves, ducts, and vents through roof are solidly set, and reglets are in place.

E. Verify roof drain is set to achieve weep drainage at membrane level and top grating of drain at finish deck level.

3.2 PREPARATION - CONCRETE DECK

A. Concrete Deck Preparation, General: Repair, clean, and prepare concrete to sound condition free of grease, oils, coatings, dust, curing compounds and other contaminants.

B. Concrete Repair: Patch concrete surface with concrete repair resin products compatible with fluid-applied membrane roofing system.

3.3 APPLICATION - MEMBRANE

A. Apply roofing system and primer in accordance with manufacturer's recommendations and NRCA (WM) or NRCA (RM) applicable requirements .

B. Apply membrane; lap and seal edges and ends permanently waterproof.

C. Apply membrane smooth, free from air pockets, wrinkles, or tears. Ensure full bond of membrane to substrate.

D. Extend membrane up minimum of 8 inches onto vertical surfaces.

E. Extend membrane over vapor and air barrier of wall construction and seal.

F. Mop and seal membrane around roof penetrations and protrusions.

3.4 APPLICATION - FLASHINGS AND ACCESSORIES

A. Apply membrane base flashings to seal membrane to vertical elements.

B. Install prefabricated roofing control joints in accordance with manufacturer's instructions.

C. Coordinate installation of roof drains, sumps, and scuppers and related flashings.

D. Seal flashings and flanges of items penetrating or protruding through the membrane.

3.5 INSTALLATION - INSULATION BOARD

A. Comply with roofing manufacturer's written instructions for installing roof insulation.

B. Place insulation boards, and butt edges together in close contact.

C. Place water pervious filter fabric over insulation boards in accordance with insulation manufacturer's instructions.

3.6 FIELD QUALITY CONTROL

A. Correct identified defects or irregularities.

B. Require attendance on-site of roofing and insulation materials manufacturers during installation of this Work.

3.7 CLEANING

A. Remove bituminous markings from finished surfaces.

B. In areas where finished surfaces are soiled caused by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.

C. Repair or replace defaced or disfigured finishes caused by work of this section.

3.8 PROTECTION

A. Protect building surfaces against damage from roofing work.

B. Where traffic must continue over finished roof membrane, protect roofing surfaces from mechanical damage.

END OF SECTION 07 55 56

(This page intentionally left blank)

SECTION 07 55 63 - VEGETATED PROTECTED MEMBRANE ROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Vegetated roof components that occur above roof waterproofing system, including:

1. Vegetated roof assembly.

2. Extensive vegetated roofing system with less than 6 inchesof soil/growing media.

3. Plants, field-installed.

1.2 REFERENCE STANDARDS

A. ASTM D448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction.

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

C. ASTM E2397/E2397M - Standard Practice for Determination of Dead Loads and Live Loads Associated with Vegetative (Green) Roof Systems.

D. ASTM E2398/E2398M - Standard Test Method for Water Capture and Media Retention of Geocomposite Drain Layers for Vegetative (Green) Roof Systems.

E. ASTM E2399/E2399M - Standard Test Method for Maximum Media Density for Dead Load Analysis of Vegetative (Green) Roof Systems.

F. CSA A123.24 - Standard Test Method for Wind Resistance of Vegetated Roof Assembly.

G. SPRI RP-4 - Wind Design Standard for Ballasted Single-Ply Roofing Systems.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to start of this work; attendance required by each affected installer.

1. Review installation procedures and coordination required with related work.

1.4 SUBMITTALS

A. Product Data: Provide product data on components of vegetated roof.

B. Shop Drawings: Indicate size and outline of roof, location and type of materials, and details of accessories and edge treatments.

C. Manufacturer Certification: Submit written approval by membrane manufacturer of the proposed vegetated roof assembly and its components.

D. Preinstallation Field Report: Provide documentation that membrane installation has been approved by manufacturer and has passed specified testing.

E. Manufacturer's Qualification Statement.

F. Installer's Qualification Statement.

G. Maintenance Data: Submit manufacturer recommendations for maintenance of materials and plants.

H. Maintenance Reports: Reports of vegetated roof assembly Inspector submitted quarterly. Must be signed by approved representation of vegetated roof assembly Installer, must outline actions carried out as per Maintenance Requirements.

I. Warranty Documentation:

1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work specified in this section, certified by vegetated roof assembly manufacturer, with not less than three years of documented experience.

C. Single Source Responsibility: Provide and install products from single source.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in original, unopened containers or wrappings.

B. Store materials under cover and elevated above grade.

C. Store roll material lying down and on pallets fully protected from moisture.

D. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

E. Remove damaged materials from job site, and replace damaged materials.

F. Do not deliver growing media in frozen, wet, or muddy conditions.

G. Install vegetation immediately upon delivery to site.

1.7 FIELD CONDITIONS

A. Ambient Conditions: Install vegetated roofing in accordance with local climate hardiness zones, unless otherwise indicated, or recommended in writing by manufacturer.

B. Engineered Growing Media: Place material at optimum compaction moisture content as determined by AASHTO T 99 (ASTM D698). Do not place materials in excessively moist condition.

1.8 WARRANTY

A. Special Warranty for Vegetated Roof Assembly: Provide manufacturer's standard warranty in which Manufacturer and Installer jointly agree to repair or replace vegetated roof assembly and components, including root barrier, membrane protection sheet, percolation/retention and drainage layer, geotextile filter fabric layers, horizontal insulation, and engineered growing media, and excluding plant materials covered under separate warranty below, that fail in materials or workmanship within specified warranty period.

1. Failure includes, but is not limited to, ponding water or prolonged wetness of growing media caused as a result of failure of the assembly to properly drain.

2. Manufacturer's warranty applies to Projects installed by Manufacturer-approved Installer and inspected by Manufacturer Technical Representative.

3. Warranty Period: 20 years from date of Substantial Completion.

B. Special Warranty for Plant Growth: Provide manufacturer's standard warranty in which Manufacturer and Installer jointly agree to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Groundcover Foliage Cover: Plantings shall grow to achieve and maintain at least 85 percent foliage cover over planting area, when averaged within 2 square foot increments, commencing with installation, at the end of the warranty period. Provide extended warranty for remainder of original warranty period for replaced plant material.

2. Herbaceous Perennials, Ornamental Grasses, and Vines: Plantings shall grow to achieve and maintain at least 75 percent horticultural viability over planting area commencing with installation, through the duration of this warranty. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.

3. Failures include, but are not limited to, death and unsatisfactory growth of plant materials except for defects resulting from abuse, neglect by Owner, or incidents that are beyond Contractor's control.

4. Warranty Periods from Date of Installation:

    a. Ground Covers: Two years.

    b. Herbaceous Perennials, Ornamental Grasses, and Vines: Two years.

    c. Woody Plants and Shrubs: Two years.

C. Extended Correction Period: Correct defective work within 2-year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design:

1. Tremco Inc.; VR Max 4 Vegetated Roof Assembly System: www.tremcoroofing.com.

2. or approved equal.

B. Other Acceptable - Extensive Vegetated Protected Membrane Roofing Manufacturers:

1. Bioroof Systems, Inc: www.bioroof.com/#sle.

2. XeroFlor North America: www.xeroflornorthamerica.com/#sle.

3. Or approved equal.

2.2 VEGETATED ROOF ASSEMBLY

A. Membrane Roofing System: See Section 07 54 00.

B. Vegetated Roofing Assembly: Extensive, 6 inches or less of growing media and vegetated roofing layers installed over roof waterproofing system.

1. Provide vegetated roof assembly that will support vegetation, reaching an average coverage of not less than 85 percent coverage of the growing media within 24 months of installation.

2. Structural Design Load: Provide vegetated roof assembly with superimposed dead load not greater than load as indicated on drawings; base calculations on the saturated weight of vegetated roof assembly components and maximum media density at saturation of growing media following test method ASTM E2397/E2397M.

3. Water Retention Capacity: Provide vegetated roof assembly with a water retention capacity of at least 4.5 gal/cu ft of water, value includes combined water retention capacities of growing media and drainage layers; growing media water retention is calculated using a difference between dry and saturated weight by following test method ASTM E2399/E2399M; drainage panel water retention capacity is calculated using test method ASTM E2398/E2398M.

4. Drainage: Provide vegetated roof assembly with rainfall drainage capacity not less than 15 in./hr. (38 cm/hr). Rainfall drainage capacity based on saturated hydraulic conductivity of growing media in accordance with ASTM E 2399/E2399M.

5. Wind Resistance: Provide vegetated roof assembly that complies with dynamic wind uplift and wind flow resistance requirements of test method CSA A123.24 and/or SPRI RP-4.

6. Vegetated Roof Layers, In Order from Bottom Up:

a. Root barrier.

b. Water retention and drainage panel.

c. Percolation layer with filter fabric overlay.

d. Engineered growing media.

e. Plantings.

f. Edging: Provide perforated metal edging at exposed edges of vegetated roof system and roof penetrations as indicated on drawings.

7. Number and type of vegetated roof layer materials may be reduced provided equivalent protection and functionality is achieved and is approved by vegetated roofing system manufacturer for desired system.

C. Root Barrier (Keynote 075563-A): 0.015 inch minimum thickness membrane made from two layers of polyethylene laminated to a reinforced multifilament grid.

D. Water Retention and Drainage Panels (Keynote 075563-B): High-density polypropylene, molded into a three-dimensional panel with positive-locking clips to form an integrated water retention and drainage system, consisting of 100% recycled content.

1. Thickness: 1.25 inch minimum.

2. Compressive Strength: 7,500 psf minimum.

3. Water Retention Capacity: 0.165 gal/sq. ft.

E. Percolation Layer with Filter Fabric Overlay (Keynote 075563-C): Three-dimensional woven polypropylene mat, open weave with filter fabric laminated to top surface, consisting of a minimum of 40% recycled content.

1. Thickness: 0.40 inch.

2. Compressive Load, ASTM D4716: 30,000 psf.

3. Water Flow Rate, ASTM D4491: 135 gpm/sq. ft.

F. Engineered Growing Media (Keynote 075563-D): Provide growing media that meets the following characteristics:

1. Depth: Not less than 4 inches and as indicated on Drawings.

2. Bulk Density: Not more than 75 lb./cu. ft. Calculations must be based on maximum media density at saturation of growing media in accordance with ASTM E2399/E2399M.

3. Dry Weight: Not less than 20 lb./cu. ft. Calculations must be based on dry weight of growing media in accordance with ASTM E2399/E2399M.

4. Source Material: Recycled products.

5. Source Location: Locally to project site, within 500 mile radius.

G. Plantings (Keynote 075563-E):

1. Source Location: Locally to project site, within 500 mile radius.

2. Verification: Ensure compatibility to growing media by Manufacturer prior to acceptance.

H. Edging (Keynote 075563-F): Perforated L-shaped aluminum sheet with manufacturer's standard thickness and mill finish; used to retain growing media and plant material as required at locations indicated for vegetated roof assembly. Solid at growing layer to prevent rooting and plant growth through the edging.

1. Thickness: 80 mil.

2. Height: As required by manufacturer for selected system.

3. Perforations, diameter: 3/4 inch.

2.3 ENGINEERED GROWING MEDIA

A. Engineered Growing Media: Vegetated roof assembly manufacturer's lightweight, biologically populated, engineered growing media mixture incorporating regional inorganic and organic materials that will support a wide variety of vegetation growth and retain and remediate storm water run-off.

1. Depth: 4 inch.

2. Maximum Water Holding Capacity, ASTM E2399/E2399M: 60 percent, minimum.

3. Air-Filled Porosity at Maximum Water Capacity, ASTM F1815:10 percent, minimum.

4. Water Permeability, ASTM E2399/E2399M: Minimum 15 in./hr.

B. Comply with ASTM E2399/E2399M.

C. Chemical Properties:

1. Growing Media pH: Value within 6.0 – 7.5.

2. Soluble salts: 3.5 mmhos/cm, maximum.

3. Macro- and micro- nutrients: Incorporate in initial proportions as required to support specified planting.

D. Weight of Growing Media:

1. Dry-Weight Basis: Minimum 20 lb/cu. ft.

2. Saturated Basis: Maximum 70 lb/cu. ft. (.

2.4 PLANTS

A. Planting Materials, General: Provide plant materials of types indicated.

1. Pre-Grown Sedum Mats: Three dimensional filament mat pre-grown with succulent vegetation and growing media to form a cohesive vegetated blanket.

B. Extensive Planting Materials:

1. Seed: A minimum of 90% purity, in dry form and without litter. Seed mix to be provided via injection into Blower Truck's Supplemental Injection System.

a. Spread Rate: 5 lb/1000 sq. ft.

2. Perennial Plugs: Healthy, vigorous, well-rooted specimens, provided in 50-plug tray with well-established rooting.

a. Depth: 2 inch, minimum.

b. Spacing: 6 inch on center.

3. Perennial Pots: Healthy, vigorous, well-rooted specimens, with well-established rooting. Root bound plants will not be accepted.

a. Depth: 3.5 inch, minimum.

b. Spacing: 12 inch on center.

2.5 ACCESSORIES

A. Stone Ballast (075563-G): No.4 size, 3/4 to 1-1/2 inch nominal diameter, rounded, water-worn gravel complying with ASTM D448 and applied at a minimum of 10 psf.

B. Filter Fabric: Highly permeable nonwoven polypropylene filter fabric, needle punched geo-textile manufactured, used to contain soil particles within soil profile at termination edges.

1. Thickness: 45 mil.

2. Weight: 3.2 oz./sq. yd.

3. Water Flow Rate, ASTM D 4491: 160 gpm/sq. ft..

C. Erosion Control Netting: Polypropylene quadrangular mesh netting for establishment of seed and plugs.

1. Thickness: 0.32 inch.

2. Unit Weight: 0.033 oz./sq. ft.

D. Technical Seam Tape: Self-adhered, waterproof membrane with acrylic pressure sensitive adhesive.

1. Thickness: 9.9 mil.

2. Nail Sealability, ASTM E 331/547 (per AAMA 711-07, Annex 1): Pass both before and after thermal cycling.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that roofing membrane work is complete.

B. Verify that surface of roofing membrane is ready to accept vegetated roofing components.

C. Verify that roof slope of vegetated roofing substrate is at least 2 percent.

D. Inspections and Testing Prior to Installation of Vegetated Roof Components:

1. Verify that installed roof waterproofing system has been inspected by manufacturer's representative.

2. Verify that installed roof waterproofing system has been tested by controlled flooding, electronic testing or other leak detection method approved by manufacturer.

3. Provide documentation that roof waterproofing system installation has been approved by manufacturer and passed specified testing.

3.2 PREPARATION

A. Clean roof waterproofing system surfaces of ponded water, snow, ice, dirt, debris, and foreign materials.

3.3 INSTALLATION, GENERAL

A. Dry surfaces thoroughly before vegetated roofing work begins.

B. Protect structures, utilities, sidewalks, pavements, and other facilities and areas from damage caused by installation.

C. Protect roof waterproofing system as necessary to prevent damage during installation of vegetated roofing system.

D. Provide temporary ballast in partially completed sections of vegetated roofing system to protect overburden from wind effects during installation; ensure ballast has no sharp edges, protrusions, chemical contaminants, or other compositions that could damage roof waterproofing system.

E. Install vegetated roof assembly components according to Manufacturer's written instructions and approved shop drawings.

3.4 INSTALLATION - ROOT BARRIER

A. Root barrier.

1. Conventional Roofing Assembly (CRA) Layout: Locate root barrier over roof waterproofing system in accordance with vegetated roofing system manufacturer's written installation instructions.

B. Loose-lay root barrier directly over waterproofing.

C. Overlap edges taped with manufacturer's recommended seam tape 1 foot or as recommended by manufacturer.

D. Turn root barrier up each vertically roofed, waterproofed or flashed surfaces.

E. Inspect completed root barrier, and repair any holes or tears by lapping each hole or tear with 6 inches, minimum, of new undamaged material and sealing with manufacturer-approved tape.

3.5 INSTALLATION - WATER RETENTION AND DRAINAGE PANELS

A. Horizontal Surfaces: Install drainboards in accordance with manufacturer's recommendations.

B. Penetrations: Cut drainboard to fit tightly around penetrations.

C. Inspect completed drainboard installation, and repair holes and tears by lapping each hole or tear at least 6 inches with new, undamaged filter fabric and sealing with manufacturer-approved tape.

3.6 INSTALLATION - PERCOLATION LAYER WITH FILTER FABRIC OVERLAY

A. Loose-lay protection fabric/water retention mat, draw tight without folds or wrinkles, and overlap edges 3 inches.

B. Penetrations: Cut to fit tightly around penetrations.

C. Inspect completed protection fabric/water retention mat installation; repair holes or tears by lapping each hole or tear at least 6 inches with new, undamaged material and sealing with tape approved by manufacturer.

3.7 INSTALLATION - EDGE TREATMENT

A. Edge Treatment: Install dividers and edging along perimeter border between vegetation-free area and vegetated area and where indicated.

1. Extend protection layers up vertical surfaces of dividers and edging to retain overburden.

2. At corners, cut and bend as required for clean, mitered finish.

B. Ballast: Install ballast in compliance with SPRI RP-4.

3.8 INSTALLATION - ENGINEERED GROWING MEDIA

A. Carefully place soil/growing media to avoid damaging or displacing other materials and accessories.

B. Placement, Soil Depth Less than 6 inches:

1. Place soil/growing media in single lift of 6 inches or less and to 1 inch greater than proposed finish grade.

2. Compact lift until top of soil is within 1 inch of proposed finish grade

C. Compaction:

1. Use landscape rollers or handheld mechanical compactors.

2. Compact soil/growing media to between 50 and 60 percent compaction as measured by ASTM D1557.

D. Install and maintain erosion control devices as recommended by manufacturer until plant installation is complete.

3.9 INSTALLATION - PLANTS

A. Install plants in accordance with good horticultural practice.

B. Maintain plants in a live and healthy condition until Date of Substantial Completion.

C. Pre-grown sedum succulents in Mat Form:

1. Lay pre-vegetated mats over the growing media, ensuring edges are firmly butted together.

2. Trim to fit neatly around projections and edges.

3. Dispose of excess mat.

D. Perennial Plugs, Perennial Pots:

1. Where perennial plugs or pots are used, dig a hole in excess of the size of the root ball after extracting it from the pot. Lightly cover root ball, ensure plants are planted to their full root depth and gently tamp in place.

2. If netting is used, cut holes sufficient in size to plant through.

3.10 INSTALLATION - STONE BALLAST

A. To roofed area, apply aggregate ballast uniformly at rate required by manufacturer, but not less than the following, carefully spreading aggregate to not damage roofing membrane and base flashings. Apply ballast as insulation is installed, leaving roofing membrane insulated and ballasted at end of workday.

1. Ballast: 20 lb/sq. ft. (100 kg/sq. m), aggregate within 12 inches of roof perimeter and corners and 24 inches of roof penetrations; 10 lb/sq. ft. (50 kg/sq. m) aggregate elsewhere.

3.11 FIELD QUALITY CONTROL

A. Have completed garden roof inspected by manufacturer's field representative.

B. Correct identified deficiencies or irregularities in work that do not comply with requirements.

3.12 CLEANING

A. In areas where finished surfaces are soiled by work of this section, consult manufacturers of surfaces for cleaning advice and comply with their documented instructions.

B. Repair or replace defaced or damaged finishes caused by work of this section.

3.13 PROTECTION

A. Protect installed vegetated roof system from construction traffic and subsequent construction operations.

B. Provide substantial barricades or other barriers where necessary to prevent traffic across vegetation.

3.14 MAINTENANCE

A. Maintain plants within vegetated roofing system for two years commencing on Date of Substantial Completion.

B. During maintenance period prior to substantial completion, and during warranty period, maintain plantings by pruning, cultivating, supplemental watering if required, weeding, fertilizing if required, removal of debris from drainage areas, adjusting and repairing devices, resetting plants to proper elevations or vertical position, and performing other operations as required to establish healthy, viable plantings.

1. Provide not less than three site visits per year to perform required tasks under this Service. Provide one site visit during Year Two by a qualified Manufacturer’s representative.

C. Replace growing media that becomes displaced or eroded because of settling or other processes.

D. Maintain integrated pest management program to keep plant materials, planted areas, and growing media free of pests and pathogens or disease following recommendations of USEPA as appropriate to minimize the use of pesticides and reduce hazards.

E. Use only products and methods acceptable to membrane roofing Manufacturer.

END OF SECTION 07 55 63

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fabricated sheet metal items, including brake metal, copings, flashings, counterflashings, scuppers, gutters, downspouts, and metal trim .

B. Flashing for roof drains and roof penetrations.

1.2 REFERENCE STANDARDS

A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

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

D. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

E. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free.

F. SMACNA (ASMM) - Architectural Sheet Metal Manual.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.4 SUBMITTALS

A. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

B. Samples for Initial Selection: Submit two samples 6 inch x 6 inch minimum in size illustrating metal color for each material and color.

C. Samples for Verification: Submit two samples 3 by 3 inch minimum in size illustrating metal finish color for each material and color.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) requirements and standard details, except as otherwise indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.1 SHEET MATERIALS

A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc, shop pre-coated with PVDF coating.

1. Polyvinylidene Fluoride (PVDF) Coating: Superior performing organic powder coating, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.

B. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); shop pre-coated with modified silicone coating.

1. Silicone Modified Polyester Coating: Pigmented organic powder coating, AAMA 2603; baked enamel finish system.

2. Fluoroethylene Vinyl Ether (FEVE) Coating: Superior performing organic powder coating, AAMA 2605; base coat with clear top coat of FEVE coatings.

C. Stainless Steel: ASTM A666/A666M, Type 304 alloy, soft temper.

2.2 METAL FLASHING APPLICATIONS

A. Brake Metal (076200-A)

1. Material: Pre-Finished Aluminum

2. Thickness: 0.050 inch

3. Color: As selected by Architect

B. Coping (076200-C)

1. Material: Pre-Finished Aluminum
2. Thickness: 0.050 inch
3. Color: Custom color to match Architect's sample

C. Flashing (076200-D)

1. Material: Pre-Finished Aluminum
2. Thickness: 0.050 inch
3. Color: Custom color to match Architect's sample

D. Scuppers (076200-G)

1. Material: Stainless Steel
2. Thickness: 24 gage
3. Color: As selected by Architect

E. Gravel Stops (076200-S)

1. Material: Aluminum
2. Thickness: 0.040 inch
3. Color: As selected by Architect

F. Gutter (076200-K)

1. Material: Pre-Finished Aluminum
2. Thickness: .050 inch
3. Color: Custom color to match Architect's sample
4. Fabrication: SMACNA (ASMM) Rectangular profile
5. Size for rainfall intensity determined by a storm occurrence of 1 in 10 years in accordance with SMACNA (ASMM).
6. Size: As Indicated.

7. Anchorage Devices: Profiled to suit gutters and downspouts in accordance with SMACNA or as recommended by manufacturer.

8. Supports: Brackets.

G. Downspouts (076200-J)

1. Material: Pre-Finished Aluminum

2. Thickness: .050 inch

3. Color: Custom color to match Architect's sample

4. Fabrication: Profile as indicated

5. Size for rainfall intensity determined by a storm occurrence of 1 in 10 years in accordance with SMACNA (ASMM).

6. Size: As Indicated.

7. Anchorage Devices: Profiled to suit gutters and downspouts in accordance with SMACNA or as recommended by manufacturer.

8. Downspout Extenders: Same material and finish as downspouts.

H. Downspout Strap (076200-P)

1. Material: Pre-Finished Aluminum

2. Thickness: 0.50 inch

3. Color: Custom color to match Architect's sample

4. Fabrication: Profile as indicated.

I. Bird Screen at Scupper (076200-R)

J. Two-Piece Metal Counterflashing (076200-E)

1. Material: Stainless Steel

2. Thickness: 26 gauge

3. Color: As selected by Architect

4. Fabrication: SMACNA Detail 4-4B.

K. Custom Base Trim (076200-T)

1. Material: Pre-Finished Aluminum
2. Thickness: 11 gauge
3. Color: As selected by Architect
4. Fabrication: Profile as indicated.

2.3 FABRICATION - GENERAL

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch; miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Tin edges of copper sheet to be soldered; solder shop formed metal joints, and after soldering, remove flux, wipe and wash solder joints clean; provide weathertight joints.

F. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

G. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.

2.4 ACCESSORIES

A. Fasteners: stainless steel, with soft neoprene washers.

B. Primer: Zinc chromate type.

C. Concealed Sealants: Non-curing butyl sealant.

D. Plastic Cement: ASTM D4586/D4586M, Type I.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.3 INSTALLATION

A. Comply with drawing details.

B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.

C. Apply plastic cement compound between metal flashings and felt flashings.

D. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

E. Seal or solder metal joints watertight for full metal sufrace cotact. After soldering, wash metal clean with neutralizing solution and rinse with clean water.

F. Secure gutters and downspouts in place with concealed fasteners.

G. Slope gutters 1/4 inch per 10 feet, minimum.

END OF SECTION 07 62 00

SECTION 07 76 00 - ROOF PAVERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roof pavers.

B. Pedestals.

1.2 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

B. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics.

1.3 SUBMITTALS

A. Product Data: Provide data indicating paver and pedestal materials.

B. Shop Drawings: Submit shop drawings that indicate paver and pedestal layout, including overall plan and detail drawings of system components.

C. Manufacturer's Installation Instructions: Indicate substrate precautions, special procedures, and perimeter conditions requiring special attention.

D. Manufacturer's qualification statement.

E. Installer's qualification statement.

F. Warranty Documentation:

1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

2. Submit documentation from installer that installation complies with warranty conditions for roof paver system.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:

1. Deliver supply of maintenance materials to Owner, of not less than one percent for maintenance materials from materials installed, and enclosed in protective packaging with appropriate identifying labels.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with at least three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with at least three years of documented experience.

1.5 FIELD CONDITIONS

A. Do not install roof paver components during cold or wet weather conditions.

1.6 WARRANTY

A. Manufacturer Warranty: Provide 2-year manufacturer warranty to replace material that shows manufacturing defects. Complete forms in Owner's name and register with manufacturer.

B. Installer Warranty: Provide 5-year warranty for defects of labor and/or workmanship commencing on the Date of Substantial Completion. Complete forms in Owner's name and register with installer.

PART 2 PRODUCTS

2.1 ROOF PAVERS

A. Porcelain Roof Pavers (Keynote: 077600-A): Porcelain tiles, with texture and color as indicated; supported by adjustable pedestal system.

1. Comply with local wind load resistance requirements of ASCE 7.

2. Texture and Color: As selected by Architect from manufacturer's standard line.

3. Length and Width: 23-5/8 by 47-1/4 inches, nominal.

4. Thickness: 3/4 inch, nominal.

5. Concentrated Load: Capable of supporting at least 2,000 lb with less than 0.2 inch deflection at center of paver.

6. Products:

a. Archatrak, Inc: www.archatrak.com/#sle.

b. or approved equal.

2.2 PEDESTALS AND RAIL SYSTEM

A. Pedestals: High impact copolymer polypropylene components to level and adjust height of pavers by using PVC pipe within pedestal.

1. Comply with local wind load resistance requirements of ASCE 7.

2. Self-Ignition Temperature: Provide plastic pedestal components with self-ignition temperature greater than 650 degrees F in accordance with ASTM D1929 test method.

3. Base Diameter: 4 inches, minimum.

4. Roof Slope Correction: Zero to 2 percent.

5. Pedestal Height: Within 1/2 inch to 8 inches, with use of 4-3/16 inch diameter SDR-35 PVC pipe, with maximum static load of 2,000 lb per pedestal in system.

6. Buffer pad as required by the manufacturer.

7. Products:

a. Buzon Pedestals: PB Pedestal: https://www.buzonpedestals.com/.

b. or approved equal.

B. Rail Aluminum Joist System: Reinforced aluminum joists.

1. Thickness: As recommended per manufacturer.

2. Product:

a. Buzon E-BRS System or approved equal.

3. System must be compatible with Pedestal system.

C. Pedestals: High-density black polyethylene with integral spacer ribs on upper surface to ensure even joint spacing.

2.3 ACCESSORIES

A. Paver Edge Restraints: Provide closure to underside of pavers along perimeter edge of pavers or areas that change elevation or step-down; provide restraint system that fully contain pavers and tie back into building wall or parapet.

1. Metal Flashing: Two piece metal edge, at least 22 gauge, 0.03 inch prefinished galvanized metal supported from paver edge and ledger board anchored to pedestals.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive this work.

B. Verify substrate is supported and secure.

C. Verify substrate is clean and smooth, dry and free of snow or ice, flat without depressions, waves or projections, properly sloped and suitable for installation of roof paver system.

D. Verify that roof openings, curbs, and penetrations through roof are solidly set.

E. Verify system elevations, required pedestal heights, and substrate dimensions.

3.2 PREPARATION

A. Use of pedestal system is for pedestrian traffic only and each side of deck system must be restrained containing decking panels with perimeter blocking or walls; movement of decking panels laterally is not permitted.

B. Membrane waterproofing and protection board surfaces used to support pedestals to be broom clean, free of frost, dirt, oil or any rough foreign matter that may impair substrate material manufacturer's warranty requirements.

C. Provide substrate for pedestals with slope and positive drainage in accordance with applicable building codes.

D. Substrate surface that will support paver and pedestal system must be structurally capable of carrying dead and live loads anticipated.

3.3 INSTALLATION

A. Perform work in accordance with manufacturer's written installation instructions and applicable requirements in coordination with project attributes, paver type being installed, pattern, grid layout, starting point, and finished elevation as indicated on approved shop drawings.

B. Install pavers on pedestals in accordance with manufacturer's instructions.

1. Fully support edges; shim and adjust pavers to provide level surface.

2. Provide approximately 1/8 inch space between pavers to permit surface water drainage.

C. Paver Edge Restraints: Install exposed paver edge restraints in accordance with roof paver manufacturer's instructions.

3.4 FIELD QUALITY CONTROL

A. Inspect during installation to ensure that grid spacer lines are being maintained in a straight and consistent pattern and that deck roof pavers are level and not rocking.

B. Unless otherwise specified in writing to allow for expansion, inspect to ensure that spacing between pavers at perimeter walls does not exceed a tab width.

C. Inspect during installation to ensure that pedestrian entry or access points to roof paver areas are level and that pavers are not randomly raised or uneven creating a tripping or safety hazard.

D. Verify that deck pedestal heights in excess of 16 inches have been braced in accordance with manufacturers written installation instructions.

3.5 CLEANING

A. Remove markings from finished surfaces, or replace defaced components of roof pavers system if markings cannot be removed.

B. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.

C. Repair or replace defaced or damaged finishes caused by work of this section.

3.6 PROTECTION

A. Protect installed roof pavers from construction operations.

B. Where traffic must continue over finished roof pavers, protect surfaces using durable materials.

END OF SECTION 07 76 00

SECTION 07 81 00 - APPLIED FIRE PROTECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Applied fire protection of interior structural steel not exposed to damage or moisture.

1.2 REFERENCE STANDARDS

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

B. ASTM E736/E736M - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.

C. ASTM E937/E937M - Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members.

1.3 SUBMITTALS

A. Product Data: Provide data indicating product characteristics.

B. Test Reports: Reports from reputable independent testing agencies for proposed products, indicating compliance with specified criteria, conducted under conditions similar to those on project, as follows:

1. Bond strength.

2. Bond impact.

3. Compressive strength.

4. Fire tests using substrate materials similar those on project.

C. Manufacturer's Installation Instructions: Indicate special procedures.

D. Manufacturer's Qualification Statement.

E. Shop Drawings: Framing plans, schedules, or both, indicating the following:

1. Extent of fireproofing for each construction and fire-resistance rating.

2. Applicable fire-resistance design designations of a qualified testing and inspection agency acceptable to authorities having jurisdiction.

3. Minimum fireproofing thickness needed to achieve fire-resistance rating of each structural component and assembly.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

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

1.5 FIELD CONDITIONS

A. Do not apply fireproofing when temperature of substrate material and surrounding air is below 40 degrees F or when temperature is predicted to be below said temperature for 24 hours after application.

B. Provide ventilation in areas to receive fireproofing during application and 24 hours afterward, to dry applied material.

C. Provide temporary enclosure to prevent spray from contaminating air.

D. Do not allow roof traffic during installation of roof fireproofing and drying period.

1.6 WARRANTY

A. Correct defective Work within a three year period after Date of Substantial Completion.

1. Include coverage for fireproofing to remain free from cracking, checking, dusting, flaking, spalling, separation, and blistering.

2. Reinstall or repair failures that occur within warranty period.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Applied Fire Protection:

1. GCP Applied Technologies: www.gcpat.com/#sle.

2. Isolatek International Corp: www.isolatek.com/#sle.

3. Southwest Fireproofing Products Company: www.sfrm.com/#sle.

2.2 APPLIED FIRE PROTECTION ASSEMBLIES

A. Provide assemblies as indicated on drawings.

2.3 MATERIALS

A. Applied Fire Protection Material for Interior Applications, Exposed to View and Not to Damage: Manufacturer's standard factory mixed material, which when combined with water is capable of providing indicated fire resistance, and complying with following requirements:

1. Bond Strength: 150 pounds per square foot, minimum, when tested in accordance with ASTM E736/E736M when set and dry.

2. Compressive Strength: 8.33 pounds per square inch, minimum.

3. Effect of Impact on Bonding: No cracking, spalling or delamination, when tested in accordance with ASTM E760/E760M.

4. Corrosivity: No evidence of corrosion, when tested in accordance with ASTM E937/E937M.

5. Surface Burning Characteristics: Maximum flame spread index of 0 (zero) and maximum smoke developed index of 0 (zero), when tested in accordance with ASTM E84.

2.4 ACCESSORIES

A. Primer Adhesive: Of type recommended by applied fire protection manufacturer.

B. Water: Clean, potable.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive fireproofing.

B. Verify that clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are in place.

C. Verify that ducts, piping, equipment, or other items that would interfere with application of fireproofing have not been installed.

D. Verify that voids and cracks in substrate have been filled.

E. Verify that projections have been removed where fireproofing will be exposed to view as a finish material.

3.2 PREPARATION

A. Perform tests as recommended by fireproofing manufacturer in applications where adhesion of fireproofing to substrate is in question.

B. Remove incompatible materials that could effect bond by scraping, brushing, scrubbing, or sandblasting.

C. Prepare substrates to receive fireproofing in strict accordance with instructions of fireproofing manufacturer.

D. Protect surfaces not scheduled for fireproofing and equipment from damage by overspray, fall-out, and dusting.

E. Close off and seal duct work in areas where fireproofing is being applied.

3.3 APPLICATION

A. Apply primer adhesive in accordance with manufacturer's instructions.

B. Apply fireproofing in uniform thickness and density as necessary to achieve required ratings.

3.4 FIELD QUALITY CONTROL

A. Inspect installed fireproofing after application and curing for integrity, prior to its concealment.

B. Ensure that actual thicknesses, densities, and bond strengths meet requirements for specified ratings and requirements of authorities having jurisdiction (AHJ).

C. Re-inspect installed fireproofing for integrity of fire protection, after installation of subsequent Work.

3.5 CLEANING

A. Remove excess material, overspray, droppings, and debris.

B. Remove fireproofing from materials and surfaces not required to be fireproofed.

END OF SECTION 07 81 00

SECTION 07 81 23 - INTUMESCENT FIRE PROTECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Thin-film intumescent mastic fireproofing for exposed structural steel.

B. Compressible-rod intumescent fire protection.

1.2 REFERENCE STANDARDS

A. SSPC-PA 2 - Procedure For Determining Conformance To Dry Coating Thickness Requirements.

1.3 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Performance characteristics and test results.

2. Preparation instructions and recommendations.

3. Storage and handling requirements and recommendations.

4. Installation methods.

B. Verification Samples: For each thickness, color, sheen, and finish required, submit samples not less than 4 inches square on designated substrate illustrating finished appearance.

C. Test Reports: Published fire resistive designs for structural elements of the types required for the project, indicating hourly ratings of each assembly.

D. Field Quality Control Submittals: Submit field test report.

E. Manufacturer's qualification statement.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company that specializes in manufacturing the type of products specified, with minimum of ten years of documented experience.

B. MOCK-UPS

1. Provide a mock-up for evaluation of surface preparation techniques and application workmanship; approved mock-up will serve as a standard of comparison for subsequent work of this section.

2. Finish at least 100 sq ft of surface in areas as designated by Architect.

3. Evaluate mock-up for compliance with specified requirements, including thickness and finish texture.

4. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.

5. Refinish mock-up area as required to produce acceptable work.

6. Approved mock-up may remain as part of the project.

1.5 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.

B. Deliver materials in manufacturer’s original, unopened containers with identification labels and testing agency markings intact and legible.

C. Store products in manufacturer's unopened packaging until ready for installation.

1. Store at temperatures not less than 50 degrees F in dry, protected area.

2. Protect from freezing, and do not store in direct sunlight.

3. Dispose of any materials that have come into contact with contaminants of any kind prior to application.

D. Dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.6 FIELD CONDITIONS

A. Protect areas of application from windblown dust and rain.

B. Maintain ambient field conditions, such as temperature, humidity, and ventilation, within limits recommended by manufacturer for optimum results. Do not install products under ambient conditions outside manufacturer's absolute limits.

1. Provide temporary enclosures as required to control ambient conditions.

2. Do not apply intumescent fireproofing when ambient temperatures are below 50 degrees F without specific approval from manufacturer.

3. Ensure that relative humidity is between 40 and 60 percent in areas of application.

4. Provide ventilation in enclosed spaces during application and for not less than 72 hours afterward.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Intumescent Thin-Film Fire Protection for Metal:

1. Contego International, Inc; Contego High Solids Reactive Fire Barrier (HS RFB) Intumescent: www.contegointernational.com/#sle.

2. FlameOFF Coatings, Inc; FlameOFF Fire Barrier Paint: www.flameoffcoatings.com/#sle.

3. International Coatings Group; FBL-100 Fire Barrier Latex: www.internationalcoatingsgroup.com/#sle.

4. Isolatek International Corp: www.isolatek.com/#sle.

5. Or approved equal.

2.2 SYSTEM REQUIREMENTS

A. Fireproofing: Provide intumescent thin-film fire resistive coating systems tested by an independent testing agency in accordance with ASTM E119 and acceptable to authorities having jurisdiction (AHJ).

1. Provide assemblies listed by UL and bearing listing agency label or mark.

2. Refer to code sheet.

2.3 MATERIALS

A. Fire Resistive Coating System: Thin film intumescent mastic fireproofing system for fire protection of structural steel.

B. Fire Resistive Compressible-Rod System: Compressible intumescent fire protection system for structural steel and gypsum board.

C. Sealers and Primer: As required by tested and listed assemblies, and as recommended by fireproofing manufacturer to suit specific substrate conditions.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates to determine if they are in satisfactory condition to receive intumescent fire protection; verify that substrates are clean and free of oil, grease, incompatible primers, or other foreign substances capable of impairing bond to fireproofing system.

B. Do not begin installation until substrates have been properly prepared.

C. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Thoroughly clean surfaces to receive fireproofing.

B. Repair substrates to remove surface imperfections that could effect uniformity of texture and thickness of fireproofing system, and remove minor projections and fill voids that could telegraph through finished work.

C. Cover or otherwise protect other work that might be damaged by fallout or overspray of fireproofing system, and provide temporary enclosures as necessary to confine operations and maintain required ambient field conditions.

3.3 APPLICATION

A. Comply with manufacturer's instructions for each particular intumescent fire protection system installation application as indicated.

B. Apply manufacturer’s recommended primer to required coating thickness.

C. Apply fireproofing to full thickness over entire area of each substrate to be protected.

D. Apply coats at manufacturer’s recommended rate to achieve dry film thickness (DFT) as required for fire resistance ratings designated for each condition.

E. Apply intumescent fire protection by spraying to maximum extent possible, and as necessary complete coverage by roller application or other method acceptable to manufacturer.

3.4 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01 40 00 - Quality Requirements.

1. Arrange for testing of installed intumescent fire protection by an independent testing laboratory using magnetic pull-off dry film thickness gauge in accordance with SSPC-PA 2, and ensure it meets requirements of authorities having jurisdiction (AHJ).

2. Submit field test reports promptly to Contractor and Architect.

B. Repair or replace intumescent fire protection at locations where test results indicate fireproofing does not meet specified requirements.

3.5 PROTECTION

A. Protect installed intumescent fire protection from damage due to subsequent construction activities, so fireproofing is without damage or deterioration before Date of Substantial Completion.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

(This page intentionally left blank)

SECTION 07 84 00 - FIRESTOPPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.2 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

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

C. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestops.

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

E. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus.

F. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies.

G. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

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

1.3 SUBMITTALS

A. Product Data: Provide data on product characteristics, performance ratings, and limitations.

B. Manufacturer's qualification statement.

1.4 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.5 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Firestopping Manufacturers:

1. 3M Fire Protection Products: www.3m.com/firestop/#sle.
2. A/D Fire Protection Systems Inc: www.adfire.com/#sle.
3. Hilti, Inc: www.us.hilti.com/#sle.
4. Nelson FireStop Products: www.nelsonfirestop.com/#sle.
5. Specified Technologies Inc: www.stifirestop.com/#sle.

2.2 MATERIALS

A. Firestopping Materials: Any materials meeting requirements.

B. Mold and Mildew Resistance: Provide firestopping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.

C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

D. Fire Ratings: Refer to drawings for required systems and ratings.

2.3 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Perimeter Fire Containment Firestopping: Use system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of floor assembly.

B. Head-of-Wall (HW) Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of wall assembly.

C. Floor-to-Floor (FF), Floor-to-Wall (FW), Head-of-Wall (HW), and Wall-to-Wall (WW) Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.

D. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

3.3 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by authorities having jurisdiction.

C. Install labeling required by code.

3.4 FIELD QUALITY CONTROL

A. Independent Testing Agency: Inspection agency employed and paid by Owner, will examine penetration firestopping in accordance with ASTM E2174 and ASTM E2393.

B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.5 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION 07 84 00

SECTION 07 92 00 - JOINT SEALANTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Self-leveling pourable joint sealants.

C. Joint backings and accessories.

1.2 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer.

B. ASTM C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants.

C. ASTM C834 - Standard Specification for Latex Sealants.

D. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications.

E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.

F. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems.

G. ASTM C1193 - Standard Guide for Use of Joint Sealants.

H. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants.

I. ASTM C1311 - Standard Specification for Solvent Release Sealants.

J. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.

K. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.

L. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness.

M. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168.

1.3 SUBMITTALS

A. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.

1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.

2. List of backing materials approved for use with the specific product.

3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.

4. Substrates the product should not be used on.

5. Substrates for which use of primer is required.

6. Substrates for which laboratory adhesion and/or compatibility testing is required.

B. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, VOC content, and recommended tools.

C. Color Cards for Preliminary Selection: Where sealant color is not specified, submit manufacturer's color cards showing full range of colors available for selection. Architect may select up to three colors for final selection at each condition.

D. Field Samples for Verification: Provide a maximum of three color samples for each condition requiring color selection (up to 6 locations selected by Architect), including custom colors, installed in-situ, 12 inches in length, to be reviewed by Architect for final color selection.

E. Preconstruction Laboratory Test Reports: Submit with Product Data.

F. Joint Sealant Schedule: Include the following information:

1. Joint sealant substrate application, joint location, and designation.

2. Joint sealant manufacturer and product name.

3. Joint sealant primer and backer.

4. Joint sealant color.

5. Any special conditions.

G. Field Quality Control Plan: Submit at least two weeks prior to start of installation.

H. Field Quality Control Log: Submit filled out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience and approved by manufacturer.

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

D. Preconstruction Laboratory Testing:

1. Adhesion Testing: In accordance with ASTM C794.

2. Compatibility Testing: In accordance with ASTM C1087.

3. Stain Testing: In accordance with ASTM C1248; required only for porous substrates.

4. Provide data showing previous testing on each combination of sealant, substrate, backing and accessories used on this Project, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.

a. If a substrate used on the Project has not been tested within the last 24 months, arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories. Allow sufficient time for testing to avoid delaying the work, and deliver sufficient samples to manufacturer for testing. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.

E. Field Quality Control Plan:

1. Visual inspection of entire length of sealant joints.

2. Destructive field adhesion testing of sealant joints, except interior sealant joints.

a. For each different sealant and substrate combination, allow for one test every 1000 linear feet (305 meters).

b. If any failures occur in the first 1000 linear feet, continue testing at frequency of one test per 500 linear feet at no extra cost to Owner.

3. Field testing agency's qualifications.

4. Field Quality Control Log Form: Show same data fields as on Joint Sealant Schedule, adding date of installation of field sample to be tested and date of test, with known information filled out and lines for multiple tests per sealant/substrate combinations; include visual inspection and specified field testing; allow for possibility that more tests than minimum specified may be necessary.

F. Field Adhesion Test Procedures:

1. Allow sealants to fully cure as recommended by manufacturer before testing.

2. Have a copy of the test method document available during tests.

3. Take photographs or make video records of each test, with joint identification provided in the photos/videos; for example, provide small erasable whiteboard positioned next to joint.

4. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.

5. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.

6. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Owner.

7. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.

G. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.

1. Sample: At least 18 inches long.

2. Minimum Elongation Without Adhesive Failure: Consider the tail at rest, not under any elongation stress; multiply the stated movement capability of the sealant in percent by two; then multiply 1 inch by that percentage; if adhesion failure occurs before the "1 inch mark" is that distance from the substrate, the test has failed.

3. If either adhesive or cohesive failure occurs prior to minimum elongation, take necessary measures to correct conditions and re-test; record each modification to products or installation procedures.

4. Record results on Field Quality Control Log.

5. Repair failed portions of joints.

1.5 WARRANTY

A. Correct defective work within a five year period after Date of Substantial Completion.

B. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

1. Provide 20-year warranty for silicones; minimum 10-year warranty for urethanes.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.

1. Dow Corning Corporation: www.dowcorning.com/construction/#sle.

2. Pecora Corporation: www.pecora.com.

3. Sherwin-Williams Company: www.sherwin-williams.com.

4. Sika Corporation: www.usa-sika.com.

5. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.

6. or approved equal..

B. Self-Leveling Sealants: Pourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.

1. Dow Corning Corporation: www.dowcorning.com/construction/#sle.
2. Pecora Corporation: www.pecora.com.
3. Sika Corporation: www.usa-sika.com.
4. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
5. W.R. Meadows, Inc: www.wrmeadows.com/sle.
6. or approved equal.

2.2 JOINT SEALANT APPLICATIONS

A. Scope:

1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
    a. Wall expansion and control joints.
    b. Joints between door, window, and other frames and adjacent construction.
    c. Joints between different exposed materials.
    d. Openings below ledge angles in masonry.
    e. Other joints indicated below.
2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
    a. Joints between door, window, and other frames and adjacent construction.
    b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
        1) Exception: Through-penetrations in sound-rated assemblies that are also fire-rated assemblies.
    c. Other joints indicated below.

3. Do not seal the following types of joints.

    a. Intentional weepholes in masonry.

    b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.

    c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.

    d. Joints where installation of sealant is specified in another section.

    e. Joints between suspended panel ceilings/grid and walls.

B. Exterior Joints: Use nonsag non-staining silicone sealant, unless otherwise indicated.

1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.

2. Control and Expansion Joints in Concrete Paving: Self-leveling or Nonsag polyurethane "traffic-grade" sealant.

3. Concealed, non-dynamic "bedding" joints, such as door thresholds: Butyl rubber, non-curing

C. Interior Joints: Use nonsag polyurethane sealant, unless otherwise indicated.

1. Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.

2. Floor Joints in Wet Areas: Nonsag or Self-leveling polyurethane "traffic-grade" sealant suitable for continuous liquid immersion.

3. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; <>.

4. In Sound-Rated Assemblies: Acrylic emulsion latex or water-based elastomeric sealant.

5. Narrow Control Joints in Interior Exposed Concrete Slabs: Self-leveling epoxy sealant.

6. Tile control and expansion joints in Wet Areas: Mildew-resistant silicone sealant

D. Interior Wet Areas include: Bathrooms and restrooms; fixtures in wet areas include plumbing fixtures, countertops, cabinets, and other similar items.

2.3 NONSAG JOINT SEALANTS

A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.

1. Movement Capability: Plus and minus 50 percent, minimum.

2. Non-Staining To Porous Materials: Non-staining to porous materials when tested in accordance with ASTM C1248.

3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.

4. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.

5. Color: To be selected by Architect from manufacturer's full standard range.

6. Cure Type: Single-component, neutral moisture curing.

B. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.

1. Color: To be selected by Architect.

C. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multicomponent; not expected to withstand continuous water immersion or traffic.

1. Movement Capability: Plus and minus 50 percent, minimum.

2. Hardness Range: 25 to 35, Shore A, when tested in accordance with ASTM C661.

3. Custom Color: To be selected by Architect from manufacturer's full custom range.

D. Nonsag "Traffic-Grade" Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multicomponent; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.

1. Movement Capability: Plus and minus 25 percent, minimum.

2. Hardness Range: 25 to 35, Shore A, when tested in accordance with ASTM C661.

3. Color: To be selected by Architect from manufacturer's full range.

E. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.

1. Color: To be selected by Architect from manufacturer's full range.

F. Non-Curing Butyl Sealant: Solvent-based; ASTM C1311; single component, nonsag, non-skinning, non-hardening, non-bleeding; vapor-impermeable; intended for fully concealed applications.

2.4 SELF-LEVELING SEALANTS

A. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multicomponent; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion.

1. Movement Capability: Plus and minus 25 percent, minimum.

2. Hardness Range: 25 to 35, Shore A, when tested in accordance with ASTM C661.

3. Color: To be selected by Architect from manufacturer's full range.

B. Self-Leveling Polyurethane Sealant for Continuous Water Immersion: Polyurethane; ASTM C920, Grade P, Uses M and A; single or multicomponent; explicitly approved by manufacturer for traffic exposure and continuous water immersion.

1. Movement Capability: Plus and minus 25 percent, minimum.

2. Hardness Range: 25 to 35, Shore A, when tested in accordance with ASTM C661.

3. Color: To be selected by Architect from manufacturer's full range.

C. Semi-Rigid Self-Leveling Epoxy Joint Filler: Epoxy or epoxy/polyurethane copolymer; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.

1. Composition: Single or multicomponent, 100 percent solids by weight.

2. Durometer Hardness: Minimum of 85 for Type A or 35 for Type D, after seven days when tested in accordance with ASTM D2240.

3. Custom Color: To be selected by Architect <>.

4. Joint Width, Minimum: 1/8 inch.

2.5 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.

1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type C - Closed Cell Polyethylene.

2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.

3. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.

E. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

3.2 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

3.3 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Perform acoustical sealant application work in accordance with ASTM C919.

D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

E. Install bond breaker backing tape where backer rod cannot be used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

I. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

3.4 FIELD QUALITY CONTROL

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

B. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.

C. Destructive Adhesion Testing: If there are any failures in first 1000 linear feet, notify Architect immediately.

D. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

E. Repair destructive test location damage immediately after evaluation and recording of results.

END OF SECTION 07 92 00

SECTION 080671 – DOOR HARDWARE SCHEDULE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section references specification sections relating to commercial door hardware for the following:

1. Swinging doors.
2. Sliding Doors.
3. Other doors to the extent indicated.

B. Commercial door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical and access control door hardware.
3. Electromechanical and access control door hardware power supplies, back-ups and surge protection.
4. Automatic operators.
5. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Door Hardware”.

D. Codes and References: Comply with the version adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: Reference Related Sections for requirements regarding compliance with applicable industry standards.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

a. Type, style, function, size, label, hand, and finish of each door hardware item.
b. Manufacturer of each item.
c. Fastenings and other pertinent information.
d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
e. Explanation of abbreviations, symbols, and codes contained in schedule.
f. Mounting locations for door hardware.
g. Door and frame sizes and materials.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.

D. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and

contact information of the manufacturers providing the hardware and their nearest service representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.

F. Warranties and Maintenance: Special warranties and maintenance agreements specified in the Related Sections.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum [5] years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum [3] years documented experience installing both standard and electrified builders hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum [5] years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor in good standing by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

D. Source Limitations: Obtain each type and variety of Door Hardware specified in the Related Sections from a single source, qualified supplier unless otherwise indicated.

E. Regulatory Requirements: Comply with NFPA 70, NFPA 80, NFPA 101 and ANSI A117.1 requirements and guidelines as directed in the applicable model building code.

F. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door and Frame Preparation: Division 08 Sections (Steel, Aluminum and Wood) doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Refer to “PART 3 – EXECUTION” for required specification sections.

PART 3 - EXECUTION

3.1 DOOR HARDWARE SETS

A. The door hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.

2. The supplier is responsible for handing and sizing all products.

3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Products listed in the hardware sets shall be supplied by and in accordance with the requirements described in the specification section as noted for each item.

1. Section 08 71 00 – Door Hardware.

C. Manufacturer's Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. SU - Securitron
4. RO - Rockwood
5. YA - ASSA ABLOY ACCENTRA
6. HS - HES
7. RF - Rixson
8. NO - Norton
9. BM - Besam
10. OT - Other

Hardware Sets

Set: 1.0

Doors: 101

2	Continuous Hinge	CFM-SLF-HD1 PT x Length Required		PE	
2	Electric Power Transfer	EL-CEPT	630	SU	⚡
1	Concealed Vert Rod Exit, Exit Only	7160 B MELR EO	630	YA	⚡
1	Concealed Vert Rod Exit, Nightlatch	7160 B MELR 121NL	630	YA	⚡
2	Pull	RM5277 (Size & Mtg-Type as	US32D	RO	

		Required)			
1	Concealed Operator	By Besam		BM	
1	Rain Guard	346C (Omit at overhangs)		PE	
2	Sweep	3452CNB x Length Required		PE	
1	Threshold	273x224AFGT x Length Required		PE	
2	ElectroLynx Harness - Frame	QC-C1500P		MK	
2	ElectroLynx Harness - Door	QC-CXXX (Size as required)		MK	
1	Card Reader	By Security Supplier			
1	Bollard	By Besam		BM	
2	Position Switch	DPS - M/W		SU	
2	Door Switch	By Besam		BM	
1	Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: Perimeter/meeting seals by frame/door supplier.
Operational narrative: Door normally closed and secure. Access by valid credential or key. Free egress always. Door remains latched and secure upon power loss or fire alarm activation. Access control system monitors door position (DPS) and verifies valid egress via REX.
During normal operating hours, the automatic operator is active for entry and egress via wall switches. After hours, the doors remain locked and disabled from automatic operation for public use. A valid credential will always allow access via operators.

Set: 2.0

Doors: 101A

2	Continuous Hinge	CFM-SLF-HD1 x Length Required		PE	
1	Concealed Vert Rod Exit, Exit Only	7160 MELR EO	630	YA	
1	Concealed Vert Rod Exit, Nightlatch	7160 MELR 121NL	630	YA	
2	Pull	RM5277 (Size & Mtg-Type as Required)	US32D	RO	
2	Conc Overhead Stop	6-X36 (Size as Required)	630	RF	
2	Surface Closer	PR7500	689	NO	
1	Rain Guard	346C (Omit at overhangs)		PE	
2	Sweep	3452CNB x Length Required		PE	
1	Threshold	273x224AFGT x Length Required		PE	
1	ElectroLynx Harness - Frame	QC-C1500P		MK	
1	ElectroLynx Harness - Door	QC-CXXX (Size as required)		MK	
1	Power Supply	AQLx-R8E1 x Relays as Required		SU	

1	Wiring Diagram	Elevation and Point to Point as Specified		OT

Notes: Perimeter/meeting seals by frame/door supplier.
Operational narrative: Doors normally closed and secure. Access by key. Free egress always. Doors scheduled open (MELR) during scheduled times. Doors latch and secure upon power loss or fire alarm activation.

Set: 3.0

Doors: 201

2	Continuous Hinge	CFM-SLF-HD1 x Length Required		PE
1	Concealed Vert Rod Exit, Exit Only	7165 EO	630	YA
1	Concealed Vert Rod Exit, Nightlatch	7165 121NL	630	YA
2	Pull	RM5277 (Size & Mtg-Type as Required)	US32D	RO
2	Conc Overhead Stop	6-X36 (Size as Required)	630	RF
2	Surface Closer	PR7500	689	NO
1	Rain Guard	346C (Omit at overhangs)		PE
2	Sweep	3452CNB x Length Required		PE
1	Threshold	273x224AFGT x Length Required		PE

Notes: Perimeter/meeting seals by frame/door supplier.

Set: 3.1

Doors: 210B

2	Continuous Hinge	CFM-SLF-HD1 x Length Required		PE
1	Concealed Vert Rod Exit, Exit Only	7165 EO	630	YA
1	Concealed Vert Rod Exit, Nightlatch	7165 121NL	630	YA
2	Pull	RM5277 (Size & Mtg-Type as Required)	US32D	RO
2	Surface Closer	PR7500	689	NO
2	Door Stop	463-RKW EXP	US32D	RO
1	Rain Guard	346C (Omit at overhangs)		PE
2	Sweep	3452CNB x Length Required		PE
1	Threshold	273x224AFGT x Length Required		PE

Notes: Perimeter/meeting seals by frame/door supplier.
Provide template for 180° swing.

Set: 4.0

Doors: 104B

2	Continuous Hinge	10BE-FM-HD1 PT x Length Required		PE	
2	Electric Power Transfer	EL-CEPT	613E	SU	
1	Concealed Vert Rod Exit, Exit Only	7160 B MELR EO	613E	YA	
1	Concealed Vert Rod Exit, Nightlatch	7160 B MELR 121NL	613E	YA	
2	Pull	RM5277 (Size & Mtg-Type as Required)	10BE	RO	
2	Surface Closer	UNI7500	613E	NO	
2	Astragal	29310-10BE-PK x Door Height		PE	
1	Gasketing, Head & Jambs	290-10BE-PK x 2891-10BE-PK		PE	
1	Rain Guard	346-10BE (Omit at overhangs)		PE	
2	Sweep	3452-10BE-NB x Length Required		PE	
1	Threshold	273x224-10BE-FGT x Length Required		PE	
2	ElectroLynx Harness - Frame	QC-C1500P		MK	
2	ElectroLynx Harness - Door	QC-CXXX (Size as required)		MK	
1	Card Reader	By Security Supplier			
2	Position Switch	DPS - M/W		SU	
1	Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: This set represents the intended functionality. Actual products may vary as required by door/frame manufacturer.
Provide template for 180° swing.
Operational narrative: Doors normally closed and secure. Access by valid credential or key. Free egress always. Doors remain latched and secure upon power loss or fire alarm activation. Access control system monitors door position (DPS) and verifies valid egress via REX.

Set: 5.0

Doors: 110

2	Continuous Hinge	10BE-FM-HD1 PT x Length		PE	

		Required			
2	Electric Power Transfer	EL-CEPT	613E	SU	⚡
1	Concealed Vert Rod Exit, Exit Only	7160 B MELR EO	613E	YA	⚡
1	Concealed Vert Rod Exit, Nightlatch	7160 B MELR 121NL	613E	YA	⚡
2	Pull	RM5277 (Size & Mtg-Type as Required)	10BE	RO	
1	Concealed Operator	By Besam		BM	⚡
2	Astragal	29310-10BE-PK x Door Height		PE	
1	Gasketing, Head & Jambs	290-10BE-PK x 2891-10BE-PK		PE	
1	Rain Guard	346-10BE (Omit at overhangs)		PE	
2	Sweep	3452-10BE-NB x Length Required		PE	
1	Threshold	273x224-10BE-FGT x Length Required		PE	
2	ElectroLynx Harness - Frame	QC-C1500P		MK	⚡
2	ElectroLynx Harness - Door	QC-CXXX (Size as required)		MK	⚡
1	Card Reader	By Security Supplier			
2	Position Switch	DPS - M/W		SU	⚡
2	Door Switch	By Besam		BM	⚡
1	Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: This set represents the intended functionality. Actual products may vary as required by door/frame manufacturer.
Operational narrative: Door normally closed and secure. Access by valid credential or key. Free egress always. Door remains latched and secure upon power loss or fire alarm activation. Access control system monitors door position (DPS) and verifies valid egress via REX.
During normal operating hours, the automatic operator is active for entry and egress via wall switches. After hours, the doors remain locked and disabled from automatic operation for public use. A valid credential will always allow access via operators.

Set: 6.0

Doors: 209A, 210A

1	Continuous Hinge	10BE-FM-HD1 x Length Required		PE	
1	Rim Exit Device, Nightlatch	7100 MO627F	613E	YA	
1	SMART Pac Bridge Rectifier	2005M3 (By Security Vendor)		HS	⚡
1	Electric Strike	9600-LBSM	613E	HS	⚡
1	Surface Closer	UNI7500	613E	NO	

1	Gasketing, Head & Jambs	290-10BE-PK x 2891-10BE-PK		PE	
1	Rain Guard	346-10BE (Omit at overhangs)		PE	
1	Sweep	3452-10BE-NB x Length Required		PE	
1	Threshold	273x224-10BE-FGT x Length Required		PE	
1	ElectroLynx Harness - Frame	QC-C1500P		MK	
1	Card Reader	By Security Supplier			
1	Position Switch	DPS - M/W		SU	
1	Motion Sensor	XMS		SU	
1	Power Supply	AQLx-R8E1 x Relays as Required		SU	
1	Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: This set represents the intended functionality. Actual products may vary as required by door/frame manufacturer.
Operational narrative: Door normally closed and secure. Access by valid credential or key. Free egress always. Door remains latched and secure upon power loss or fire alarm activation. Access control system monitors door position (DPS) and verifies valid egress via motion sensor (REX).

Set: 7.0

Doors: 202A

2	Continuous Hinge	10BE-FM-HD1 x Length Required		PE
1	Concealed Vert Rod Exit, Exit Only	7160 EO	613E	YA
1	Concealed Vert Rod Exit, Nightlatch	7160 121NL	613E	YA
2	Pull	RM5277 (Size & Mtg-Type as Required)	10BE	RO
2	Surface Closer	UNI7500	613E	NO
2	Astragal	29310-10BE-PK x Door Height		PE
1	Gasketing, Head & Jambs	290-10BE-PK x 2891-10BE-PK		PE
1	Rain Guard	346-10BE (Omit at overhangs)		PE
2	Sweep	3452-10BE-NB x Length Required		PE
1	Threshold	273x224-10BE-FGT x Length Required		PE

Notes: This set represents the intended functionality. Actual products may vary as required by door/frame manufacturer.

Set: 8.0

Doors: 102A

1	Continuous Hinge	10BE-FM-HD1 x Length Required		PE	
1	Fire Rated Rim Exit, Classroom	7100F MO626F	613E	YA	
1	Surface Closer	UNI7500	613E	NO	
1	Gasketing, Head & Jambs	290-10BE-PK x 2891-10BE-PK		PE	
1	Rain Guard	346-10BE (Omit at overhangs)		PE	
1	Sweep	3452-10BE-NB x Length Required		PE	
1	Threshold	273x224-10BE-FGT x Length Required		PE	

Notes: This set represents the intended functionality. Actual products may vary as required by door/frame manufacturer.

Set: 9.0

Doors: 203A

3	Hinge, Full Mortise, Hvy Wt	T4A3386 [NRP] FT	US10BE(SS)	MK	
1	Storeroom or Closet Lock	MOR 8805FL	613E	YA	
1	SMART Pac Bridge Rectifier	2005M3 (By Security Vendor)		HS	⚡
1	Electric Strike	1600-CS-DLMS (By Security Vendor)	613E	HS	⚡
1	Surface Closer	UNI7500	613E	NO	
1	Gasketing, Head & Jambs	290-10BE-PK x 2891-10BE-PK		PE	
1	Rain Guard	346-10BE (Omit at overhangs)		PE	
1	Sweep	3452-10BE-NB x Length Required		PE	
1	Threshold	273x224-10BE-FGT x Length Required		PE	
1	ElectroLynx Harness - Frame	QC-C1500P		MK	⚡
1	Card Reader	By Security Supplier			
1	Position Switch	DPS - M/W		SU	⚡
1	Motion Sensor	XMS		SU	⚡
1	Power Supply	AQLx-R8E1 x Relays as Required		SU	⚡
1	Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: This set represents the intended functionality. Actual products may vary as required by door/frame manufacturer.
Operational narrative: Door normally closed and secure. Access by valid credential or key. Free egress always. Door remains latched and secure upon power loss or fire alarm activation. Access control system

monitors door position (DPS) and verifies valid egress via REX.

Set: 10.0

Doors: 202

8	Hinge, Full Mortise, Hvy Wt	T4A3786 [NRP] FT	US10BE	MK	
2	Electric Power Transfer	EL-CEPT	613E	SU	⚡
1	Fire Rated Conc Vert Rod, Nightlatch	7160F LBR B MELR MO627F	613E	YA	⚡
1	Fire Rated Conc Vert Rod, Dummy	7160F LBR B MELR MO629F	613E	YA	⚡
2	Surface Closer	CPS7500	613E	NO	
2	Kick Plate	K1050 10" high BEV CSK	US32D	RO	
2	Astragal	29310-10BE-PK x Door Height		PE	
1	Gasketing	S88BL (Head & Jambs)		PE	
2	ElectroLynx Harness - Frame	QC-C1500P		MK	⚡
2	ElectroLynx Harness - Door	QC-CXXX (Size as required)		MK	⚡
1	Card Reader	By Security Supplier			
2	Position Switch	DPS - M/W		SU	⚡
1	Power Supply	AQLx-R8E1 x Relays as Required		SU	⚡
1	Wiring Diagram	Elevation and Point to Point as Specified		OT	

Notes: This set represents the intended functionality. Actual products may vary as required by door/frame manufacturer.
Operational narrative: Door normally closed and secure. Access by valid credential or key. Free egress always. Door remains latched and secure upon power loss or fire alarm activation. Access control system monitors door position (DPS) and verifies valid egress via REX.

Set: 11.0

Doors: 102

6	Hinge, Full Mortise, Hvy Wt	T4A3786 [NRP] FT	US10BE	MK	
2	Fire Rated Conc Vert Rod, Classroom	7160F LBR MO626F	613E	YA	
2	Surface Closer	PR7500	613E	NO	
2	Kick Plate	K1050 10" high CSK BEV	10BE	RO	
2	Electromagnetic Holder	998M x Voltage as Required	613E	RF	⚡
2	Astragal	29310-10BE-PK x Door Height		PE	
1	Gasketing	S88BL (Head & Jambs)		PE	

Notes: This set represents the intended functionality. Actual products may vary as required by door/frame manufacturer.
Door normally held open. Holder connected to alarm system to release upon fire alarm or loss of power. Verify projection from wall and adjust electromagnetic model as required.

Set: 12.0

Doors: 209, 210

3	Hinge, Full Mortise, Hvy Wt	T4A3786 [NRP] FT	US10BE	MK	
1	Rim Exit Device, Classroom	7100 MO626F	613E	YA	
1	Surface Closer	PR7500	613E	NO	
1	Kick Plate	K1050 10" high CSK BEV	10BE	RO	
1	Wall Stop	RM860	10BE	RO	
3	Silencer	608/609 (As Required)		RO	

Set: 13.0

Doors: 110A

3	Hinge, Full Mortise	TA2714 [NRP] FT	US26D	MK	
1	Storeroom or Closet Lock	MOR 8805FL	626	YA	
1	Electric Strike	1600-CS-DLMS (By Security Vendor)	630	HS	⚡
1	SMART Pac Bridge Rectifier	2005M3 (By Security Vendor)		HS	⚡
1	Surface Closer	7500 (Arm to suit)	689	NO	
1	Kick Plate	K1050 10" high BEV CSK	US32D	RO	
1	Wall Stop	RM860	US26D	RO	
3	Silencer	608/609 (As Required)		RO	
1	ElectroLynx Harness - Frame	QC-C1500P		MK	⚡
1	Card Reader	By Security Supplier			
1	Position Switch	DPS - M/W		SU	⚡
1	Motion Sensor	XMS		SU	⚡
1	Power Supply	AQLx-R8E1 x Relays as Required		SU	⚡

Notes:
Operational narrative: Door normally closed and secure. Access by valid credential or key. Free egress always. Door remains latched and secure upon power loss or fire alarm activation. Access control system monitors door position (DPS) and verifies valid egress via motion sensor (REX).

Set: 13.1

Doors: 103

3	Hinge, Full Mortise	TA2714 [NRP] FT	US26D	MK	
1	Storeroom or Closet Lock	MOR 8805FL	626	YA	
1	Electric Strike	1600-CS-DLMS (By Security Vendor)	630	HS	⚡
1	SMART Pac Bridge Rectifier	2005M3 (By Security Vendor)		HS	⚡
1	Surface Closer	7500 (Arm to suit)	689	NO	
1	Kick Plate	K1050 10" high BEV CSK	US32D	RO	
1	Wall Stop	RM860	US26D	RO	
1	Gasketing	S88BL (Head & Jambs)		PE	
1	ElectroLynx Harness - Frame	QC-C1500P		MK	⚡
1	Card Reader	By Security Supplier			
1	Position Switch	DPS - M/W		SU	⚡
1	Motion Sensor	XMS		SU	⚡
1	Power Supply	AQLx-R8E1 x Relays as Required		SU	⚡

Notes:
Operational narrative: Door normally closed and secure. Access by valid credential or key. Free egress always. Door remains latched and secure upon power loss or fire alarm activation. Access control system monitors door position (DPS) and verifies valid egress via motion sensor (REX).

Set: 14.0

Doors: 207

3	Hinge, Full Mortise	TA2714 [NRP] FT	US26D	MK	
1	Storeroom or Closet Lock	MOR 8805FL	626	YA	
1	Electric Strike	1600-CS-DLMS (By Security Vendor)	630	HS	⚡
1	SMART Pac Bridge Rectifier	2005M3 (By Security Vendor)		HS	⚡
1	Surface Closer	2800ST	689	NO	
1	Kick Plate	K1050 10" high BEV CSK	US32D	RO	
3	Silencer	608/609 (As Required)		RO	
1	ElectroLynx Harness - Frame	QC-C1500P		MK	⚡
1	Card Reader	By Security Supplier			
1	Position Switch	DPS - M/W		SU	⚡
1	Motion Sensor	XMS		SU	⚡
1	Power Supply	AQLx-R8E1 x Relays as Required		SU	⚡

Notes:
Operational narrative: Door normally closed and secure. Access by valid credential or key. Free egress always. Door remains latched and secure upon power loss or fire alarm activation. Access control system monitors door position (DPS) and verifies valid egress via motion sensor (REX).

Set: 15.0

Doors: 104A, 207B

3	Hinge, Full Mortise	TA2714 [NRP] FT	US26D	MK	
1	Storeroom or Closet Lock	MOR 8805FL	626	YA	
1	Electric Strike	1600-CS-DLMS (By Security Vendor)	630	HS	⚡
1	SMART Pac Bridge Rectifier	2005M3 (By Security Vendor)		HS	⚡
1	Surface Closer	CPS7500	689	NO	
1	Kick Plate	K1050 10" high BEV CSK	US32D	RO	
3	Silencer	608/609 (As Required)		RO	
1	ElectroLynx Harness - Frame	QC-C1500P		MK	⚡
1	Card Reader	By Security Supplier			
1	Position Switch	DPS - M/W		SU	⚡
1	Motion Sensor	XMS		SU	⚡
1	Power Supply	AQLx-R8E1 x Relays as Required		SU	⚡

Notes:
Operational narrative: Door normally closed and secure. Access by valid credential or key. Free egress always. Door remains latched and secure upon power loss or fire alarm activation. Access control system monitors door position (DPS) and verifies valid egress via motion sensor (REX).

Set: 16.0

Doors: 104

3	Hinge, Full Mortise	TA2714 [NRP] FT	US26D	MK	
1	Storeroom or Closet Lock	MOR 8805FL	626	YA	
1	Electric Strike	1600-CS-DLMS (By Security Vendor)	630	HS	⚡
1	SMART Pac Bridge Rectifier	2005M3 (By Security Vendor)		HS	⚡
1	Surface Closer	2800ST	689	NO	
1	Kick Plate	K1050 10" high BEV CSK	US32D	RO	
1	Gasketing	S88BL (Head & Jambs)		PE	
1	ElectroLynx Harness - Frame	QC-C1500P		MK	⚡
1	Card Reader	By Security Supplier			

1	Position Switch	DPS - M/W	SU	
1	Motion Sensor	XMS	SU	
1	Power Supply	AQLx-R8E1 x Relays as Required	SU	

Notes: This set represents the intended functionality. Actual products may vary as required by door/frame manufacturer.
Operational narrative: Door normally closed and secure. Access by valid credential or key. Free egress always. Door remains latched and secure upon power loss or fire alarm activation. Access control system monitors door position (DPS) and verifies valid egress via motion sensor (REX).

Set: 17.0

Doors: 211

6	Hinge, Full Mortise	TA2714 [NRP] FT	US26D	MK
1	Dust Proof Strike	570	US26D	RO
2	Flush Bolt	555 / 557 (As Required)	US26D	RO
1	Storeroom or Closet Lock	MOR 8805FL	626	YA
2	Wall Stop	RM860	US26D	RO
2	Silencer	608/609 (As Required)		RO

Set: 18.0

Doors: 109

3	Hinge, Full Mortise	TA2714 [NRP] FT	US26D	MK
1	Storeroom or Closet Lock	MOR 8805FL	626	YA
1	Wall Stop	RM860	US26D	RO
1	Gasketing	S88BL (Head & Jambs)		PE

Set: 19.0

Doors: 105A

3	Hinge, Full Mortise	TA2714 [NRP] FT	US26D	MK
1	Storeroom or Closet Lock	MOR 8805FL	626	YA
1	Surf Overhead Stop	10-X36 (Size as Required)	630	RF
1	Surface Closer	7500 (Arm to suit)	689	NO
1	Kick Plate	K1050 10" high BEV CSK	US32D	RO
1	Gasketing	S88BL (Head & Jambs)		PE

Set: 20.0

Doors: 106, 107

3	Hinge, Full Mortise	TA2714 [NRP] FT	US26D	MK
1	Classroom or Office Lock	MOR 8809FL	626	YA
1	Wall Stop	RM860	US26D	RO
3	Silencer	608/609 (As Required)		RO

Set: 21.0

Doors: 203

3	Hinge, Full Mortise	TA2714 [NRP] FT	US10BE	MK
1	Classroom Lock	MOR 8808FL	613E	YA
1	Wall Stop	RM860	10BE	RO
3	Silencer	608/609 (As Required)		RO

Set: 22.0

Doors: 105

3	Hinge, Full Mortise	TA2714 [NRP] FT	US10BE	MK
1	Classroom Lock	MOR 8808FL	613E	YA
1	Surface Closer	7500 (Arm to suit)	613E	NO
1	Kick Plate	K1050 10" high CSK BEV	10BE	RO
1	Electromagnetic Holder	998M x Voltage as Required	613E	RF
1	Gasketing	S88BL (Head & Jambs)		PE

Notes: This set represents the intended functionality. Actual products may vary as required by door/frame manufacturer.
Verify projection from wall and adjust electromagnetic model as required. Holder connected to alarm system to release upon fire alarm or loss of power.

Set: 23.0

Doors: 111, 112, 113, 114, 204, 205, 206, 208

3	Hinge, Full Mortise	TA2714 [NRP] FT	US10BE	MK
1	Privacy Lock	MOR 8802FL V21	613E	YA
1	Surface Closer	7500 (Arm to suit)	613E	NO
1	Kick Plate	K1050 10" high CSK BEV	10BE	RO
1	Wall Stop	RM860	10BE	RO
1	Gasketing	S88BL (Head & Jambs)		PE
1	Coat Hook	RM801	10BE	RO

Set: 24.0

Doors: 116

3	Hinge, Full Mortise, Hvy Wt	T4A3386 [NRP] FT	US32D	MK
1	Storeroom Lock	MOR 8823FL	626	YA
1	Surface Closer	2800ST	689	NO
1	Kick Plate	K1050 10" high BEV CSK	US32D	RO
1	Gasketing	S88BL (Head & Jambs)		PE

Notes: This set represents the intended functionality. Actual products may vary as required by door/frame manufacturer.
Verify application with elevator manufacturer prior to submittals. Closer may be required to mount on the corridor side.

END OF SECTION 080671

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flush wood doors; flush and flush glazed configuration; fire-rated, non-rated, and acoustical.

1.2 REFERENCE STANDARDS

A. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights.

B. ICC (IBC) - International Building Code.

C. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.

D. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives.

E. WDMA I.S. 1A - Interior Architectural Wood Flush Doors.

1.3 SUBMITTALS

A. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

B. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.

C. Samples for Initial Selection: Submit samples of all standard and custom door veneer options, illustrating wood grain, stain color, and sheen.

D. Samples for Verification: Submit two samples of door veneer, 12" by 12" inch in size illustrating wood grain, stain color, and sheen.

E. Warranty, executed in Owner's name.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging, and inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

D. Follow Manufacturer's recommendations for product specific delivery, storage and handling requirements.

1.5 WARRANTY

A. Provide manufacturer's warranty for the life of the installation.

B. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Wood Veneer Faced Doors:

1. Haley Brothers: www.haleybros.com.

2. Forte Opening Solutions: https://www.forteopenings.com/

3. VT Industries, Inc: www.vtindustries.com

2.2 DOORS

A. Doors: See drawings for locations and additional requirements.

1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with WDMA I.S. 1A.

2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.

1. Provide solid core doors at each location.

2. Wood veneer facing with factory transparent finish,unless noted otherwise.

2.3 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.

B. FSC Certification: All wood products in this specification shall be certified according to the rules of the Forest Stewardship Council (www.fscus.org).

1. To review a list of North American Certification Bodies that are accredited by the FSC to certify forest products, go to https://us.fsc.org/en-us/certification/certifying-bodies-in-the-us

2.4 DOOR FACINGS

A. Veneer Facing for Transparent Finish: White birch, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face; unless otherwise indicated.

1. Vertical Edges: Any option allowed by quality standard for grade.

2. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet of each other when doors are closed.

2.5 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:

1. Provide solid blocks at lock edge and top of door for closer for hardware reinforcement.

2. Provide solid blocking for other throughbolted hardware.

C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

E. Provide edge clearances in accordance with the quality standard specified.

2.6 FINISHES - WOOD VENEER DOORS

A. Finish work in accordance with WDMA I.S. 1A for grade specified and as follows:

1. Transparent:

    a. System - TR-6, Catalyzed Polyurethane.

    b. Stain: As selected by Architect.

    c. Sheen: Flat.

B. Factory finish doors in accordance with approved sample.

C. Seal door top edge with color sealer to match door facing.

2.7 ACCESSORIES

A. Glazing: See Section 08 80 00.

B. Glazing Stops: Wood with metal clips for rated doors, mitered corners; prepared for countersink style tamper proof screws.

C. Door Hardware: See Section 08 71 00.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.2 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.

1. Install fire-rated doors in accordance with NFPA 80 requirements.

2. Install smoke and draft control doors in accordance with NFPA 105 requirements.

3. Install exterior doors in accordance with ASTM E2112.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Use machine tools to cut or drill for hardware.

D. Coordinate installation of doors with installation of frames and hardware.

E. Coordinate installation of glazing.

F. Install door louvers plumb and level.

3.3 TOLERANCES

A. Comply with specified quality standard for fit and clearance tolerances.

B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.4 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

END OF SECTION 08 14 16

(This page intentionally left blank)

SECTION 08 16 13 - FIBERGLASS DOORS AND FRAMES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fiberglass doors.

B. Fiberglass door frames.

1.2 REFERENCE STANDARDS

A. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.

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

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

D. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

E. ICC (IBC) - International Building Code.

F. ITS (DIR) - Directory of Listed Products.

G. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.

H. UL (DIR) - Online Certifications Directory.

I. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.

1.3 SUBMITTALS

A. Product Data: Provide manufacturer's standard details, installation instructions, hardware and anchor recommendations.

B. Shop Drawings: Indicate layout and profiles; include assembly methods.

1. Indicate product components, including hardware reinforcement locations and preparations, accessories, finish colors, patterns, and textures.

2. Indicate wall conditions, door and frame elevations, sections, materials, gauges, finishes, location of door hardware by dimension, and details of openings; use same reference numbers indicated on drawings to identify details and openings.

C. Selection Samples: Submit two complete sets of color chips, illustrating manufacturer's available finishes, colors, and textures.

D. Verification Samples: Submit door surface samples for each finish specified, 10 inches by 10 inches in size, illustrating finishes, colors, and textures.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Mark doors with location of installation, door type, color, and weight.

B. Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

C. Store materials in original packaging, under cover, protected from exposure to harmful weather conditions and from direct contact with water.

1. Store at temperature and humidity conditions recommended by manufacturer.

2. Do not use non-vented plastic or canvas shelters.

3. Immediately remove wet wrappers.

D. Store in position recommended by manufacturer, elevated minimum 4 inches above grade, with minimum 1/4 inch space between doors.

1.5 FIELD CONDITIONS

A. Do not install doors until structure is enclosed.

B. Maintain temperature and humidity at manufacturer's recommended levels during and after installation of doors.

1.6 WARRANTY

A. Provide five (5) year manufacturer warranty covering materials and workmanship , including degradation or failure due to chemical contact.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Fiberglass Composite Doors:

1. Plastpro Inc: www.plastproinc.com/#sle.
2. Special-Lite, Inc: www.special-lite.com/#sle.
3. or approved equal.

B. Fire-Rated Fiberglass Doors and Frames:

1. Plastpro Inc: www.plastproinc.com/#sle.
2. Special-Lite, Inc: www.special-lite.com/#sle.
3. or approved equal.

2.2 DOOR AND FRAME ASSEMBLIES

A. Door and Frame Assemblies: Factory-fabricated, prepared and machined for hardware.

1. Screw-Holding Capacity: Tested to 890 pounds, minimum.
2. Surface Burning Characteristics: Flame spread index (FSI) of 0 to 25, Class A, and smoke developed index (SDI) of 450 or less, when tested in accordance with ASTM E84.
3. Flammability: Self-extinguishing when tested in accordance with ASTM D635.
4. Clearance Between Door and Frame: 1/8 inch, maximum.
5. Clearance Between Bottom of Door and Finished Floor: 3/4 inch, maximum; not less than 1/4 inch clearance to threshold.

B. Fire-Rated Doors and Frames: Comply with fire-ratings as indicated on drawings.

1. Tested in accordance with ICC (IBC) for positive pressure or UL 10C.
2. ITS (DIR) or UL (DIR) listed and labeled.
3. Visible seals when doors are open or closed is not permitted.

2.3 COMPONENTS

A. Doors: Fiberglass construction with reinforced core.

1. Type: As indicated on drawings, including swinging doors.
2. Thickness: 1-3/4 inch, nominal.
3. Core Material: Manufacturer's standard core material for application indicated.
4. Construction:
    a. Pultruded as single monolithic fiberglass reinforced plastic (FRP) panel.
5. Face Sheet Texture: Smooth.
6. Door Panel Configuration: As indicated on drawings.
7. Subframe and Reinforcements: Manufacturer's standard materials.
8. Waterproof Integrity: Provide factory fabricated edges, cut-outs, and hardware preparations of fiberglass reinforced plastic (FRP); provide cut-outs with joints sealed independently of glazing, louver inserts, or trim.
9. Hardware Preparations: Factory reinforce, machine, and prepare for door hardware including field installed items; provide solid blocking for each item; field cutting, drilling or tapping is not permitted; obtain manufacturer's hardware templates for preparation as necessary.

B. Door Frames: Provide type in compliance with performance requirements specified for doors.

1. Type: Factory assembled with chemically welded joints.
2. Profiles: As indicated on drawings.
3. Texture: Smooth.
4. Non-Fire-Rated:
    a. Fiberglass reinforced plastic (FRP) with gel-coating matching doors.
5. Fire-Rated: Provide frames bearing labels to match doors.
6. Corner Joints: Mitered with concealed corner blocks or angles of same material as frame; fiberglass and aluminum joined with screws; steel and stainless steel spot welded; sealed watertight with silicone sealant; field assemble knock-down type frames as required.

7. Hardware Cut-outs: Provide continuous backing or mortar guards of same material as frame, with watertight seal.

8. Frame Anchors: Stainless steel, Type 304; provide three anchors in each jamb for heights up to 84 inches with one additional anchor for each additional 24 inches in height.

9. Reinforcing: Provide manufacturer's standard reinforcing at hinge, strike, and closer locations.

2.4 PERFORMANCE REQUIREMENTS

A. Provide door assemblies that have been designed and fabricated in compliance with specified performance requirements.

B. Water Leakage: No uncontrolled leakage on interior face when tested in accordance with ASTM E331 at differential pressure of 7.5 psf.

C. Air Leakage: Maximum of 0.1 cfm per square foot at 6.27 psf differential pressure, when tested in accordance with ASTM E283.

D. Thermal Transmittance, Exterior Doors: AAMA 1503, U-value of 0.35, maximum, measured on exterior door in size required for this project.

2.5 FINISHES

A. Gel Coating: Ultraviolet (UV) stabilized polyester finish.

1. Thickness: Minimum 15 mils, 0.015 inch wet thickness, plus/minus 3 mils, 0.003 inch.

2. Color: As indicated on the drawings and as selected by Architect from manufacturer's standard line of colors.

a. FRP-1: Basis of Design: Special-Lite, Inc.: Seawolf

b. FRP-2: Basis of Design: Special-Lite, Inc.: Sage Brown

2.6 HARDWARE

A. Door Hardware: See Section 08 71 00.

2.7 ACCESSORIES

A. Stops for Glazing: Fiberglass, unless otherwise indicated or required by fire rating; provided by door manufacturer to fit factory made openings, with color and texture to match door; fasteners shall maintain waterproof integrity.

1. Glazed Openings: Provide removable stops on interior side.

2. Fire-Rated Doors: Provide stop kit listed by labeling authority.

3. Opening Sizes and Shapes: As indicated on drawings.

B. Glazing: See Section 08 80 00.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

3.2 PREPARATION

A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

B. Clean and prepare substrate in accordance with manufacturer's directions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions; do not penetrate frames with anchors.

B. Install fire-rated assemblies in accordance with NFPA 80.

C. Set units plumb, level, and true-to-line, without warping or racking doors, and with specified clearances; anchor in place.

D. In stud walls, install frames prior to building walls; anchor frames to studs using concealed anchors.

E. Separate aluminum and other metal surfaces from sources of corrosion of electrolytic action at points of contact with other materials.

3.4 ADJUSTING

A. Lubricate, test, and adjust doors to operate easily, free from warp, twist or distortion, and to fit watertight for entire perimeter.

B. Adjust hardware for smooth and quiet operation.

C. Adjust doors to fit snugly and close without sticking or binding.

3.5 CLEANING

A. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance.

3.6 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION 08 16 13

(This page intentionally left blank)

SECTION 08 31 00 - ACCESS DOORS AND PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall-mounted access units.

B. Ceiling-mounted access units.

1.2 REFERENCE STANDARDS

1.3 SUBMITTALS

A. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

B. Shop Drawings: Indicate exact position of each access door and/or panel unit.

C. Project Record Documents: Record actual locations of each access unit.

PART 2 PRODUCTS

2.1 ACCESS DOORS AND PANELS ASSEMBLIES

A. Wall-Mounted Units with Return Air Grille:

1. Panel Material: Aluminum extrusions with gypsum board inlay.

2. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

3. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.

4. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.

B. Ceiling-Mounted Units with Return Air Grille:

1. Size - Lay-In Grid Ceilings: To match module of ceiling grid.

2. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that rough openings are correctly sized and located.

B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to proceeding with this work.

B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.3 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings, and secure units rigidly in place.

C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION 08 31 00

SECTION 08 43 13 - ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.

1.2 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site.

B. AAMA 501.2 - Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage.

C. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems.

D. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.

E. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.

F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

G. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

H. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

I. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

J. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.

K. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.4 SUBMITTALS

A. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, and internal drainage details.

B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.

1. Include design engineer's stamp or seal on shop drawings for attachments and anchors.

C. Samples: Submit two samples two by six inches in size illustrating finished aluminum surface, glass, infill panels, glazing materials.

D. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

E. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.

F. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.7 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.8 WARRANTY

A. Correct defective Work within a five year period after Date of Substantial Completion.

B. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

C. Provide twenty year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Storefront Basis of Design:

1. Kawneer: Trifab Versaglaze 451T F

2. Or approved equal.

2.2 ALUMINUM-FRAMED STOREFRONT (KEYNOTE: 084313-A)

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.

1. Glazing Position: Centered (front to back).

2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.

3. Finish: Class I natural anodized.

a. Factory finish all surfaces that will be exposed in completed assemblies.

b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

4. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.

5. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.

6. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

7. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.

8. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.

9. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

B. Performance Requirements

1. Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330, using loads 1.5 times the design wind loads and 10 second duration of maximum load. **Steel reinforcing required inside the mullions based on the design, shall be included.**

a. Design Wind Loads: See Structural Drawings for load requirements.

b. Member Deflection: Limit member deflection to flexture limit of glass in any direction, with full recovery of glazing materials.

2. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf.

3. Air Leakage: 0.06 cfm/sq ft maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf pressure difference.

4. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.

5. Thermal Resistance (U-factor):

   a. System: 0.38, maximum

   b. Doors: 0.77, maximum

2.3 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.

   1. Glazing Stops: Flush.

B. Glazing: See Section 08 80 00.

2.4 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Fasteners: Stainless steel.

C. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.5 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

3.2 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.3 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.4 FIELD QUALITY CONTROL

A. Water-Spray Test: Provide water spray quality test of installed storefront components in accordance with AAMA 501.2 during construction process and before installation of interior finishes.

1. Perform a minimum of two tests in each designated area as directed by Architect.

2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.

B. Provide field testing of installed storefront system by independent laboratory in accordance with AAMA 503 during construction process and before installation of interior finishes.

1. Perform a minimum of two tests in each designated area as directed by Architect.

2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.

3. Field test for water penetration in accordance with ASTM E1105 with uniform static air pressure difference (Procedure A) not less than 4.18 psf.

a. Maximum allowable rate of water penetration in 15-minute test is 0.5 ounce that is not contained in an area with provisions to drain to exterior, or collected on surface of interior horizontal framing member.

4. Field test for air leakage in accordance with ASTM E783 with uniform static air pressure difference of 1.57 psf.

C. Repair or replace storefront components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.5 ADJUSTING

A. Adjust operating hardware and sash for smooth operation.

3.6 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

3.7 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION 08 43 13

(This page intentionally left blank)

SECTION 08 43 33 - FOLDING GLASS STOREFRONT

PART 1 GENERAL

1.1 SUMMARY

A. Section includes furnishing and installing a floor track supported, sliding-folding thermally broken, aluminum-framed glass panel system that includes:

1. Aluminum frame.
2. Threshold.
3. Sliding-folding and locking hardware.
4. Weather stripping.
5. Glass and glazing.
6. Accessories as required for a complete working installation.

1.2 REFERENCES

A. AAMA. American Architectural Manufacturers Association; www.aamanet.org

1. AAMA 205-15, In-Plant Testing Guidelines for Manufacturers and Independent Laboratories.
2. AAMA 502, Voluntary Specification for Field Testing of Newly Installed Fenestration Products.
3. AAMA 611, Voluntary Specification for Anodized Architectural Aluminum.
4. AAMA 920-11, Specification for Operating Cycle Performance of Side-Hinged Exterior Door Systems.
5. AAMA 1304, Voluntary Specifications for Forced Entry Resistance of Side-Hinged Door Systems.
6. AAMA 2604, Voluntary Specifications, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
7. AAMA/WDMA/CSA 101/I.S.2/A440-17, NAFS, North American Fenestration Standard Specification for Windows, Doors, and Skylights.

B. ANSI. American National Standards Institute; www.ansi.org

1. ANSI Z97.1, Safety Performance Specifications and Methods of Test for Safety Glazing Material Used in Buildings.

C. ASTM. ASTM International; www.astm.org

1. ASTM C1036, Standard Specification for Flat Glass.
2. ASTM C1048, Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
3. ASTM E283-04 (2012), Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
4. ASTM E330-00 (2016), Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
5. ASTM E331-00 (2016) Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
6. ASTM E547-00 (2016), Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference.
7. ASTM E2068-00 (2016) Standard Test Method for Determination of Operating Force of Sliding Windows and Doors.
8. ASTM E987-88 (2017) Standard Test Methods for Deglazing Force of Fenestration Products.
9. ASTM E1332, Standard Classification for Rating Outdoor-Indoor Sound Attenuation.
10. ASTM F842, Standard Test Methods for Measuring the Forced Entry Resistance of Sliding Door Assemblies, Excluding Glazing Impact.

D. CPSC. Consumer Product Safety Commission; www.cpsc.gov

1. CPSC 16CFR-1201, Safety Standard for Architectural Glazing Materials

E. Energy Star, U.S. Environmental Protection Agency (EPA) Program; www.energystar.gov

F. NFRC. National Fenestration Rating Council; www.nfrc.org

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.

3. NFRC 400, Procedure for Determining Fenestration Product Air Leakage.

4. NFRC 500, Procedure for Determining Fenestration Product Condensation Resistance Rating Values.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's printed product literature for each Folding Glass Door system to be incorporated into the Work. Show performance test results and details of construction relative to materials, dimensions of individual components, profiles, and colors.

B. Product Drawings: Indicate Folding Glass Door system component sizes, dimensions and framing R.O., configuration, swing panels, direction of swing, stacking layout, typical head jamb, side jambs and sill details, type of glazing material, and handle heights.

C. Design Data: Provide framing member structural and physical characteristics and engineering calculations, and identify dimensional limitations; include load calculations at points of attachment to building structure. Submit signed and sealed calculations.

D. Manufacturers' Instructions: Submit Owner's Manual from manufacturer which includes installation instructions, operation, and maintenance data: Identify with project name, location and completion date, and type and size of unit installed.

1.4 QUALITY ASSURANCE

A. Designer Qualifications: Design curtain wall and its structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the State in which the Project is located.

B. Manufacturer Qualifications: Manufacturer capable of providing complete, precision built, engineered, pre-fitted units with a minimum thirty (30) years' experience in the sale of folding-sliding door systems for large openings in the North American market.

C. Installer Qualifications: Installer experienced in the installation of manufacturer's products or other similar products for large openings. Installer to provide reference list of at least three (3) projects of similar scale and complexity successfully completed in the last three (3) years.

1. Installer to be trained and certified by manufacturer.

D. Single Source Responsibility: Furnish Folding Glass Door system materials from one manufacturer for entire Project.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's instructions and recommendations, Section 01 60 00 requirements, and as follows:

1. Deliver materials to job site in sealed, unopened cartons or crates.

a. Upon receipt, inspect the shipment to ensure it is complete, in good condition and meets project requirements.

2. Store material under cover in a clean and dry location, protecting units against weather and defacement or damage from construction activities, especially to the edges of panels.

1.6 FIELD CONDITIONS

A. Field Measurements: Contractor to field verify dimensions of rough openings (R.O.) and threshold depressions to receive sill. Mark field measurements on product drawing submittal.

1.7 WARRANTY

A. Manufacturer Warranty: Provide Folding Glass Door system manufacturer's standard limited warranty as per manufacturer's published warranty document in force at time of purchase, subject to change, against defects in materials and workmanship.

1. Warranty Period beginning from the Date of Substantial Completion:

a. Rollers and Insulated Glass Seal Failure: Ten (10) years

b. All Other Components Except Screens: Ten (10) years

1) Exception: Five (5) years if NOT installed by manufacturer's specific system approved or certified trained installer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product by Manufacturer: NanaWall SL70 by NANA WALL SYSTEMS, INC. (www.nanawall.com).

B. Or approved equal.

2.2 PERFORMANCE / DESIGN CRITERIA

A. Performance Criteria (Lab Tested): **Low Profile Saddle Sill - Outward Opening**

1. Structural Load Deflection (ASTM E330):

a. Design Pressure - Positive: 70 psf (3350 Pa)

b. Design Pressure - Negative: 70 psf (3350 Pa)

c. Uniform Load deflection, L/175: Pass 25 psf (1190 Pa)

2. Air Infiltration (ASTM E283):

a. 0.12 cfm/ft2 (0.61 L/s/m2) at a static air pressure difference of 1.57 psf (75 Pa)

3. Water Penetration (ASTM E331, ASTM E547):

a. No uncontrolled water leakage at a static (with weeps) test pressure of 5.43 psf (260 Pa). (Not applicable for even-even configurations)

B. Performance Criteria (Lab Tested):

1. Swing Panel – Operation / Cycling Performance (AMMA 920): 500,000 cycles

2. System – Life Cycle Performance (DIN EN 1191/12400): 20,000 cycles

3. Operating Force (ASTM E2068):

a. Swing Panel: Open 1 lbf (2.8 N) & Close 1 lbf (3.9 N)

b. Folding Panels:

1) Initiate Motion - Open 4 lbf (20 N) & Close 3 lbf (15 N)

2) Maintain Motion - Open 1 lbf (3 N) & Close 1 lbf (4 N)

4. Forced Entry (AAMA 1304, DIN EN 1191): Pass

5. Forced Entry Resistance (ASTM F842, AMMA 1304, CAWM 300): Meets Grade 40; +F2

6. Unit Burglary Resistance: EN 1627-30, Class RC2/ RC2N Certified

7. Thermal Performance (U-factor): 0.25 maximum NFRC 100 Rated, Certified, and Labeled

8. Solar Heat Gain Coefficient (SHGC) + Visible Light Transmission (VT): NFRC 200 Rated, Certified, and Labeled

9. Air Leakage: NFRC 400 Rated, Certified, and Labeled

10. Condensation Resistance (CR): NFRC 500 Rated, Certified, and Labeled

11. EPA Energy Star: Meets requirements

C. Design Criteria:

1. Sizes and Configurations: As indicated by the Drawings for selected number and size of panels, location of swing panels, and number of panels stacking to the left and to the right.

2. Unit Operation: Adjustable sliding and folding hardware with top and bottom tracks.

3. Mounting Type: Floor track supported with upper guide track.

4. Panel Configuration:

a. Straight

b. Window / door combination

5. Stack Storage Configuration:

a. Outswing type

6. Panel Type: Hinged

7. Panel Pairing Configuration: See drawings.

    a. Bi-folding panels unhinged FourFold or SixFold panel sets

2.3 MATERIALS

A. Thermally Broken Aluminum Framed Folding Glass Door Description: 2-5/8 inch (67 mm) thick, floor track supported system. Manufacturer's standard thermally broken panels and frame profiles, with head track, side jambs, sill, and panels with dimensions as shown on Drawings.

1. Panels and Frame:

    a. Panels

        1) Single lite.

        2) Panel Size (W x H): As indicated.

        3) Rail Depth: 2-5/8 inch (67 mm)

        4) Top Rail Width: 2-5/8 inch (67 mm)

        5) Typical Stile Width: 1-3/4 inch (45 mm) on both stiles for a nominal frame stile width of 3-7/8 inch (99 mm) between folding panels.

        6) Bottom Rail Width:

            (a) 2-5/8 inch (67 mm)

    b. Frame:

        1) Thermally broken top track and side jambs with multipurpose frame insert to hide anchoring frame connections and conceal cable routing to security system by others. For long-term tight, consistent sealing, provide a lateral patented (Patent Number: US10683688B2) adjustment feature at the side jambs capable of adjustment of +/- 3/16? (5 mm). Frame finish to match panel finish.

        2) Side Jamb Depth: 2-5/8 inch (67 mm)

        3) Head Track Width:

(a) 3-7/8 inch (99 mm) anti-tilt feature for unhinged FourFold or SixFold panel set configurations

4) Side Jamb Width: 2 inches (51 mm)

5) Sill Type - Extruded Aluminum:

(a) Low profile saddle sill - ADA compliant with high heel protector insert (thermally broken)

6) Sill Finish:

(a) Clear anodized

2. Aluminum Extrusion: AlMgSi0.5 alloy, 6063-T5 (F-22 - European standard)

a. Thickness: 0.078 inch (2.0 mm) nominal

b. Thermal Break: 1-15/16 inch (49 mm) wide specially designed and patented (Patent Number: US10550625B2) glass fiber reinforced (GFR) polyamide "Bionic Turtle®" for panels. Standard thermal break elsewhere.

3. Aluminum Finish:

a. Inside and Outside;

1) Same (one-color)

b. Powder Coat (AAMA 2604): Custom Color to match 08 44 13 finish.

B. Glass and Glazing:

1. Safety Glazing: In compliance with ASTM C1036, ASTM C1048, ANSI Z97.1 and CPSC 16CFR 1201.

2. GL-1 per 08 8000.

C. Locking Hardware and Handles:

1. Main Entry Panel(s) for Models WITH a Swing Panel: No hardware or locking provided by manufacturer; Field installed panic device by Section 08 7100 prepped for commercial application for supply by others.

2. Pairs of Folding Panels: Provide manufacturer's flat handle and concealed two-point locking hardware operated by 180° turn of handle between each pair. Face applied flush bolt locking NOT acceptable.

3. Handle Height: 41-3/8 inch (105 cm) centered from bottom of panel or as otherwise indicated.

4. Locking rods with standard end caps at the top and bottom. Rods to have a stroke of 15/16 inch (24 mm).

5. Panel Catch: panel catch to hold swing panel to adjacent folding panel to prevent incorrect operation when moving the panel.

D. Sliding-Folding Hardware: Provide manufacturer's standard combination sliding and folding hardware with top and bottom tracks and threshold. All bottom rollers to be with sealed, self-lubricating, double ball bearing multi-rollers. Surface mounted hinges and bottom rollers NOT acceptable.

1. Bottom Rollers Carrying Capacity: 240 lb. (110 kg). Bottom rollers provided with two vertical stainless-steel wheels with double row of ball bearings and two horizontal polyamide wheels.

2. Vertical wheels with Gothic arch feature to ride on top of stainless-steel guide track covers over the full length of the sill track.

3. Upper guide rollers with two horizontal polyamide guiding wheels. For configurations with unhinged FourFold and SixFold panel sets that can slide left or right, additional concealed, additional vertical tilt protection hardware.

4. Hinges and Rollers:anodized aluminum with stainless steel security hinge pins and set-screws. Concealed panel alignment with a tight seal through the patented (Patent Number: US10711510B2) TwinX mechanism reinforced between panels. Double ball bearing stainless-steel wheel rollers match hinge finish.

5. Spring-Loaded Pull Handle: For outswing units with larger panel sizes, a spring-loaded pull handle is supplied for ease of closing the system. The pull handle is located above the flat handle. When not in use, the handle lays flat against the adjacent panel and is supplied with bumpers to avoid metal to metal contact. Handles are stainless steel with the attachment to coordinate the hinge hardware of the system.

6. Weather stripping: Manufacturer's double layer EPDM between panels and EPDM gasket, Q-Ion gasket, or brush seal between panel and frame, or brush seals with a two-layer fiberglass reinforced polyamide fin attached at both inner and outer edge of bottom of door panels with a recessed sill or on frame for sealing between panels and between panel and frame.

E. Fasteners: Installation plates for connecting frame components made of stainless steel with sealing cushion to avoid thermal conductivity.

2.4 FABRICATION

A. Folding Glass Wall: Extruded aluminum frame and panel profiles, corner connectors and hinges, sliding and folding hardware, locking hardware and handles, glass and glazing and weather stripping.

1. Each unit factory pre-assembled and shipped with complete system components, installation mounting plates, and installation instructions.

2. Exposed work to be carefully matched to produce continuity of line and design with all joints.

3. No raw edges visible at joints.

PART 3 EXECUTION

3.1 EXAMINATION

A. Carefully examine rough openings with Installer present, for compliance with requirements affecting Work performance.

1. Examine surfaces of openings and verify dimensions; verify rough openings are level, plumb, and square with no unevenness, bowing, or bumps on the floor; and other conditions as required by the manufacturer for readiness to receive Work.

2. Verify structural integrity of the header for deflection with live and dead loads limited to the lesser of L/720 of the span or 1/4 inch (6 mm). Provide structural support for lateral loads, and both wind load and eccentric load when the panels are stacked open.

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

3.2 INSTALLATION

A. General: Install Folding Glass Door system in accordance with the Drawings, approved submittals, manufacturer's recommendations, and installation instructions, and as follows:

1. Properly flash, waterproof and seal around opening perimeter.

2. Securely attach anchorage devices to rigidly fit frame in place, level, straight, plumb, and square. Install frame in proper elevation, plane, and location, and in proper alignment with other work.

3. When lower track is designed to drain, provide connections to allow for drainage.

4. Install panels, handles, lockset, screens, and other accessories in accordance with manufacturer's recommendations and instructions.

3.3 FIELD QUALITY CONTROL

A. Verify the Folding Glass Door system operates and functions properly. Adjust hardware for proper operation.

3.4 CLEANING AND PROTECTION

A. Keep units closed and protect Folding Glass Door installation against damage from construction activities.

B. Remove protective coatings and use manufacturer recommended methods to clean exposed surfaces.

END OF SECTION 08 43 33

(This page intentionally left blank)

SECTION 08 44 13 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Aluminum-framed curtain wall, with vision glazing and glass infill panels.

B. Firestopping between curtain wall and edge of floor slab.

1.2 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site.

B. AAMA 501.2 - Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage.

C. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems.

D. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.

E. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.

F. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

G. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

H. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

I. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

J. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

K. ASTM C1401 - Standard Guide for Structural Sealant Glazing

L. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

M. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors

N. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.

O. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.4 SUBMITTALS

A. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, internal drainage details, glazing.

B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required. Submit signed and sealed shop drawings.

C. Samples: Submit two samples 2 by 6 inches in size illustrating finished aluminum surface.

D. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

E. Design Data: Provide framing member structural and physical characteristics and engineering calculations, and identify dimensional limitations; include load calculations at points of attachment to building structure. Submit signed and sealed calculations.

F. Test Reports: Submit results of full-size mock-up testing. Reports of tests previously performed on the same design are acceptable.

G. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Designer Qualifications: Design curtain wall and its structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.7 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.8 WARRANTY

A. Correct defective Work within a two year period after Date of Substantial Completion.

B. Provide twenty year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Kawneer 1600 Wall System 1.

B. Other Acceptable - Glazed Aluminum Curtain Walls Manufacturers:

1. Oldcastle Building Envelope: www.oldcastlebe.com/#sle.

2. YKK AP America, Inc: www.ykkap.com/commercial/#sle.

3. EFCO: www.efco.com

2.2 CURTAIN WALL (KEYNOTE 084413-A)

A. Aluminum-Framed Curtain Wall: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.

1. Outside glazed, with pressure plate and mullion cover.

2. Vertical Mullion Depth From Face of Glazing to Back of Frame: 7-1/2 inches maximum.

3. Finish: Class I natural anodized.

a. Factory finish surfaces that will be exposed in completed assemblies.

b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

c. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

4. Provide flush joints and corners, weathersealed, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads.

5. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.

6. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

7. Maintain continuous air barrier and/or vapor retarder seal throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.

8. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

B. Structural Performance Requirements: Design and size components to withstand the following load requirements without damage or permanent set. **Steel reinforcing required inside the mullions based on the design, shall be included.**

1. Design Wind Loads: Comply with structural drawings and the requirements of ASCE 7

2. Seismic Loads: Design and size components to withstand seismic loads and sway displacement in accordance with requirements of ASCE 7.

3. Movement: Accommodate the following movement without damage to components or deterioration of seals:

a. Expansion and contraction caused by 180 degrees F surface temperature.

b. Expansion and contraction caused by cycling temperature range of 170 degrees F over a 12 hour period.

c. Movement of curtain wall relative to perimeter framing.

d. Deflection of structural support framing, under permanent and dynamic loads.

C. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on indoor face when tested as follows:

1. Test Pressure Differential: 15 psf.

D. Air Leakage: 0.06 cfm/sq ft maximum leakage of wall area when tested in accordance with ASTM E283/E283M at 6.27 psf pressure difference across assembly.

E. Thermal Performance Requirements:

1. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.

2. Thermal Resistance of System (U-factor): 0.38 minimum

2.3 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.

1. Framing members for interior applications need not be thermally broken.

2. Cross-Section: As indicated on drawings.

B. Glazing: See Section 08 80 00.

2.4 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Structural Steel Sections: ASTM A36/A36M; galvanized in accordance with requirements of ASTM A123/A123M.

C. Structural Supporting Anchors Attached to Structural Steel: (KEYNOTE: 084413-F) Design for bolted attachment.

D. Exposed Flashings: Aluminum sheet, 20 gauge, 0.032 inch minimum thickness; finish to match framing members.

E. Concealed Flashings: Galvanized steel, 26 gauge, 0.0179 inch minimum base metal thickness.

F. Firestopping: See Section 07 84 00.

G. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

H. Glazing Accessories: See Section 08 80 00.

I. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

2.5 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other related work.

B. Verify that curtain wall openings and adjoining water-resistive and air barrier seal materials are ready to receive work of this section.

C. Verify that anchorage devices have been properly installed and located.

3.2 INSTALLATION

A. Install curtain wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Coordinate attachment and seal of perimeter air and vapor barrier materials.

H. Install firestopping at each floor slab edge.

I. Provide insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

J. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.3 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 0.5 inches per 100 ft, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

C. Sealant Space Between Curtain Wall Mullions and Adjacent Construction: Maximum of 3/4 inch and minimum of 1/4 inch.

3.4 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.

B. Water-Spray Test: Provide water spray quality test of installed curtain wall components in accordance with AAMA 501.2 during construction process and before installation of interior finishes.

1. Perform a minimum of two tests in each designated area as indicated on drawings.

2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.

C. Provide field testing of installed curtain wall system by independent laboratory in accordance with AAMA 503 during construction process and before installation of interior finishes.

1. Perform a minimum of two tests in each designated area as indicated on drawings.

2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.

3. Field test for water penetration in accordance with ASTM E1105 with uniform static air pressure difference (Procedure A) not less than 4.18 psf.

a. Maximum allowable rate of water penetration in 15-minute test is 0.5 ounce that is not contained in an area with provisions to drain to exterior, or collected on surface of interior horizontal framing member.

D. Repair or replace curtain wall components that have failed designated field testing, and retest to verify performance complies with specified requirements.

E. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

F. Test Area: Perform tests on one bay at least 30 feet (9.1 m), by one story.

G. Structural-Sealant Adhesion: Test structural sealant according to recommendations in ASTM C 1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.

1. Test a minimum of two areas on each building facade.

2. Repair installation areas damaged by testing.

H. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.

I. Prepare test and inspection reports.

3.5 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

3.6 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION 08 44 13

(This page intentionally left blank)

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Automatic operators.
4. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Door Hardware Schedule”.
2. Division 08 Section “Fiberglass Doors”,
3. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. UL/ULC and CSA C22.2 - Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
8. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.
5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
3. Content: Include the following information:

    a. Type, style, function, size, label, hand, and finish of each door hardware item.
    b. Manufacturer of each item.
    c. Fastenings and other pertinent information.
    d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    e. Explanation of abbreviations, symbols, and codes contained in schedule.
    f. Mounting locations for door hardware.
    g. Door and frame sizes and materials.
    h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
b. Complete (risers, point-to-point) access control system block wiring diagrams.
c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

B. Project Record Documents: Provide record documentation of as-built door hardware sets in digital format (.pdf, .docx, .xlsx, .csv) and as required in Division 01, Project Record Documents.

1.5 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that

indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

F. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.

G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

I. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.6 DELIVERY, STORAGE AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.7 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.8 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 MATERIALS

A. Hardware shall not have any visible manufacturer names on exposed materials, except cylinders, when the door is in a closed position.

2.3 BUTT HINGES

A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

a. Two Hinges: For doors with heights up to 60 inches.
b. Three Hinges: For doors with heights 61 to 90 inches.
c. Four Hinges: For doors with heights 91 to 120 inches.
d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:

a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for all out-swinging lockable doors.

5. Manufacturers:

a. Ives (IV) - 5BB Series, 5-knuckle.
b. McKinney (MK) - TA/T4A Series, 5-knuckle.
c. dormakaba BEST (ST) - F/FBB Series, 5-knuckle.

2.4 CONTINUOUS HINGES

A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:.

a. Ives (IV).
b. Pemko (PE).
c. dormakaba BEST (ST).

2.5 POWER TRANSFER DEVICES

A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

a. Pemko (PE) - EL-CEPT Series.
b. Securitron (SU) - EL-CEPT Series.
c. dormakaba BEST (ST) EPT-12C Series.

B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide

sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

    a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
    b. McKinney (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

    a. McKinney (MK) - QC-C Series.
    b. dormakaba BEST (ST) - WH Series.

2.6 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
5. Manufacturers:

    a. Ives (IV).
    b. Rockwood (RO).

B. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Pulls shall be provided with a 10” clearance from the finished floor on the push side to accommodate wheelchair accessibility.
5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets. When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.

6. Manufacturers:

    a. Hiawatha, Inc. (HI).
    b. Ives (IV).
    c. Rockwood (RO).

2.7 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

1. Manufacturers:

    a. Match Existing, Field Verify.

B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.
2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
6. Keyway: Match Facility Standard.

C. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. Existing System: Field verify and key cylinders to match Owner's existing system.

D. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).

E. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

2.8 MORTISE LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational and Security Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide locksets with functions and features as follows:

   a. Heavy duty 12-gauge wrought steel case.
   b. Stainless steel 3/4" one-piece anti-friction reversible latchbolt with a one-piece hardened stainless steel 1” projection deadbolt.
   c. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.
   d. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
   e. Meets UL Certification Directory ZHLL.R21744 for products used in windstorm rated assemblies.
   f. Status indicators inside, outside, or on both sides of doors as specified; available with wording for “locked/unlocked”, “vacant/occupied” or custom wording options. Indicator to be located above the cylinder with the inside thumb-turn not blocking the visibility of the indicator status.
   g. Ten-year limited warranty for mechanical functions.

2. Manufacturers:

   a. Sargent Manufacturing (SA) - 8200 Series.
   b. Assa Abloy Accentra (YA) – 8800 Series

2.9 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.10 ELECTRIC STRIKES

A. Standard Electric Strikes: Electric strikes conforming to ANSI/BHMA A156.31, Grade 1, for use on non-rated or fire rated openings. Strikes shall be of stainless steel construction tested to a minimum of 1500 pounds of static strength and 70 foot-pounds of dynamic strength with a minimum endurance of 1 million operating cycles. Provide strikes with 12 or 24 VDC capability, fail-secure unless otherwise specified. Where specified provide latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike.

1. Manufacturers:

    a. HES (HS) - 1500/1600 Series.

B. Provide electric strikes with in-line power controller and surge suppressor by the same manufacturer as the strike with the combined products having a five year warranty.

2.11 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. Exit devices shall have a five-year warranty.
2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.
4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
6. Flush End Caps: Provide flush end caps made of architectural metal in the same finish as the devices as in the Hardware Sets. Plastic end caps will not be acceptable.
7. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.

    a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
    b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

8. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
9. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
10. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
11. Rail Sizing: Provide exit device rails factory sized for proper door width application.
12. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide exit devices with functions and features as follows:

    a. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.
    b. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
    c. Five-year limited warranty for mechanical features.

2. Electromechanical exit devices shall have the following functions and features:

    a. Universal Molex plug-in connectors that have standardized color-coded wiring and are field configurable in fail safe or fail secure and operate from 12vdc to 24vdc regulated.
    b. EcoFlex or equivalent technology that reduces energy consumption up to 92% as certified by GreenCircle.
    c. Options to be available for request-to-exit or enter signaling, latchbolt and touchbar monitoring.
    d. Field configurable electrified trim to fail-safe or fail-secure that operates from 12-24VDC.
    e. Five-year limited warranty for electromechanical features.

3. Manufacturers:

    a. ASSA ABLOY ACCENTRA (YA) - 7000 Series.
    b. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
    c. Sargent Manufacturing (SA) - 80 Series.

2.12 SURFACE DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.

3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Heavy duty surface mounted door closers shall have a 30-year warranty.

2. Manufacturers:

a. ASSA ABLOY ACCENTRA (YA) - 4400 Series.
b. Norton Rixson (NO) - 7500 Series.
c. Sargent Manufacturing (SA) - 351 Series.

C. Door Closers, Surface Mounted (Unitrol): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted closers with door stop mechanism to absorb dead stop shock on arm and top hinge. Hold-open arms to have a spring loaded mechanism in addition to shock absorber assembly. Arms to be provided with rigid steel main arm and secondary arm lengths proportional to the door width.

1. Manufacturers:

a. ASSA ABLOY ACCENTRA (YA) - Unitrol Series.
b. Norton Rixson (NO) - Unitrol Series.

D. Door Closers, Surface Mounted (Cam Action): ANSI/BHMA 156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, high efficiency door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be of the cam and roller design, one piece cast aluminum silicon alloy body with adjustable backcheck and independently controlled valves for closing sweep and latch speed.

1. Manufacturers:

a. Norton Rixson (NO) - 2800ST Series.
b. Sargent Manufacturing (SA) - 422 Series.

2.13 ELECTROHYDRAULIC DOOR OPERATORS

A. Electrohydraulic Door Operators (High Traffic): Provide ANSI/BHMA A156.19 Certified Products Directory (CPD) listed low energy operators that meet ANSI/BHMA A156.4 requirements and are UL listed for use on fire rated doors and UL10C certified that comply with requirements for the Americans with Disabilities Act (ADA). Operators shall be verified by GreenCircle to offer energy savings of 19% when compared to similar products to accommodate openings up 250 pounds and 48" wide. Provide accessories such as custom templates, special mounting brackets, spacers and drop plates as needed for proper installation. Operators shall accommodate openings up to 200 pounds and 48" wide. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide operators with features as follows:

   a. Non-handed with push and pull side mounting.
   b. Operates as mechanical surface closer during close cycles, when door is opened manually or if power is off.
   c. Activation by push button, hands-free or radio frequency devices.
   d. On board electronics to collect usage and cycle count data to facilitate preventative maintenance/diagnostics.
   e. Two-year limited warranty.
   f. Wi-Fi interface where the operator is a secure, password protected WiFi hot spot with no connection to building's IT required.
      1) Simple setup with no app required.
      2) View status and make adjustments without removing the cover.
      3) Built-in logic to support single use restroom applications with no external relay boards, logic modules, position switches required.
   g. Mounting backplate to simplify and speed up installation.

2. Operators shall have the following functionality:

   a. Adjustable Hold Open: Amount of time a door will stay in the full open position after an activation.
   b. Blow Open for Smoke Ventilation: Door opens when signal is received from alarm system allowing air or smoke to flow through opening. Door will stay open until signal from alarm system is stopped.
   c. Infinite Hold Open: Door will hold open at set position until power is turned off.
   d. Obstruction Detection: Door closes if it hits an obstruction while opening; door will reverse to open position if it hits an obstruction while closing. Door will stop once it hits an obstruction and will rest against the obstruction until removed.
   e. Open Delay: Delays operator opening for locking hardware.
   f. Overload Safety Shut-Off: After two minutes of receiving a door activation signal, inverter times out and door closes to prevent motor/inverter damage.
   g. Presence Detector Input: Input for external sensor to detect presence at door open or close position only.
   h. Push & Go: As the door is manually opened, the operator "senses" movement and opens door to the full-open position.

i. Selector Mode Switch: Off disables the signal inputs unless Blow Open is activated, on activates the signal inputs, hold open activates the unit (unless Blow Closed is activated) to the hold open position.
j. Vestibule Delay: When the wall switch is pressed, first door in vestibule will open. Second door will open once vestibule door delay has expired. Delay is adjustable.

3. Manufacturers:

a. LCN (LC) - 4630/4640 Series.
b. Norton Rixson (NO) - 6000 Series.

2.14 SURFACE MOUNTED CLOSER HOLDERS

A. Electromagnetic Door Holders: ANSI A156.15, Grade 1 electromagnetic door holder/releases with a minimum 25 to 40 pounds holding power and fail-safe operation; power failure releases door to close.

1. Manufacturers:

a. LCN Door Closers (LC) - SEM7800 Series.
b. Norton Rixson (RF) - 900 Series.
c. Sargent Manufacturing (SA) - 1560 Series.

2.15 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:

a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:

a. Hiawatha, Inc. (HI).
b. Ives (IV).

c. Rockwood (RO).

2.16 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

a. Hiawatha, Inc. (HI).
b. Ives (IV).
c. Rockwood (RO).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:

a. Norton Rixson (RF).
b. Rockwood (RO).
c. Sargent Manufacturing (SA).

2.17 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. National Guard Products (NG).
2. Pemko (PE).
3. Zero (ZE).

2.18 ELECTRONIC ACCESSORIES

A. Request to Exit Motion Sensor: Passive infrared request to exit (REX) motion sensor designed for detecting exiting through a door from the secure area to a non-secure area.

1. Provide devices with functions and features as follows:

a. Adjustable infrared beam and relock time.
b. UL listed.
c. 12VDC or 24VDC power.
d. Single pole, double throw (SPDT) switch.

2. Manufacturers:

a. Alarm Controls (AK) - SREX Series.
b. Securitron (SU) - XMS2 Series.

B. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Manufacturers:

a. Sargent Manufacturing (SA) - 3280 Series.
b. Securitron (SU) - DPS Series.

C. Intelligent Switching Power Supplies: Provide the least number of power supplies at the appropriate amperage level sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.

1. Power supplies shall meet all functions and features as specified herein.

    a. UL listed dual voltage 12 or 24 VDC field selectable continuous output.
    b. Dedicated fast charger to prolong battery life with low battery cutoff to protect batteries from deep discharge.
    c. Enhanced surge immunity for input/output protection
    d. Separate, dedicated battery charging circuit to keep locks cooler.
    e. Dual-color LED visual notification to prevent applying incorrect voltages to the power supply.
    f. Instant auto-switch to battery on AC loss.
    g. Expandable up to 16 outputs in the standard enclosure
    h. Integrated fire alarm interface to allow main output shutdown or disconnect on a per output basis when using an R8 output module.
    i. Network ready and remotely manage locks and connected devices when using an M8 managed output module on network models.
    j. Lifetime replacement, no-fault, no questions asked warranty.

2. Manufacturers:

    a. Life Safety Power (LP).
    b. Securitron (SU) - AQL Series.

2.19 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.20 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Push Plates and Door Pulls: When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.

E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies,

conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Refer to Section 080671, Door Hardware Sets, for hardware sets.

END OF SECTION 087100

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 08 71 13 – AUTOMATIC DOOR OPERATORS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes Low Energy and power assist door operators for swinging doors.

B. Related Sections:

1. Division 7 Sections for caulking to the extent not specified in this section.
2. Division 8 Section “Aluminum-Framed Entrances and Storefronts” for entrances furnished separately in Division 8 Section.
3. Division 8 Section “Door Hardware” for hardware to the extent not specified in this Section.
4. Division 26 and 28 Sections for electrical connections including conduit and wiring for automatic entrance door operators and access control devices.

1.2 REFERENCES

A. References: Refer to the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.

B. American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA) - ANSI/BHMA A156.19 Standards for Power Assist and Low Energy Power Operated Doors.

C. Underwriters Laboratories (UL).

1. UL10C – Positive Pressure Fire Tests of Door Assemblies.
2. UL 325 Standard for Safety for Door, Drapery, Gate, Louver and Window Operators and Systems.
3. UL991 - Tests for Safety-Related Controls Employing Solid-State Device.

D. American Association of Automatic Door Manufacturers (AAADM).

E. American Society for Testing and Materials (ASTM).

1. ASTM B221 Standard Specification for Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
2. ASTM B209 Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate.

F. American Architectural Manufacturers Association (AAMA) - AAMA 611 Voluntary Specification for Anodized Architectural Aluminum.

G. National Association of Architectural Metal Manufacturers (NAAMM).

H. International Code Council (ICC) - IBC: International Building Code.

1.3 DEFINITIONS

A. Activation Device: Device that, when actuated, sends an electrical signal to the door operator to activate the operation of the door.

B. Knowing act: Consciously initiating the opening of a power operated door using acceptable methods including wall mounted switches such as push plates and controlled access devices such as keypads, card readers and key switches.

C. Safety Device: A device that detects the presence of an object or person within a zone where contact could occur and provides a signal to stop the movement of the door.

D. Double Egress Doors: A pair of doors that swing with the two doors moving in opposite directions and no mullion between them.

1.4 PERFORMANCE REQUIREMENTS

A. Automatic door equipment accommodates medium to heavy pedestrian traffic.

B. Opening Force Requirements: Doors shall open with a manual force, not to exceed 30lbf (133N) to set the door in motion and 15 lbf to fully open the door applied at 1” (25 mm) from the latch edge of the door. The force required to prevent a stopped door from opening or closing shall not exceed 15 lbf (67 N) measured 1” (25 mm) from the latch edge of the door at any point during opening or closing.

C. Closing Time:

1. Doors shall be field adjustable to close from 90 degrees to 10 degrees in 3 seconds or longer as applicable per ANSI/BHMA A156.19 standards.
2. Doors shall be field adjusted to close from 10 degrees to fully closed in not less than 1.5 seconds.

1.5 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, fabrication, operational descriptions and finishes.

B. Shop Drawings: Submit manufacturer’s shop drawings, including elevations, sections and details, indicating dimensions, materials, operator, motion /presence sensor control device, anchors, hardware, finish, options and accessories.

1. Indicate required clearances, and location and size of each field connection.
2. Indicate locations and elevations of entrances showing activation and safety devices.
3. Wiring Diagrams: For power, signal, and activation / safety device wiring.

C. Samples: Submit manufacturer's samples of aluminum finish.

D. Informational Submittals: Manufacturer's product information and applicable sustainability program credits that are available to contribute towards a LEED rated project certification.

1. Credit MR 4: Manufacturer's or fabricator's certificate indicating percentage of post-consumer recycled content by weight and pre-consumer recycled content by weight for each Product specified under this Section.
2. EPDs: Manufacturer's Environmental Product Declaration.

E. Manufacturers Field Reports: Submit manufacturer's field reports from AAADM certified technician of inspection and approval of doors for compliance with ANSI/BHMA after completion of installation.

F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the work of this section in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the operators and their nearest service representatives. The final copies delivered after completion of the installation test to include spare parts list.

G. Warranties and Maintenance: Special warranties and maintenance agreements specified in this Section.

1.6 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 10 years of documented experience in manufacturing of doors and equipment of similar to that indicated for this Project and that have a proven record of successful in-service performance. Manufacturer to have a company certificate issued by AAADM.

B. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum 3 years documented experience installing and maintenance of units similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Certified Inspector Qualifications: Certified by AAADM.

D. Source Limitations for Automatic Door Operators: Obtain each type of operator and sensor components specified in this Section from a single source, same manufacturer unless otherwise indicated.

E. Certifications: Operators shall be certified by the manufacturer to meet performance design criteria in accordance with the following standards.

1. ANSI/BHMA A156.19 American National Standard for Power Assist and Low Energy Operated Doors.
2. NFPA 101 - Life Safety Code.
3. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.
4. Labeled that operator has been tested for use on fire rated doors by a third-party certification agency.

F. Emergency Exit Door Requirements: Comply with requirements of authorities having jurisdiction for automatic entrance doors serving as a required means of egress.

1.7 COORDINATION

A. Coordinate door operators with doors, frames and related work to ensure proper size, thickness, hand, function and finish. Coordinate hardware for automatic entrances with hardware required for rest of the project.

1. Review sequence of operation for doors with automatic operators as noted in the hardware schedule in Division 8 Section “Door Hardware”.

B. Electrical System Roughing-in: Coordinate layout and installation of power door operators with connections to power supplies, fire alarm system, smoke evacuation system, and access control system as applicable.

1.8 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Automatic Door Operators shall be free of defects in material and workmanship for a period of one (1) year from the date of substantial completion.

C. During the warranty period a factory-trained technician shall perform service and affect repairs. An inspection shall be performed after each adjustment or repair.

D. During the warranty period all warranty work, including but not limited to emergency service, shall be performed during normal business hours.

E. Manufacturer shall have in place a dispatch procedure that shall be available 24 hours a Day, 7 Days a week for emergency call back service.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Manufacturer: ASSA ABLOY Entrance Systems, 1900 Airport Road, Monroe, NC (basis of design)

B. Operators shall be installed by manufacturer with factory trained and AAADM certified installers.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish shall be: Extruded Aluminum, Alloy 6063-T5.

2.3 SWING DOOR OPERATORS

A. Model: ASSA ABLOY SW300 low energy automatic door operator (Basis of Design):

1. Reference Standard: ANSI/BHMA A156.19.
2. Configuration: Operator to control single swinging doors and pairs of swinging doors as indicated on the drawings and specified below:
   a. Traffic Pattern: Two way.
   b. Pairs of Doors: Single leaf operation.
   c. Double Egress Doors: Simultaneous swing.
3. Automatic Door Operator: Electro-mechanical, non-handed operator, powered by 24 volt, 5/16 HP motor. Operator shall be adjustable to compensate for different manual push forces as required.
   a. Surface Mounted Operator:
      1) Side Access Operator Housing: Operator is contained in 6-1/2" deep x 2-3/4" high extruded aluminum housing with a removable cover.
      2) Surface Mounted Housing: Continuous for full width of door.
      3) Connecting Hardware: Surface mounted operators to have a steel arm from the operator, mounted to the top face of the swing door.
      4) Surface mounted operator shall be capable of operating and controlling up to a 621 pound door, 48 inches in width.
      5) Labeled that operator has been tested for use on fire rated doors by a third-party certification agency.
   b. Operator Temperature Range: Capable of operating within temperature ranges of -31° F to 160° F.
   c. Electrical Characteristics: Maximum power consumption is 300 watts (2.5 amps at 120 VAC), 50/60hz, built-in thermal overload protection.
   d. Battery Convenience Mode: Operator to maintain continuous operation by battery power during power failure. Battery is continuously monitored and provides a warning signal if the battery is not working properly.
4. Door Operation:
   a. Opening Cycle: The adjustable speed operator mechanically powers the drive shaft, and the torque control maintains constant speed throughout the opening cycle regardless of stack pressures or wind speed. Operator shall allow manual door operation with operational forces as indicated to fully open the door applied at 1" from the latch edge of the door.
      1) Manual push force shall be adjustable from 5 lbf to 15 lbf maximum.
   b. Hold Open: The operator shall stop and hold the door open at the selected door opening angle for an adjustable period of time (1.5 seconds to 30 seconds).
   c. Closing Cycle: Spring close with speed-controlled power assist.
      1) Upon loss of power, dynamic braking will control the door insuring controlled closing.
      2) Selectable Torque Control: Automatically adjusts torque without changing the closing speed of the operator.
         a) When the torque control is activated, the closing speed shall remain constant regardless of stack pressures or wind speed.
         b) Torque Cancellation: The torque control is deactivated whenever there is a signal received from door mounted sensors.
         c) The torque control is disabled during manual use of the door.

d. Wind Force Dampening: The operator electromechanically counteracts wind forces, slowing down the door movement to safely open or close the door.
e. Stack Pressure Compensation: Operator shall counteract positive stack pressures, negative stack pressures, and sudden changes of stack pressures. The operator never allows the door to open or close faster than the speed control settings, regardless of pressures.
f. Obstruction Control: The operator will stop and reverse the door movement.
g. Electric Lock Management:
    1) Internal module for electrified locking integration.
    2) Electric Lock Output: Selectable 12 VDC, maximum 1200 mA / 24 VDC, maximum 600 mA.
    3) Lock monitoring prevents operator(s) from opening door(s) until release of electrified lock.
    4) Operator pulls door closed before opening, automatically unjamming electric latch hardware.
    5) Sequenced operation between operators for pairs of doors allowing lock release and astragal coordination.
h. Lock Retry Circuit: If attempt to fully close the door is unsuccessful, the operator will automatically reverse open 10 degrees and reclose in an attempt to successfully close the door.
i. Selectable Alarm Reset: The operator can be field set so that after receiving an alarm signal, the operator will not accept any activation impulses and will operate only as a manual door closer until manually reset.
j. Electronic Controls: Solid state integrated circuit controls the operation and switching of the swing power operator. The electronic control provides low voltage power supply for all means of actuation. The controls include time delay (1 to 30 seconds) for normal cycle.
k. Control Switch: Automatic door operators shall be equipped with the following type of multi-position function switch:
    1) 3 position rocker switch mounted on end cap (On-Off-Hold).

5. Operator Interface:
    a. Safety Sensor Integration for overhead presence safety device and door mounted reactivation safety sensors.

2.4 ACTIVATION BY SMOKE EVACUATION SYSTEM

A. General: Provide activation by the smoke evacuation system and/or fire detection system. Coordinate other required activation devices and safety devices with door operation and door operator mechanisms.

B. Activation: Smoke evacuation system and/or fire detection system shall provide activation of the operator by means of a normally open maintained contact to control the opening and closing of the door systems in the event of an alarm condition. Doors are to be held open until the smoke evacuation/fire detection system is reset.

2.5 ACTIVATION DEVICES

A. General: Provide activation devices in accordance with ANSI/BHMA standards, for condition of exposure and for long-term, maintenance-free operation under normal traffic load for type of

occupancy indicated. Coordinate activation and safety devices with door operation and door operator mechanisms.

B. Knowing Act Activation Device:

1. Bollard Post – Door 101: Exterior Only: Pedestal Pro “ADA-SS-TWR-47x6x6-2” (Basis of Design) – Stainless Steel (brushed #4 finish), Square, 47” H x 6” W x 6” D, 2 precut holes for ADA push plate 4 ½” x 4 ½”, and card reader (By Security Contractor), wiring by others.
2. Door 101 (Interior Only): Jamb Mounted 1 ¾” x 4 ½” push plate, stainless steel. Wiring by others from push plate to ADO.
3. Push Plate Switch (All Other Doors- Interior and Exterior): 4 ½” Square stainless steel faceplate engraved with blue "Push to Open" text and an ADA logo, hard wired.
   a. Wiring by others, 18 AWG shielded pair recommended.
   b. Push plates supplied and installed by manufacturer.
4. Mounting: Push plates are to be mounted at heights and locations as required by the building code and as per ANSI A156.19 standards.

C. Card Reader Activation:

1. Card readers shall be provided and configured by others. Integration to the automatic door operators installed by manufacturers trained AAADM technicians.

D. Manual Operation:

1. Operator shall allow manual door operation with operational forces adjustable from 5 lbf to 15 lbf maximum.

2.6 ALUMINUM FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Automatic Door Operator Enclosure:

1. Anodized Finish:
   a. AAMA 611, Clear, AA- M12C22A41, Class I, 0.018 mm. Class 2 anodizing is unacceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, wall and floor construction, and other conditions affecting performance of swinging power operated doors.

B. Examine roughing-in for electrical source power to verify actual locations of wiring connections.

C. Proceed only after such discrepancies or conflicts have been resolved.

3.2 INSTALLATION

A. Do not install damaged components. Fit joints to produce hairline joints free of burrs and distortion. Rigidly secure non-movement joints.

B. Operators: Install automatic door operators plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.

1. Install surface mounted hardware using concealed fasteners to greatest extent possible.
2. Set headers, carrier assemblies, tracks, operating brackets and guides level and true to location with anchorage for permanent support.

C. Door Operators: Connect door operators to electrical power distribution system including smoke evacuation system and/or fire detection system as specified in Division 26 Sections.

D. Sealants: Comply with requirements specified in division 7 Section “Joint Sealants” to seal between the operator housing and the adjacent surfaces.

E. Signage: Apply signage on both sides of each door and sidelite as required by ANSI/BHMA A156.19 and manufacturers installation instructions.

3.3 ADJUSTING

A. Adjust automatic door operators, controls and hardware for smooth and safe operation and for weather tight closure. Adjust doors in compliance with ANSI/BHMA A156.19.

3.4 FIELD QUALITY CONTROL

A. Before placing doors into operation, AAADM certified technician shall inspect and approve doors for compliance with ANSI/BHMA A156.19. Certified technician shall be approved by manufacturer.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by automatic door operator installation.

B. Clean metal surfaces promptly after installation. Remove excess sealants, compounds, dirt and other substances. Repair damages and finish to match original finish.

3.6 DEMONSTRATION

A. Engage a factory-authorized representative to train Owner's maintenance personnel to adjust, operate, and maintain safe operation of the door.

END OF SECTION

SECTION 08 80 00 - GLAZING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Insulating glass units.

B. Glazing units.

C. Glass coatings.

D. Fire-rated glazing units.

E. Glazing compounds.

1.2 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test.

C. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.

E. ASTM C1036 - Standard Specification for Flat Glass.

F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.

G. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass.

H. ASTM C1193 - Standard Guide for Use of Joint Sealants.

I. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass.

J. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings.

K. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.

L. GANA (GM) - GANA Glazing Manual.

M. GANA (SM) - GANA Sealant Manual.

N. GANA (LGRM) - Laminated Glazing Reference Manual.

O. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use.

P. NFRC 100 - Procedure for Determining Fenestration Product U-factors.

Q. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

R. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems.

1.3 SUBMITTALS

A. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

B. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

C. Samples: Submit two samples 12 by 12 inch in size of glass units.

D. Certificate: Certify that products of this section meet or exceed specified requirements.

E. Manufacturer's qualification statement.

F. Installer's qualification statement.

G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods. Maintain one copy on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

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

1.5 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.6 WARRANTY

A. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

B. Laminated Glass: Provide a five (5) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Glass Manufacturers:

1. Guardian Glass, LLC: www.guardianglass.com

2. Pilkington North America Inc: www.pilkington.com/na/#sle.

3. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com

B. Fire-Protection-Rated Glass: Provide products as required to achieve indicated fire-rating period.

1. Manufacturers:

a. SAFTIFIRST, a division of O'Keeffe's Inc; SuperClear 45-HS: www.safti.com

b. Technical Glass Products: www.fireglass.com/#sle.

c. Or approved equal.

C. Bird-Friendly Glass Manufacturers:

1. Guardian Glass, LLC: www.guardianglass.com/#sle.

2. ORNILUX Bird Protection Glass, developed by ARNOLD GLAS: www.ornilux.com/#sle.

3. Walker Glass Company Ltd: www.walkerglass.com/#sle.

4. or approved equal.

2.2 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.

1. Design Pressure: Calculated in accordance with ASCE 7.

2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.

3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.

4. Glass thicknesses listed are minimum.

B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.

1. In conjunction with weather barrier related materials described in other sections, as follows:

a. Water-Resistive Barriers: See Section 07 25 00.

2. To maintain a continuous vapor retarder and/or air barrier throughout glazed assembly from glass pane to heel bead of glazing sealant.

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:

1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.

2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.

3. Solar Optical Properties: Comply with NFRC 300 test method.

2.3 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.

1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.

2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.

3. Kind FT - Fully Tempered Type: Complies with ASTM C1048.

4. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.

B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.

1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class A or 16 CFR 1201 - Category II impact test requirements.

2. Polyvinyl Butyral (PVB) Interlayer: 0.030 inch thick, minimum.

2.4 INSULATING GLASS UNITS

A. Manufacturers:

1. Guardian Glass, LLC: www.guardianglass.com

2. Pilkington North America Inc: www.pilkington.com/na

3. Viracon, Apogee Enterprises, Inc: www.viracon.com

4. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com

5. Oldcastle Building Envelope: www.obe.com.

6. Or approved equal.

B. Insulating Glass Units: Types as indicated.

1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
3. Metal-Edge Spacers: Aluminum, bent and soldered corners.
4. Spacer Color: Black.
5. Edge Seal:
    a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone sealant as secondary seal applied around perimeter.
6. Color: Black.
7. Purge interpane space with dry air, hermetically sealed.

C. Type GL-1 - Insulating Glass Units: Vision glass, double glazed.

1. Applications: Exterior glazing unless otherwise indicated.
2. Space between lites filled with 10% air, 90% argon.
3. Outboard Lite: Fully tempered float glass, 1/4 inch thick.
    a. Tint: Clear.
    b. Coating: Etch (2x2 dot pattern, non directional) , on #1 surface.
        1) Basis of Design Product: Guardian Glass, Bird 1st - Etch DX22 clear
    c. Coating: Low-E, triple Silver coating on #2 surface
        1) Basis of Design Product: Guardian Glass, SunGuard SNX 62/27
4. Inboard Lite: Heat-strengthened float glass, 1/4 inch thick, minimum.
    a. Tint: Clear.
5. Total Thickness: 1 inch.

6. Thermal Transmittance (U-Value), Summer - Center of Glass: 0.24, maximum.
7. Visible Light Transmittance (VLT): 62 percent, nominal.
8. Solar Heat Gain Coefficient (SHGC): 0.27, maximum.

D. Type[GL-2]- Insulating Glass Units: Vision glass, double glazed.Applications: Exterior glazing unless otherwise indicated.Space between lites filled with [10% air, 90% argon].

1. Applications: Exterior glazing unless otherwise indicated.
2. Space between lites filled with [10% air, 90% argon].
3. Outboard Lite: Annealed Float Glass, 1/4 inch thick.
    a. Tint: Clear
    b. Coating: [Etch (2x2 dot pattern, non directional)], on #1 surface.
        1) Basis of Design Product: Guardian Glass, Bird 1st - Etch DX22 clear
    c. Coating: Low-E, triple Silver coating on #2 surface
        1) Basis of Design Product: Guardian Glass, SunGuard SNX 62/27
4. Inboard Lite: Heat-strengthened float glass, 1/4 inch thick, minimum.
    a. Tint: Clear.
5. Total Thickness: 1 inch.
6. Thermal Transmittance (U-Value), Summer - Center of Glass: [0.24], maximum.
7. Visible Light Transmittance (VLT): [62] percent, nominal.
8. Solar Heat Gain Coefficient (SHGC): [0.27], maximum.

E. Type GL-3 - Insulating Glass Units: Spandrel glazing.

1. Applications: Exterior spandrel glazing unless otherwise indicated.
2. Space between lites filled with 10% air, 90% argon.
3. Outboard Lite: Heat-strengthened float glass, 1/4 inch thick, minimum.

a. Tint: Clear.

b. Coating: Same as on vision units, on #2 surface.

4. Inboard Lite: Heat-strengthened float glass, 1/4 inch thick.

a. Tint: Clear.

b. Opacifier: Elastomeric coating, on #4 surface.

1) Opacifier Color: to be selected from Manufacturer's full range.

5. Total Thickness: 1 inch.

6. Thermal Transmittance (U-Value), Summer - Center of Glass: 0.24, nominal.

2.5 GLAZING UNITS

A. Type GL-4 - Monolithic Interior Vision Glazing:

1. Applications: Interior glazing unless otherwise indicated.

2. Glass Type: Fully tempered float glass.

3. Tint: Clear.

4. Thickness: 1/4 inch, nominal.

2.6 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.

C. Glazing Tape: Closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent, designed for compression of 25 percent to effect an air barrier and vapor retarder seal.

D. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

E. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.1 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that the minimum required face and edge clearances are being provided.

C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

D. Verify that sealing between joints of glass framing members has been completed effectively.

E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.3 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

C. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

D. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.4 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.5 FIELD QUALITY CONTROL

A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

B. Monitor and report installation procedures and unacceptable conditions.

3.6 CLEANING

A. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

B. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

C. Remove nonpermanent labels immediately after glazing installation is complete.

D. Clean glass and adjacent surfaces after sealants are fully cured.

E. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.7 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION 08 80 00

SECTION 08 91 00 - LOUVERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Louvers, frames, and accessories.

1.2 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.

B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.

C. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

D. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating.

E. AMCA 511 - Certified Ratings Program for Air Control Devices.

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

G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

1.3 SUBMITTALS

A. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.

B. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, and tolerances; head, jamb and sill details; blade configuration, screens, blank-off areas required, and frames.

C. Samples: Submit two samples 2 by 2 inches in size illustrating finish and color of exterior and interior surfaces.

D. Test Reports: Independent agency reports showing compliance with specified performance criteria.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.

1.5 WARRANTY

A. Provide five year manufacturer's warranty against distortion, metal degradation, and connection failures of louver components.

1. Finish: Include twenty year coverage against degradation of exterior finish.

PART 2 PRODUCTS

2.1 LOUVERS

A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.

1. Wind Load Resistance: Design to resist positive and negative wind load of 25 psf without damage or permanent deformation.

2. Intake Louvers: Design to allow maximum of 0.01 oz/sq ft water penetration at calculated intake design velocity based on design air flow and actual free area, when tested in accordance with AMCA 500-L.

3. Drainable Blades: Continuous rain stop at front or rear of blade aligned with vertical gutter recessed into both jambs of frame.

B. Stationary Louvers: Horizontal blade, formed galvanized steel sheet construction, with intermediate mullions matching frame.

1. Free Area: 50 percent, minimum.

2. Blades: Drainable.

3. Frame: 6 inches deep, channel profile; corner joints mitered and , with continuous recessed caulking channel each side.

4. Steel Thickness, Galvanized: Frame 16 gauge, 0.0598 inch minimum base metal; blades 16 gauge, 0.0598 inch minimum base metal.

5. Steel Finish: Superior performing organic coating, finished after fabrication.

6. Color: Custom, to match approved sample.

2.2 MATERIALS

A. Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

B. Polyvinylidene Fluoride Coating: Minimum 70 percent Kynar 500/Hylar 500 resin, two coat finish, complying with AAMA 2604.

C. Primer: Zinc chromate, alkyd type.

2.3 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

B. Superior Performing Organic Coatings System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch.

2.4 ACCESSORIES

A. Blank-Off Panels: Same material as louver, painted black on exterior side; provide where duct connected to louver is smaller than louver frame, sealing off louver area outside duct.

B. Insect Screen: size as indicated on the drawings; aluminum mesh.

C. Fasteners and Anchors: Galvanized steel.

D. Flashings: Of same material as louver frame, formed to required shape, single length in one piece per location.

E. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that prepared openings and flashings are ready to receive this work and opening dimensions are as indicated on shop drawings.

B. Verify that field measurements are as indicated.

3.2 INSTALLATION

A. Install louver assembly in accordance with manufacturer's instructions.

B. Coordinate with installation of flashings by others.

C. Install louvers level and plumb.

D. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.

E. Secure louver frames in openings with concealed fasteners.

F. Install perimeter sealant and backing rod in accordance with Section 07 90 05.

G. Coordinate with installation of mechanical ductwork.

3.3 CLEANING

A. Strip protective finish coverings.

B. Clean surfaces and components.

END OF SECTION 08 91 00

SECTION 09 21 16 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Acoustic insulation.

C. Gypsum wallboard.

D. Joint treatment and accessories.

1.2 REFERENCE STANDARDS

A. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

B. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.

C. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.

D. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

E. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base.

F. ASTM C1396/C1396M - Standard Specification for Gypsum Board.

G. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.

H. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels.

I. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

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

K. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

L. ASTM E413 - Classification for Rating Sound Insulation.

M. GA-216 - Application and Finishing of Gypsum Board.

N. GA-600 - Fire Resistance Design Manual.

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

1.3 SUBMITTALS

A. Product Data: Provide data on gypsum board, glass mat faced gypsum board, accessories, and joint finishing system.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board application and finishing, with minimum 5 years of documented experience.

PART 2 PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

B. Interior Partitions, Indicated as Sound-Rated: Provide completed assemblies with the following characteristics:

1. Acoustic Attenuation: STC as indicated calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

C. Fire Rated Assemblies: Provide completed assemblies as indicated on Drawings.

D. For gypsum board installed within the building interior: Documentation indicating compliance with California Department of Public Health (CDPH) Standard Method v1.2-2017 indicating TVOC range or GREENGUARD Gold Certification.

2.2 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:

1. CertainTeed Corporation: www.certainteed.com/#sle.

2. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
3. National Gypsum Company: www.nationalgypsum.com/#sle.
4. USG Corporation: www.usg.com/#sle.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.

1. Application: Use for vertical surfaces, unless otherwise indicated.
2. Glass mat faced gypsum panels, as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
3. Unfaced fiber-reinforced gypsum panels as defined in ASTM C1278/C1278M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
4. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
5. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
6. Thickness: 5/8 inch unless otherwise indicated on Drawings.

C. Abuse Resistant Wallboard (Keynote: 092116-A):

1. Application: as indicated on drawings.
2. Surface Abrasion: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
3. Indentation: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
4. Soft Body Impact: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
5. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
6. Paper-Faced Type: Gypsum wallboard, as defined in ASTM C1396/C1396M.
7. Type: Fire-resistance-rated Type X, UL or WH listed.

8. Thickness: 5/8 inch.

9. Edges: Tapered.

D. Moisture Resisitant Board: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.

1. Application: Vertical surfaces behind thinset tile, except in wet areas.

2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.

4. Type: Type X, in locations indicated.

5. Edges: Tapered.

E. Ceiling Board (Keynote: 092116-H): Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.

1. Application: Ceilings, unless otherwise indicated.

2. Type: Type C at fire-rated assemblies.

3. Thickness: 1/2 inch.

4. Edges: Tapered.

F. Shaftwall and Coreboard (Keynote: 092116-F): Type C; 1/2 inch thick by 24 inches wide, beveled long edges, ends square cut.

1. Paper-Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM C1396/C1396M; water-resistant faces.

2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

G. Shaftwall and Coreboard (Keynote: 092116-D): Type X; [1] inch thick by 24 inches wide, beveled long edges, ends square cut.

1. Paper-Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM C1396/C1396M; water-resistant faces.

2.3 GYPSUM BOARD ACCESSORIES

A. Acoustic Insulation (Keynote: 092116-K): ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness as indicated on the drawings.

B. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.

1. Types: As detailed or required for finished appearance.

2. Special Shapes: In addition to conventional corner bead and control joints, provide L-bead at exposed panel edges unless noted otherwise.

C. Beads, Joint Accessories, and Other Trim: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.

1. Corner Beads: Low profile, for 90 degree outside corners.

2. Control Joints:

a. At Assemblies Indicated with Fire-Resistance Rating: Provide rating equal to rated assembly when joint system tested in accordance with UL 2079.

b. Type: V-shaped PVC with tear away fins.

D. Decorative Metal Trim (Keynote: 092116-M and 092116-S):

1. Material: Extruded aluminum alloy 6063-T5 temper.

2. Finish: Anodized, clear.

3. Location: Where indicated on the Drawings

E. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.

1. Fiberglass Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.

2. Paper Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.

3. Ready-mixed vinyl-based joint compound.

4. Powder-type vinyl-based compound.

5. Chemical hardening type compound.

6. Joint Compound: Setting type, field-mixed.

F. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

G. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

H. Wire Mesh: Galvanized steel, hexagonal wire mesh.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.2 SHAFT WALL INSTALLATION

A. Shaft Wall Liner: Cut panels to accurate dimensions and install sequentially between special friction studs.

3.3 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

3.4 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Double-Layer Non-Rated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.

D. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

E. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.

F. Exterior Soffits: Install exterior soffit board perpendicular to framing, with staggered end joints over framing members or other solid backing.

1. Seal joints, cut edges, and holes with water-resistant sealant.

G. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.

3.5 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.

1. Not more than 30 feet apart on walls and ceilings over 50 feet long.

2. At exterior soffits, not more than 30 feet apart in both directions.

3. Install per GA-234/GA-216, or ASTM C840.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

D. Decorative Trim: Install at locations shown on drawings and in accordance with manufacturer's instructions.

E. Exterior Soffit Vents: Install according to manufacturer's written instructions and in locations shown on the Drawings. Provide vent area specified.

3.6 JOINT TREATMENT

A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.

B. Paper Faced Gypsum Board: Use paper joint tape, bedded with ready-mixed vinyl-based joint compound and finished with ready-mixed vinyl-based joint compound.

C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:

1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.

2. Level 3: Walls to receive textured wall finish.

3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.

4. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.

D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.

1. Feather coats of joint compound so that camber is maximum 1/32 inch.

2. Taping, filling, and sanding are not required at base layer of double-layer applications.

3.7 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION 09 21 16

SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal partition, ceiling, and soffit framing.

B. Framing accessories.

1.2 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members.

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

C. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members.

D. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

E. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

F. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

G. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

H. ASTM E413 - Classification for Rating Sound Insulation.

I. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).

1.3 SUBMITTALS

A. Shop Drawings:

1. Indicate prefabricated work, component details, stud layout, framed openings, anchorage to structure, acoustic details, type and location of fasteners, accessories, and items of other related work.

2. Describe method for securing studs to tracks, splicing, and for blocking and reinforcement of framing connections.

B. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.

C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.

PART 2 PRODUCTS

2.1 DESCRIPTION

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent MR testing agency.

2.2 FRAMING MATERIALS

A. Fire Rated Assemblies: Comply with applicable code and as indicated on drawings.

B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.

1. Studs: C shaped with knurled or embossed faces.

2. Runners: U shaped, sized to match studs.

3. Ceiling Channels: C shaped.

4. Furring: Hat-shaped sections, minimum depth of 7/8 inch.

C. Loadbearing Studs: As specified in 05 4000.

D. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

E. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws, and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.

1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100.

2. Material: ASTM A653/A653M steel sheet, SS Grade 50, with G60/Z180 hot-dipped galvanized coating.

3. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.

F. Tracks and Runners: Same material and thickness as studs, bent leg retainer notched to receive studs with provision for crimp locking to stud.

G. Furring and Bracing Members: Of same material as studs; thickness to suit purpose; complying with applicable requirements of ASTM C754.

H. Fasteners: ASTM C1002 self-piercing tapping screws.

I. Sheet Metal Backing: 0.036 inch thick, galvanized.

J. Anchorage Devices: Powder actuated.

K. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

L. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic.

2.3 FABRICATION

A. Fabricate assemblies of framed sections to sizes and profiles required.

B. Fit, reinforce, and brace framing members to suit design requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that rough-in utilities are in proper location.

3.2 INSTALLATION OF STUD FRAMING

A. Comply with requirements of ASTM C754.

B. Extend partition framing to structure in all locations, unless shown otherwise on drawings.

C. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

D. Align and secure top and bottom runners at 24 inches on center.

E. At partitions indicated with an acoustic rating:

1. Provide components and install as required to produce STC ratings as indicated, based on published tests by manufacturer conducted in accordance with ASTM E90 with STC rating calculated in accordance with ASTM E413.

F. Place one bead of acoustic sealant between runners and substrate, studs and adjacent construction.

1. Place one bead of acoustic sealant between studs and adjacent vertical surfaces.

G. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.

H. Install studs vertically at 12, 16 or 24 inches on center, to meet specified performance requirements.

I. Align stud web openings horizontally.

J. Secure studs to tracks.

K. Stud splicing is not permissible.

L. Fabricate corners using a minimum of three studs.

M. Install double studs at wall openings, door and window jambs, not more than 2 inches from each side of openings.

N. Brace stud framing system rigid.

O. Coordinate erection of studs with requirements of all openings; install supports and attachments.

P. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.

Q. Blocking: Use wood blocking secured to studs. Provide blocking where indicated, and for support of wall cabinets, toilet accessories, and other wall mounted accessories.

R. Furring: Install at spacing and locations shown on drawings. Lap splices a minimum of 6 inches.

3.3 CEILING AND SOFFIT FRAMING

A. Comply with requirements of ASTM C754.

B. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.

C. Install furring independent of walls, columns, and above-ceiling work.

D. Securely anchor hangers to structural members or embed them in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.

E. Space main carrying channels at maximum 72 inch on center, and not more than 6 inches from wall surfaces. Lap splice securely.

F. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.

G. Place furring channels perpendicular to carrying channels, not more than 2 inches from perimeter walls, and rigidly secure. Lap splices securely.

H. Reinforce openings in suspension system that interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches past each opening.

3.4 TOLERANCES

A. Maximum Variation From True Position: 1/8 inch in 10 feet.

B. Maximum Variation From Plumb: 1/8 inch in 10 feet.

END OF SECTION 09 22 16

SECTION 09 30 00 - TILING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Tile for wall applications.

B. Cementitious backer board as tile substrate.

C. Tile accessories.

1.2 REFERENCE STANDARDS

A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium).

B. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar.

C. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar.

D. ANSI A108.1c - Specifications for 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 Bed with Dry-Set or Latex-Portland Cement.

E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive.

F. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.

G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy.

H. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout.

I. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout.

J. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework.

K. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units.

L. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior glue plywood) Latex-Portland Cement Mortar.

M. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone.

N. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation.

O. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar.

P. ANSI A137.1 - American National Standard Specifications for Ceramic Tile.

Q. ANSI A137.2 - American National Standard Specifications for Glass Tile.

R. ASTM C373 - Standard Test Method for Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products, Ceramic Tiles, and Glass Tiles.

S. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation.

1.3 SUBMITTALS

A. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

B. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches in size illustrating pattern, color variations, and grout joint size variations.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Installer's Qualification Statement:

1. Submit documentation of National Tile Contractors Association (NTCA) or Tile Contractors' Association of America (TCAA) accreditation.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Tile: 1 percent of each size, color, and surface finish combination.

1.4 QUALITY ASSURANCE

A. Maintain one copy of and ANSI A108/A118/A136 and TCNA (HB) on site.

B. Installer Qualifications:

1. Company specializing in performing tile installation, with minimum of five years of documented experience.

1.5 MOCK-UPS

A. Construct tile mock-up where approved by Architect or Owner, incorporating all components specified for the location.

1. Approved mock-up may remain as part of work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 TILE

A. Manufacturers:

1. American Olean Corporation: www.americanolean.com/#sle.

2. Dal-Tile Corporation: www.daltile.com/#sle.

3. Florim USA: www.milestonetiles.com/#sle.

4. Crossville Studios: https://www.crossvillestudios.com/.

5. Or approved equal.

B. Porcelain Tile, Type W-3: ANSI A137.1 standard grade.

1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.

2. Size: As indicated on drawings.

3. Thickness: 3/8

4. Edges: Square.

5. Color(s): As indicated on drawings.

6. Pattern: As indicated on drawings.

C. Glass Tile, Type W-2: ANSI A137.2 standard grade.

1. Size: As indicated on drawings.

2. Thickness: 5/16 inch

3. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.

4. Edges: Square.

5. Color(s): As indicated on drawings.

6. Pattern: As indicated on drawings.

2.2 SETTING MATERIALS

A. Provide setting and grout materials from same manufacturer.

B. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.

1. Applications: Use this type of bond coat where indicated and where no other type of bond coat is indicated.

2.3 GROUTS

A. Provide setting and grout materials from same manufacturer.

B. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.

1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.

2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.

3. For W-2: Grout joint thickness: 3/16 to 1/4 inch.

4. For W-3: Grout joint thickness: 5/16 inch.

5. Color(s): Two colors. As selected by Architect from manufacturer's full line.

2.4 ACCESSORY MATERIALS

A. Backer Board for Wet Areas: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 5/8 inch thick; 2 inch wide coated glass fiber tape for joints and corners.

B. Mesh Tape: 2 inch wide self-adhesive fiberglass mesh tape.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

3.2 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.3 INSTALLATION - GENERAL

A. Install tile and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install ceramic accessories rigidly in prepared openings.

G. Install non-ceramic trim in accordance with manufacturer's instructions.

H. Install thresholds where indicated.

I. Sound tile after setting. Replace hollow sounding units.

J. Keep control and expansion joints free of mortar, grout, and adhesive.

K. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

L. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

M. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.4 INSTALLATION - WALL TILE

A. Over gypsum wallboard on wood or metal studs install in accordance with TCNA (HB) Method W243, thin-set with dry-set or latex-Portland cement bond coat, unless otherwise indicated.

3.5 CLEANING

A. Clean tile and grout surfaces.

END OF SECTION 09 30 00

SECTION 09 51 00 - ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.2 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.

C. ASTM E1264 - Standard Classification for Acoustical Ceiling Products.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.4 SUBMITTALS

A. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.

B. Product Data: Provide data on suspension system components and acoustical units.

C. Samples: Submit two samples 6x6 inch in size illustrating material and finish of acoustical units.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Acoustical Units: Quantity equal to 2 percent of total installed.

1.5 QUALITY ASSURANCE

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.6 FIELD CONDITIONS

A. Maintain uniform temperature within range recommended by manufacturer, but not less 60 degrees F, with a maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acoustic Tiles/Panels:

1. Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.

2. CertainTeed Corporation: www.certainteed.com/#sle.

3. Hunter Douglas Architectural: www.hunterdouglasarchitectural.com/#sle.

4. Or approved equal.

B. Suspension Systems:

1. Same as for acoustical units.

2.2 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.

B. Acoustical Panels for Seamless System, Type CLG TYPE 3.01: Mineral fiber, with the following characteristics:

1. Classification: ASTM E1264 Type A.

2. Size: 48 by 72 inches.

3. Thickness: 7/8 inch.

4. Light Reflectance: White Panel 87 percent, determined in accordance with ASTM E1264.

5. Noise Reduction Coefficient (NRC): Panel 0.80 (UL) , determined in accordance with ASTM E1264.

6. Ceiling Attenuation Class (CAC): Panel 46 (UL), System up to 48, determined in accordance with ASTM E1264.

7. Sabin: Cloud Appliations: 0.80 Sabins/SF

8. Flame Spread: ASTM E 1264; Class A

9. Dimensional Stability: HumiGuard Plus

10. Panel Edge: Tapered edges four sides.

11. Color: White.

12. Suspension System:

    a. Armstrong Drywall Suspension Systems all main beams and cross tees shall be commercial quaility hot-dipped galvanized steel

        1) Main beam: manufactured main bean 1-1/2" knurled face with ScrewStop reverse hem by 1-11/16 inches high. Drywall Main Beams are factory punched with cross tee routs, hanger wire hoels, and SuperLock Main beam clip for strong secure connection and fast accurate alignment. Drywall Main Beams are Heavy-duty performance per ASTM C635.

            (a) HD8906- 12ft HD Drywall Main Beam 1-1/2 in

        2) Cross Tees: Manufactured cross tee 1-1/2" knurled face with ScrewStop reverse hem by 1-1/2 inches high with factory punched cross tee routes and hanger wire roles and XL stake on clip for a strong secure connection.

            (a) XL8945P - 4 Ft Drywall Cross Tee.

13. Finish:

    a. Joint Compound:

1) Setting Compound: Lightweight setting-type drywall joint compound, Ultra lightweight drying-type drywall joint compound

2) Joint Tape: Self-Adhesive mesh drwyall joint tape (Panel to Panel)

(a) Use Setting Type Compound for inital coats and use Drying Type Compound for final coats per the installation instructions. DO NOT use any other type of drywall compound such as All-Purpose Compound.

(b) Paper tape at the wall intersection

b. Spray Applied Finish:

1) Armstrong Finish (Armstrong Fine-Texture Finish for AcoustiBuilt)

14. Products:

a. Armstrong World Industries: ACOUSTIBuilt or approved equal.

C. Acoustical Panels, Type CLG 1.04: Mineral fiber with membrane-faced overlay, with the following characteristics:

1. Classification: ASTM E1264 Type A.

a. Pattern: "G" - smooth.

2. Size: 24 by 24 inches.

3. Thickness: 1 inch.

4. NRC: 0.85, determined in accordance with ASTM E1264.

5. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.

6. Panel Edge: beveled tegular for interface with 9/16" suspension system.

7. Color: White.

8. Suspension System: Exposed grid.

a. Suprafine XL 9/16" Exposed Tee Grid System

1) Color: Blizzard White Finish

b. Or approved equal.

9. Products:

a. Armstrong World Industries, Inc; Calla Tegular: www.armstrongceilings.com/#sle.

b. Or approved equal.

D. Acoustical Panels, Type CLG 1.01: Mineral fiber with membrane-faced overlay, with the following characteristics:

1. Classification: ASTM E1264 Type A.

a. Pattern: "E" - lightly textured.

2. Size: 24 by 24 inches.

3. Thickness: 1 inch.

4. Light Reflectance: 85 percent, determined in accordance with ASTM E1264.

5. NRC : 0.85, determined in accordance with ASTM E1264.

6. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.

7. Panel Edge: Beveled tegular for interface with 9/16" suspension system.

8. Suspension System: Exposed grid.

a. Suprafine XL 9/16" Exposed Tee Grid System

1) Color: White

b. Or approved equal.

9. Products:

a. Armstrong World Industries, Inc; Ultima High NRC: www.armstrongceiligns.com#sle.

b. Or approved equal.

2.3 SUSPENSION SYSTEM(S)

A. Manufacturer: Same as for acoustical units.

B. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.

C. Exposed Suspension System: Hot-dipped galvanized steel grid with steel cap.

1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.

2. Profile: Tee; 9/16 inch face width.

3. Products:

a. Armstrong World Industries, Inc; Suprafine XL 9/16" Exposed Tee Grid System

b. Or approved equal.

D. Concealed Suspension Systems for Seamless System

1. Components:

a. Main Beam: Shall be double-web construction (minimum 0.0179 inch prior to protective coating, ASTM C645), hot dipped galvanized (per ASTM A653)

1) Armstrong HD8906 (or approved equal): 1-11/16 inch web height, 1-1/2 inch flange, available with G40 or G90 hot dipped galvanization.

b. Primary Cross Tees: Shall be double-web steel construction (minimum 0.0179 inch prior to protective coating, ASTM C645), hot dipped galvanized (minimum G40 or G90 per ASTM A653)

1) Armstrong XL8945P (or approved equal): 48 inch, web height 1-1/2 inch with rectangular bulb and pre-finished 1-1/2 inch knurled flange

c. SimpleSoffit DGS: Shall be double web steel construction (minimum 0.0179 inch prior to protective coating, ASTM C645), Main Beams designed for creating soffits; 1-1/4inch web height. 1-1/2 inch flange, flattened top bulb. Mains 4 ft. O.C.

d. Wall Molding:

1) Armstrong LAM-12 (or approved equal): 12 foot Locking Angle Molding, 1-1/4 inch x 1-1/4 inch with pre-engineered locking tabs punched 8 inches on center, knurled surface, screw stop hem, pre-punched holes in top flange, 4" O.C., .018 mil. 25g.

2) Armstrong KAM -12 (or approved equal): 12 foot Knurled Angle molding, 1-1/4 inch x 1-1/4 inch, knurled surface, screw stop hem, pre-punched holes in top flange, 4" O.C., .018 mil. 25g.

e. Clips:

1) Armstrong DW90C: 90 degree, Drywall Angle Clip

2) Armstrong XTAC: Cross Tee Adapter Clip.

f. Support Hanger

1) Armstrong SB12P: Strong Back Support Hanger

2) Armstrong HD8906: 144 inch, web height 1-11/16 inch with PeakForm bulb and pre-finished 1-1/2 inch knurled flange

g. Cloud Trim: Axiom aluminum extrusion vertical upturn trim with integral drywall taping flange.

1) Armstrong AX1PC4STR: 120 inch x 4 inch, straight

h. Screws for wallboard application shall be bugle head screws in accordance with thickness of material used.

2. Structural Classification:

a. Main Beam shall be heavy duty per ASTM C 635.

b. Classification can require wires to be closer together for additional loading when used to support double layer gypsum, verticals, slopes, domes, half barrels, circles, soffits, canopies, and step conditions which call for loading or unusual designs and shapes in drywall construction. Using cross tees in the construction of circles, barrels, etc. is common in order to hold the radius.

c. Deflection of fastening suspension system supporting light fixtures, ceiling grilles, access doors, verticals and horizontal loads shall have a maximum deflection of 1/360 of the span.

3. Manufacturer: Armstrong World Industries, Inc. or approved equal.

2.4 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.

C. Perimeter Moldings (Keynote: 095100-C): Same metal and finish as grid.

1. Size: As required for installation conditions and specified Seismic Design Category.

2. Angle Molding: L-shaped, for mounting at same elevation as face of grid.

3. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

D. Metal Edge Trim for "Cloud" Suspension Systems (Keynote: 095100-G): Steel or extruded aluminum; provide attachment clips, splice plates, and preformed corner pieces for complete trim system.

1. Finish: Baked enamel.

2. Color: White.

3. Products:

a. Basis of Design: Armstrong AXIOM Classic Perimter Trim

b. or approved equal.

E. Linear Light Cove (Keynote: 095100-H): Extruded aluminum light cove for acoustical ceilings.

1. Color: White

2. Depth: 4"

3. Width: 4-1/2"

F. Touch-up Paint: Type and color to match acoustical and grid units.

G. Fasteners (for Ceiling Type 3.01 Panel attachment)

1. #6 x 1-5/8” Fine thread drywall screws

2. Recommended Adhesives: Loctite PL Premium Polyurethane Construction Adhesive, OSI F38 Drywall Panel Adhesive.

H. Access Panels (for Ceiling Type 3.01)

1. Product: Armstrong Plasterform GRG access panels for integration into AcoustiBuilt Seamless System.

a. Type: Rounded Corners

b. Door Size: 30 inches x 30 inches

c. Frame Size: 36 inches x 36 inches

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.2 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Locate system on room axis according to reflected ceiling plan.

D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.

1. Use longest practical lengths.

2. Overlap and rivet corners.

E. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

F. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

I. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

J. Do not eccentrically load system or induce rotation of runners.

3.3 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:

1. Make field cut edges of same profile as factory edges.

2. Double cut and field paint exposed reveal edges.

G. Where round obstructions and bullnose concrete block corners occur, provide preformed closures to match perimeter molding.

3.4 INSTALLATION - SEAMLESS SYSTEM

A. Install in accordance with manufacturer's instructions.

B. Suspend main beam from overhead construction with hanger wires spaced 4-0 ft. on center along the length of the main runner. Install hanger wires plumb and straight.

1. 48” Cross tees shall be installed 16” on center. Extra cross tees are required at 72” every 12’. All 4 panel edges must be supported by a grid main or tee.
2. Install wall moldings/perimeter trim at intersection of suspended ceiling and vertical surfaces.
3. Main runners and cross tees shall be attached at perimeter conditions
4. When determining the grid layout, consider the long edges of the boards must run parallel with the mains.

C. This system relies on a square grid system to ensure panel edges align at centers of cross tees. If the installation does not meet these squareness requirements, the panel edges may run off the grid system.
   1. The system must be square to within 1/8" over a 48" x 48" module.
   2. The suspension system must be leveled to within 1/4" in 10'.

D. Install access doors where plenum access is required.

E. Control joints are required following the standards used for gypsum board listed in ASTM C840,Section 20
   1. Ceilings with perimeter relief cannot exceed 50 LF and 2500 SF between control joints
   2. Ceilings without perimeter relief cannot exceed 30 LF and 900 SF between control joints

F. Panel joints and fasteners are finished with tape and compound to create a flat surface.

G. Joint compound coverage shall be limited to preserve the acoustical performance of the panels.Compound at panel joints shall not exceed 8 inch widths. Compound applied to field fasteners shall not exceed 2 inch by 2-inch areas. All compound shall be smooth and free of tool marks and ridges. Panels are to be finished with taping knives. Production tools, including boxes, are detailed on the installation instructions.

H. Sanding and inspection: Throughout the sanding process, inspect the surface frequently for flatness. Direct a light across the ceiling to highlight unevenness that requires attention.

I. Fine Texture Finish shall be applied in 4-5 coat process as called out in the installation instructions.

1. See Manufactures installation instructions for correct spray tip, pressure settings for spray system, finish preparation, spray calibration and spray procedure and technique.

3.5 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION 09 51 00

SECTION 09 65 00 - RESILIENT BASE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Resilient base.

B. Installation accessories.

1.2 REFERENCE STANDARDS

A. ASTM F1861 - Standard Specification for Resilient Wall Base.

1.3 SUBMITTALS

A. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

B. Shop Drawings: Provide plans indicating product, color and texture, floor pattern(s), and direction(s) of material. For sheet flooring, plans should indicate seam locations.

C. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

D. Verification Samples: Submit two full-size samples, or two samples a minimum of 6 by 6 inches, illustrating color, texture and pattern for each resilient flooring product specified.

E. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.

F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Maintain temperature in storage area within range recommended by manufacturer(s) but at a temperature no less than 55 degrees F and no more than 90 degrees F.

D. Do not double stack pallets.

1.5 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.1 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; style as scheduled.

1. Manufacturers:

a. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.

b. Mannington Commercial: www.manningtoncommercial.com#sle.

c. Or approved equal.

2. Height: 4 inch.

3. Thickness: 0.125 inch.

4. Finish: Satin.

5. Color: As indicated on drawings.

2.2 ACCESSORIES

A. Filler for Coved Base: Plastic.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

C. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.

C. Prohibit traffic until filler is fully cured.

D. Clean substrate.

3.3 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Spread only enough adhesive to permit installation of materials before initial set.

D. Fit joints and butt seams tightly.

3.4 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

3.5 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.6 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION 09 65 00

SECTION 09 66 13 - PORTLAND CEMENT TERRAZZO FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Precast Portland cement terrazzo units.

1.2 REFERENCE STANDARDS

A. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar.

B. ASTM C33/C33M - Standard Specification for Concrete Aggregates.

C. NTMA (SPECS) - NTMA Terrazzo Specifications.

1.3 SUBMITTALS

A. Product Data: Provide data for control joint strips and sealer; include printed copy of current NTMA recommendations for the type of terrazzo specified.

B. Shop Drawings: Indicate control joint layout and details of adjacent components.

C. Samples: Submit two samples, 6 by 6 inch in size illustrating color, chip size and variation, chip gradation, mortar color, and typical divider strip.

D. Cleaning and Maintenance Data: Include procedures for stain removal, stripping, and sealing.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with NTMA recommendations as posted on their web site at www.ntma.com.

B. Installer Qualifications: Company specializing in performing the work of this section with not fewer than 3 years of documented experience.

1.5 FIELD CONDITIONS

A. Do not install terrazzo when temperature is below 50 degrees F or above 90 degrees F.

B. Maintain temperature within specified range 24 hours before, during, and 72 hours after installation of terrazzo.

PART 2 PRODUCTS

2.1 PORTLAND CEMENT TERRAZZO APPLICATIONS

A. Stairs - Treads and Landings:

1. Aggregate Type and Size: Marble chips.
2. Color: To match Architect's sample.
    a. Basis of Design: Wausau Tile: TZ-504 Vapor
    b. Or Approved Equal.

2.2 PORTLAND CEMENT TERRAZZO TREADS

A. Materials:

1. Portland Cement: ASTM C150/C150M, Type I Normal; white color for topping mix; modified to NTMA higher compressive strength requirements; obtained from single source.
2. Color Pigments For Topping: Non-fading mineral type, alkali-resistant.
3. Terrazzo Sand: ASTM C33/C33M fine aggregates.
4. Water: Potable.
5. Surface Aggregate: Marble, free of deleterious or foreign matter.

B. Accessories:

1. Non-Slip Inserts: Provide channel-shaped inserts filled with a mixture of resin and fine, abrasive aggregate.
2. Caulks and Sealant
    a. Urethane or Polyurethane Sealant
    b. Color to be selected by Architect from standard selection.
3. Cleaner: Neutralizing liquid type, pH of 7 to 8. of formulation recommended by sealer manufacturer for type of terrazzo used and complying with NTMA requirements.

4. Sealer: Colorless, slip and stain-resistant, non-yellowing, penetrating liquid type, pH of 7 to 8; not detrimental to terrazzo components.

2.3 PRECAST PORTLAND CEMENT TERRAZZO UNITS

A. Precast Portland Cement Terrazzo Units: Portland cement matrix, ASTM C150/C150M; cleaned and graded aggregate sized in accordance with NTMA gradation standards.

1. Fabricate to sizes and profiles shown on drawings.

2. Setting Material: Latex Portland cement mortar, ANSI A118.4.

3. Anchors and Reinforcement for Precast Units: As recommended by manufacturer for type of installation.

4. All exposed edges to be ground and polished with a minimum of 1/16" bevel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Do not begin terrazzo work until concrete substrate has cured 28 days, minimum, and has dried to a maximum moisture content of 12 percent.

3.2 PREPARATION

A. Clean substrate of foreign matter.

3.3 INSTALLATION - PRECAST PORTLAND CEMENT TERRAZZO UNITS

A. Anchor precast units as shown on drawings.

B. Install precast units using specified setting material.

3.4 TOLERANCES

A. Maximum Variation from Flat Surface: 1/8 inch in 10 feet.

3.5 CLEANING

A. Scrub and clean terrazzo surfaces with cleaner in accordance with NTMA instructions. Let dry.

B. Seal and polish surfaces in accordance with NTMA instructions.

3.6 PROTECTION

A. Do not permit construction traffic over finished terrazzo surfaces.

END OF SECTION 09 66 13

SECTION 09 67 00 - FLUID-APPLIED FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fluid-applied flooring and base.

1.2 REFERENCE STANDARDS

A. ANSI/ESD STM7.1 - Standard Test Method for the Protection of Electrostatic Discharge Susceptible Items - Floor Materials - Resistive Characterization of Materials.

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

D. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

1.3 SUBMITTALS

A. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.

B. Samples for Verification: Submit two samples, 12 by 12 inch in size illustrating color, pattern and texture for each floor material for each color specified.

C. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and application rate for each coat.

D. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

B. Applicator Qualifications: Company specializing in performing the work of this section.

1. Minimum five years of documented experience.

2. Approved by manufacturer.

C. Supervisor Qualifications: Trained by product manufacturer , under direct full time supervision of manufacturer's own foreman.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resin materials in a dry, secure area.

B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

1.6 FIELD CONDITIONS

A. Maintain minimum temperature in storage area of 55 degrees F.

B. Store materials in area of installation for minimum period of 24 hours prior to installation.

C. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

1.7 WARRANTY

A. Submit written warranty signed by floor coating Manufacturer and installer agreeing to repair or replace floor coatings that do not meet requirements or that deteriorate within the warranty period indicated below. Warranty is to cover both materials and labor required for replacement.

1. Warranty Period: 5 years after date of Substantial Completion.

PART 2 PRODUCTS

2.1 FLUID-APPLIED FLOORING SYSTEMS

A. Fluid-Applied Flooring F-1: Epoxy base coat(s), with broadcast aggregate.

1. Aggregate: Quartz granules. Double Broadcast.

2. System Thickness: 1/8 inch, nominal, dry film thickness (DFT).

3. Texture: Smooth.

a. Orange Peel texture in Restroom 111, Restroom 112, Restroom 113, Restroom 114, Corridor 110, Closet 109, Restroom 203, Restroom 204, Restroom 205, Restroom 206, Mudroom 207, Mudroom 207B, Storage 207A.

4. Cove Base: Color to match flooring

5. Cove Base Texture: Smooth.

6. Sheen: Gloss.

7. Color: As noted on the drawings.

8. System Components: Manufacturer's standard components that are compatible with each other and as follows:

   a. Primer.

   b. 1st Receiver Coat & Broadcast Aggregate Media.

   c. UV Resistant Seal

   d. Topcoat or Sealer.

9. Products:

   a. Basis of Design: Stonhard, Inc.; Stonseal SK6-SF

   b. Or approved equal.

B. Fluid-Applied Flooring Type F-3: Waterproof elastomeric urethane with epoxy top coat.

1. System Thickness: 40 mils, 0.04 inch, nominal, dry film thickness (DFT).

2. Texture: Smooth.

3. Color: As noted on the drawings.

4. Cove Base: Color to match flooring, texture: smooth

5. Products:

   a. Stonhard; Stongard MR: www.stonhard.com/#sle.

   b. Or approved equal.

2.2 ACCESSORIES

A. Waterproofing Membrane: Type recommended or produced by manufacturer of Fluid-Applied Flooring system for type of service and floor condition indicated.

B. Anti-Microbial Additive: Incorporate anti-microbial chemical additive to control growth of most bacteria, fungi, algae and actinomycetes.

1. Provide anti-microbial additive in all flooring.

C. Floor Transition Strips (Keynote: 096700-B): At locations indicated on drawings and as appropriate for material height.

1. Basis of Design: Schluter Schiene or approved equal.

2. Stainless Steel

D. Zinc Termination Strip (Keynote: 096700-C): As indicated on drawings and as appropriate.

E. Cant Strips: Molded of flooring resin material.

F. Subfloor Filler: Type recommended by fluid-applied flooring manufacturer.

G. Primer: Type recommended by fluid-applied flooring manufacturer.

H. Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service and joint condition indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive flooring.

C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to subfloor surfaces.

D. Cementitious Subfloor Surfaces: Verify that substrates are ready for fluid-applied flooring installation by testing for moisture and alkalinity (pH).

1. Test as Follows:

    a. Alkalinity (pH): ASTM F710.

    b. Internal Relative Humidity: ASTM F2170.

    c. Moisture Vapor Emission: ASTM F1869.

2. Obtain instructions if test results are not within limits recommended by fluid-applied flooring manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

A. Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.

B. Prepare concrete control joints and expansion joints according to flooring manufacturer's instructions.

C. Mechanically prepare (shot-blast) concrete surfaces according to flooring manufacturer's instructions.

D. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Grind irregularities above the surface level. Prohibit traffic until filler is cured.

E. Vacuum clean substrate.

F. Apply primer to surfaces required by flooring manufacturer.

3.3 TERMINATIONS

A. Chase edges to "lock" the flooring system into the concrete substrate along lines of termination.

B. Penetration Treatment: Lap and seal flooring system onto the perimeter of the penetrating item by bridging over compatible elastomer at the interface to compensate for possible movement.

C. Trenches: Continue flooring system into trenches to maintain monolithic protection. Treat cold joints to assure bridging of potential cracks.

D. Treat floor drains by chasing the flooring system to lock in place at point of termination.

3.4 JOINTS AND CRACKS

A. Treat control joint to bridge potential cracks and to maintain monolithic protection.

B. Treat cold joints and construction joint cracks and to maintain monolithic protection on horizontal and vertical surfaces as well as horizontal and vertical interfaces.

C. Treat vertical and horizontal contraction and expansion joints by installing backer rod and compatible sealant after coating installation is completed. Provide sealant type recommended by manufacturer for traffic conditions and chemical exposures to be encountered.

3.5 INSTALLATION - ACCESSORIES

A. Install cant strips at base of walls where flooring is to be extended up wall as base.

3.6 INSTALLATION - FLOORING

A. Apply in accordance with manufacturer's instructions.

B. Apply each coat to minimum thickness required by manufacturer.

C. Hand trowel cove base mix to wall surfaces at locations shown on Finish Schedule to form cove base height of 4 inches unless otherwise indicated. Follow manufacturer's printed instructions and details including taping, mixing, priming, troweling, sanding, and top-coating of cove base.

3.7 FIELD QUALITY CONTROL

A. Test installed floor surface in accordance with ANSI/ESD STM7.1 .

3.8 PROTECTION

A. Prohibit traffic on floor finish for 48 hours after installation.

B. Barricade area to protect flooring until fully cured.

C. Cleaning: Remove temporary covering and clean flooring just prior to final inspection. Use cleaning materials and procedures recommended by flooring manufacturer.

END OF SECTION 09 67 00

SECTION 09 68 13 - TILE CARPETING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Carpet tile, fully adhered.

1.2 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

D. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

E. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

1.3 SUBMITTALS

A. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

B. Shop Drawings: Indicate layout of joints.

C. Samples: Submit three carpet tiles illustrating color for each carpet color selected.

D. Manufacturer's Installation Instructions: Indicate special procedures.

E. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

F. Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

1.5 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Tile Carpeting:

1. Shaw Contract: https://www.shawcontract.com/en-us/

2. Interface, Inc: www.interface.com/#sle.

3. Mannington Commercial: www.manningtoncommercial.com#sle.

4. Milliken & Company: www.milliken.com/#sle.

2.2 MATERIALS

A. Tile Carpeting: Tufted, manufactured in one color dye lot.

1. Tile Size: 24 by 24 inch, nominal.

2. Thickness: 0.218 inches inch.

3. Color:as indicated on the drawings or approved equal.

4. Pattern: Monolithic.

5. Critical Radiant Flux: Minimum of 0.22 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.

6. Density Factor: 10 kilotex.

7. Primary Backing Material: Synthetic.

8. Secondary Backing Material: Ecoworx Tile.

2.3 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Rubber Reducer: As indicated on the drawings.

C. Adhesives:

1. Compatible with materials being adhered; maximum VOC content of 50 g/L; CRI (GLP) certified; in lieu of labeled product, independent test report showing compliance is acceptable.

D. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).

1. Test as Follows:

a. Alkalinity (pH): ASTM F710.

b. Internal Relative Humidity: ASTM F2170.

c. Moisture Vapor Emission: ASTM F1869.

2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

3.2 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

C. Vacuum clean substrate.

3.3 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet tile in accordance with manufacturer's instructions.

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.

F. Trim carpet tile neatly at walls and around interruptions.

G. Complete installation of edge strips, concealing exposed edges.

3.4 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION 09 68 13

SECTION 09 77 20 - FIBERGLASS REINFORCED PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fiberglass reinforced plastic paneling adhered to unfinished gypsum wallboard.

B. Decorative plastic wall paneling.

1.2 REFERENCE STANDARDS

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

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's descriptive literature for each specified product. Include anchorage devices specific to project substrate types.

B. Shop Drawings: Submit elevations for each application and location. Indicate details of joints and attachments.

C. Samples: Submit two samples 12 by 12 inches in size, indicating finish, surface design, and color for each type of panels.

1.4 QUALITY ASSURANCE

A. Conform to building code requirements for interior finish for smoke and flame spread requirements as tested in accordance with

1. ASTM 84 (Method of test for surface burning characteristics of building mat

a. Wall Required Rating - Class C

B. Sanitary Standards: System components and finishes to comply with:

1. United States Department of Agriculture (USDA) requirements for food preparation facilities, incidental contact.

2. Food and Drug Administration (FDA) 1999 Food Code 6-101.11.

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

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project site in manufacturer's original packaging, marked with manufacturer's product identification.

B. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Fiberglass reinforced plastic panel sheets complying with ASTM D 5319

1. Crane Composites, Inc: www.cranecomposites.com/#sle.

2. Nudo Products, Inc; FiberLite FRP: www.nudo.com/#sle.

3. Panolam Surface Systems: www.panolam.com/#sle.

4. or approved equal.

2.2 REGULATORY REQUIREMENTS

A. Surface Burning Classification: Provide wall paneling assemblies meeting Class C when tested in accordance with ASTM E84.

2.3 PANELS

A. Fiberglass reinforced plastic panel sheets complying with ASTM D 5319.

1. Dimensions:

2. Thickness: 0.075 inch nominal

a. Width: 4'-0" nominal

b. Length: 10'-0" nominal

3. Properties: Resistant to rot, corrosion, staining, denting, peeling, and splintering

a. Flexural Strength: 12,000 psi per ASTM D 790

b. Flexural Modulus: 3.1 x 105 psi per ASTM D 790.

c. Tensile Strength: 77,000 psi per ASTM D 638.

d. Water Absorption: 0.16% in 24 hours at 77 degrees F per ASTM D 570.

e. Barcol Hardness (scratch resistant) of 35 per ASTM D 2583.

4. Back Surface: Smooth. Imperfections which do not affect functional properties are not cause for refjection.

5. Front Finish: Smooth.

6. Color: As selected by Architect from full range.

2.4 ACCESSORIES

A. Trim accessories: Manufacturer's standard one piece designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners and caps as needed to conceal edges.

1. Color: Match panels.

B. Moldings: As selected by Architect from manufacturer's full product range.

C. Adhesives: As recommended by plastic paneling manufacturer.

D. Fasteners: Non-staining nylon drive rivets.

1. Match panel colors.

2. Length to suit project needs.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces for adhered items are clean and smooth.

1. Test painted or wall covering surfaces for adhesion in inconspicuous area, as recommended by manufacturer.

B. Start of installation constitutes acceptance of project conditions.

3.2 INSTALLATION

A. Install panels in accordance with manufacturer's instructions.

B. Apply adhesive to back side of panel using trowel recommended by adhesive manufacturer.

C. Apply panels to wall with vertical joints plumb and horizontal joints level and pattern aligned with adjoining panels.

D. Using a roller, apply pressure to panel face to ensure proper adhesion between surfaces.

E. Install panels with manufacturer's recommended gaps for panel field and corner joints.

F. Install trim with adhesive.

G. Seal joints at wall base and between panels with approved sealant to prevent moisture intrusion.

H. Remove excess sealant after paneling is installed and prior to curing.

3.3 CLEANING

A. Clean panel faces using cleaning agents and methods recommended by manufacturer to remove soiling.

3.4 PROTECTION

A. Protect installed interior wall paneling from subsequent construction operations.

END OF SECTION 09 77 20

SECTION 09 91 13 - EXTERIOR PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:

1. Exposed surfaces include those whether or not scheduled colors are designated.

2. Exposed surfaces of steel lintels and ledge angles.

D. Do Not Paint or Finish the Following Items:

1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.

2. Items indicated to receive other finishes.

3. Items indicated to remain unfinished.

4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.

5. Marble, granite, slate, and other natural stones.

6. Floors, unless specifically indicated.

7. Ceramic and other types of tiles.

8. Brick, glass unit masonry, architectural concrete, cast stone, integrally colored plaster and stucco.

9. Glass.

10. Concealed pipes, ducts, and conduits.

1.2 REFERENCE STANDARDS

A. SSPC-SP 1 - Solvent Cleaning.

B. SSPC-SP 2 - Hand Tool Cleaning.

C. SSPC-SP 6 - Commercial Blast Cleaning.

1.3 SUBMITTALS

A. Product Data: Provide complete list of products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").

2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

B. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.

1. Where sheen is specified, submit samples in only that sheen.

2. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as siding, factory finished metals, and wood doors, have been approved.

C. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, care and cleaning instructions, touch-up procedures, and repair of painted and finished surfaces.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.

2. Label each container with color in addition to the manufacturer's label.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience and approved by manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.6 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Paints: Provide products by one of the following manufacturers:

1. Base Manufacturer: Sherwin-Williams Company: www.sherwin-williams.com/#sle.

2. PPG Paints: www.ppgpaints.com/#sle.

3. Benjamin Moore & Company: www.benjaminmoore.com.

4. Or Approved Equal.

C. Primer Sealers: Same manufacturer as top coats.

2.2 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.

1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.

2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.

4. Supply each paint material in quantity required to complete entire project's work from a single production run.

5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.

B. Flammability: Comply with applicable code for surface burning characteristics.

C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

D. Colors: As indicated on drawings.

1. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.3 PAINT SYSTEMS - EXTERIOR

A. Paint E-OP - 2: Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including concrete masonry units.

1. Two top coats and one coat primer.

2. Top Coat(s): Exterior Acrylic Latex.

a. Products:

1) Sherwin-Williams, Loxon Self-Cleaning Acrylic Coating.

3. Top Coat Sheen:

a. Flat: MPI gloss level 1; use this sheen for concrete masrony units.

4. Primer: As recommended by top coat manufacturer for specific substrate.

5. Primer for concrete: Alkali Resistant Primer Sealer.

6. Primer for concrete masonry units: Exterior Latex Block Filler.

7. Top Coat Minimum Volume Solids: 40%.

B. Paint E-OP-MExterior Metal Surfaces to be Painted, not included in High Performance Coatings: Including Miscellaneous exposed steel.

1. Two top coats and one coat primer.

2. Top Coat(s): Exterior Light Industrial Water Based Acrylic Alkyd.

a. Products:

1) Sherwin-Williams, Pro Industrial WB Alkyd Urethane.

3. Top Coat Sheen:

a. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.

4. Primer: As recommended by top coat manufacturer for specific substrate.

5. Top Coat Minimum Volume Solids: 32%.

2.4 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. Test shop-applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. Masonry, Concrete, and Concrete Masonry Units: 12 percent.

3.2 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Masonry:

1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.

2. Prepare surface as recommended by top coat manufacturer.

G. Galvanized Surfaces:

1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

2. Prepare surface according to SSPC-SP 2.

H. Ferrous Metal:

1. Solvent clean according to SSPC-SP 1.

2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.

3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

I. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.3 APPLICATION

A. Apply products in accordance with manufacturer's written instructions.

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance.

D. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.

E. Sand metal surfaces lightly between coats to achieve required finish.

F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.5 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION 09 91 13

(This page intentionally left blank)

SECTION 09 91 23 - INTERIOR PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:

1. Exposed surfaces include those whether or not scheduled colors are designated.

2. Where suspended ceiling systems such as 'clouds' are held away from or do not touch wall surfaces, all surfaces above 'clouds' shall be painted.

3. Mechanical and Electrical:

a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.

b. In finished areas, paint shop-primed items.

c. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.

d. Paint dampers exposed behind louvers, grilles, to match face panels.

D. Do Not Paint or Finish the Following Items:

1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.

2. Items indicated to receive other finishes.

3. Items indicated to remain unfinished.

4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.

5. Any items not permitted to be painted by the AHJ.

6. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.

7. Floors, unless specifically indicated.

8. Ceramic and other tiles.

9. Brick, architectural concrete, cast stone, integrally colored plaster, and stucco.

10. Glass.

11. Acoustical materials, unless specifically indicated.

12. Concealed pipes, ducts, and conduits.

1.2 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.

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

C. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating.

D. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board.

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

F. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual.

G. SCAQMD 1113 - South Coast Air Quality Management District Rule No.1113.

H. SSPC-SP 1 - Solvent Cleaning.

I. SSPC-SP 6 - Commercial Blast Cleaning.

1.3 SUBMITTALS

A. Product Data: Provide complete list of products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").

2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

B. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.

1. Where sheen is specified, submit samples in only that sheen.

C. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, care and cleaning instructions, touch-up procedures, and repair of painted and finished surfaces.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.

2. Label each container with color in addition to the manufacturer's label.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience and approved by manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.6 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.

D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Paints: Provide products by one of the following manufacturers:

1. Base Manufacturer: Sherwin-Williams Company: www.sherwin-williams.com unless noted otherwise.

2. Pittsburgh Paints: www.ppgpaints.com/#sle.

3. Benjamin Moore & Company: www.benjaminmoore.com.

4. Or Approved equal.

C. Primer Sealers: Same manufacturer as top coats.

2.2 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.

1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.

2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.

4. Supply each paint material in quantity required to complete entire project's work from a single production run.

5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Flammability: Comply with applicable code for surface burning characteristics.

C. Fire Retardant:

1. Flame Stop, Inc.: www.flamestop.com

2. ForceField Products: www.shieldindustries.com

3. Or Approved Equal.

D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

E. Colors: As indicated on drawings.

1. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling on/under which they are mounted.

2.3 PAINT SYSTEMS - INTERIOR

A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board.

1. Two top coats and one coat primer.

2. Top Coat(s): Interior Latex.

a. Products:

1) I-OP-1: Sherwin-Williams ProMar 200 Zero VOC Interior Latex.

(a) Locations: All gypsum ceilings; all surfaces of storage rooms and other utility spaces.

(b) Top Coat Minimum Volume Solids: 42%

2) I-OP-2: Sherwin-Williams ProMar 200 HP Zero VOC Interior Latex.

(a) Locations: All other locations not included elsewhere for listed substrates.

(b) Top Coat Minimum Volume Solids: 40%

3. Top Coat Sheen:

   a. Flat: MPI gloss level 1; use this sheen for ceilings and other overhead surfaces.

   b. Eggshell: MPI gloss level 3; unless noted otherwise, use this sheen at all locations.

   c. Semi-Gloss: MPI gloss level 5; use this sheen for wet wall locations.

4. Primer: As recommended by top coat manufacturer for specific substrate.

5. Primer for concrete masonry units: Latex Block Filler.

B. Paint I-OP-MDMedium Duty: For surfaces subject to frequent contact by occupants, including surfaces listed below:

1. Medium duty applications include other metal surfaces not included in other Sections.

2. Two top coats and one coat primer.

3. Top Coat(s): Interior Light Industrial Coating, Water Based.

   a. Products:

      1) Sherwin-Williams Pro Industrial Acrylic Coating, Semi-Gloss.

4. Top Coat Sheen:

   a. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.

5. Primer: As recommended by top coat manufacturer for specific substrate.

6. Top Coat Minimum Volume Solids: 33%

C. Paint I-OP-DF - Dry Fall: Metals; exposed structure and overhead-mounted services, including shop primed and non-shop primed steel deck, structural steel, metal fabrications, and insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment.

1. One top coat.

2. Top Coat: Latex Dry Fall, for specified sheen.

a. Products:

1) Sherwin-Williams Pro-Industrial Waterborne Acrylic Dryfall.

3. Top Coat Sheen:

a. Flat: MPI gloss level 1; use this sheen at all locations.

4. Primer: As recommended by top coat manufacturer for specific substrate.

D. Water-Based Fire Retardant (Keynote: 099123-B)

1. Surfaces to be coated: Wood walls and assocaited wood accessories and trim.

2. Preparation: Sanded smooth, clean, dry.

3. Achieve Class B fire rating, minimum

4. Cured color: Clear

5. Product: Flame Stop II or Approved equal.

2.4 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:

1. Gypsum Wallboard: 12 percent.

3.2 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

F. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

G. Ferrous Metal:

1. Solvent clean according to SSPC-SP 1.

2. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

3.3 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions.

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

E. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.5 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION 09 91 23

(This page intentionally left blank)

SECTION 09 96 00 - HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. High performance coatings.

B. Surface preparation.

1.2 REFERENCE STANDARDS

A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual.

B. SSPC-SP 1 - Solvent Cleaning.

C. SSPC-SP 2 - Hand Tool Cleaning.

D. SSPC-SP 6 - Commercial Blast Cleaning.

1.3 SUBMITTALS

A. Product Data: Provide complete list of all products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").

2. Cross-reference to specified coating system(s) product is to be used in; include description of each system.

B. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.

C. Manufacturer's Certificate: Certify that high-performance coatings comply with VOC limits specified.

D. Maintenance Data: Include finish schedule showing where each product/color/finish was used, product technical data sheets, care and cleaning instructions, touch-up procedures, and repair of painted and finished surfaces.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Coating Materials: 1 gallon of each type and color.

2. Label each container with manufacturer's name, product number, color number, and room names and numbers where used.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum ten years documented experience.

B. Applicator Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of coating, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Coating Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.6 FIELD CONDITIONS

A. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the coating product manufacturer.

C. Do not install materials when temperature is below 55 degrees F or above 90 degrees F.

D. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

F. Restrict traffic from area where coating is being applied or is curing.

1.7 WARRANTY

A. Correct defective Work within a five year period after Date of Substantial Completion.

B. Warranty: Include coverage for bond to substrate.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide high performance coating products from the same manufacturer.

B. High-Performance Coatings: Provide products by one of the following manufacturers:

1. PPG Paints: www.ppgpaints.com/#sle.

2. Sherwin-Williams Company: www.protective.sherwin-williams.com/industries/#sle.

3. Tnemec Company, Inc: www.tnemec.com/#sle.

4. or approved equal.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

A. Provide complete multi-coat systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated; number of coats specified does not include primer or filler coat.

1. Colors: Custom color as selected by Architect.

2. Paints and coatings shall comply with VOC cont

B. Provide coatings that meet the following minimum performance criteria, unless more stringent criteria are specified:

1. Zinc Rich Primer HP-1, HP-2

a. ASTM B 117 – No blistering, cracking or delamination of film. No more than 1/8” creepage at scribe and no more than 1% rusting on the plane after 50,000 hours.

b. ASTM G 85 – No blistering, cracking or delamination of film. No more than 1/64” rust creepage at the scribe after 15,000 hours exposure.

c. ASTM D 4541 Type V – No less than 2,083 psi adhesion, average of three tests.

2. Epoxy Base Coat/Primer/Intermediate Coat HP-1, HP-2

a. ASTM D 1653 – No more than 0.23 perms water vapor permeability.

b. ASTM B 117 – No blistering, cracking, checking, rusting or delamination of film. No more than 1% rusting on plane. No more than 3/16" rust creepage at scribe after 20,000 hours.(with specified primer).

c. ASTM D 870 – No blistering, cracking, checking, rusting or delamination of film after two years continuous water immersion.

d. ASTM D 4541 – No less than 1,943 psi pull, average of three tests.

3. Urethane Topcoat HP-1, HP-2

a. ASTM D 4585 – No blistering, cracking, rusting or delamination of film after 5,000 hours exposure. (whole system)

b. ASTM D 2794 – No visible cracking or delamination of film after 25 inch-pounds direct impact.

c. ASTM G 85 – No blistering, cracking, rusting or delamination of film after 5,000 hours exposure.

4. Epoxy Primer HP-3

a. ASTM D 4060 – No more than 69.5 mg loss after 1,000 cycles.

b. ASTM D 695 – 6,866 psi compressive strength.

c. ASTM D 790 – 12,873 psi flexural strength.

d. ASTM D 4585 – No blistering, cracking or delamination of film after 1,500 hours exposure.

5. Epoxy Base Coat HP-3

a. No blistering, cracking or delamination of film and no more than slight softening after seven days exposure to 5% sulfuric acid, 5% acetic acid, 5% chromic acid, 5% hydrochloric acid.

b. No blistering, cracking, checking, gloss loss or delamination of film after four hours continuous exposure to 250° steam at 15-17 psi.

c. ASTM D 1653 – No more than 0.20 perms water vapor permeability.

6. Waterborne Urethane Topcoat HP-3

a. ASTM D 4060 – No more than 83 mg loss after 1,000 cycles.

b. ASTM D 522 – No less than 40% elongation.

c. Full removal of epoxy spray paint from surface film.

d. ASTM D 4585 – No blistering, cracking, rusting or delamination of film after 2,000 hours exposure.

e. No gloss change, blistering, yellowing, cracking or delamination of film after 5 ½ hours continuous exposure to 250° steam.

2.3 HIGH PERFORMANCE COATING SYSTEMS

A. Paint HP-2 Interior Aliphatic Acrylic Polyurethane on Steel Substrate:

1. Surfaces to be coated: Exposed interior steel including structural steel columns, all exposed steel components of the stair.

2. Surface Preparation: SP 6 Commercial Blast Cleaning.

3. Surface Preparation for galvanized items: Solvent cleaning followed by Phosphoric Acid based treatment, Provide 1 mil surface profile preferably via abrasive blast cleaning.

4. Shop Primer (non-galvanized): Tnemec "Series H90-97 Tneme-Zinc" @ 2.5 to 3.5 mils DFT. or approved equal.

5. Base Coat: Tnemec "Series V69 Hi-Build Epoxoline II" @ 4.0 to 6.0 mils DFT. or approved equal.

6. Topcoat: Tnemec "Series 1095 Endura-Shield" @ 2.0 to 5.0 mils DFT. or approved equal.

2.4 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of coated surfaces.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Do not begin application of coatings until substrates have been properly prepared.

C. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.

D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. Cementitious Substrates: Do not begin application until substrate has cured 28 days minimum and measured moisture content is not greater than 12 percent.

2. Plaster and Stucco: 12 percent.

3. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.

4. Concrete Floors and Traffic Surfaces: 8 percent.

G. Proceed with coating application only after unacceptable conditions have been corrected.

3.2 PREPARATION

A. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

B. Clean surfaces of loose foreign matter.

C. Remove substances that would bleed through finished coatings. If unremovable, seal surface with shellac.

D. Remove finish hardware, fixture covers, and accessories and store.

E. Concrete:

1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

2. Clean surfaces with pressurized water. Use pressure range of 1,500 to 4,000 psi at 6 to 12 inches. Allow to dry.

3. Prepare surface as recommended by coating manufacturer and according to SSPC-SP 13.

F. Galvanized Surfaces:

1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

2. Prepare surface according to SSPC-SP 2.

G. Ferrous Metal:

1. Solvent clean according to SSPC-SP 1.

2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.

3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning", and protect from corrosion until coated.

3.3 PRIMING

A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

3.4 COATING APPLICATION

A. Apply coatings in accordance with manufacturer's written instructions, to thicknesses specified.

B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.5 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Clean surfaces immediately of overspray, splatter, and excess material.

C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.6 PROTECTION

A. Protect finished work from damage.

END OF SECTION 09 96 00

SECTION 10 14 19 - DIMENSIONAL LETTER SIGNAGE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Building and room identification dimensional letter signage.

1.2 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product literature for each type of dimensional letter sign, indicating style, font, colors, locations, and overall dimensions of each sign.

B. Shop Drawings:

1. Include dimensions, locations, elevations, materials, text and graphic layout, and attachment details.

C. Samples: Submit one sample of each type of dimensional letter sign of size similar to that required for project, indicating sign style, font, and method of attachment.

D. Verification Samples: Submit samples showing colors and finishes specified.

1.4 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain minimum ambient temperature during and after installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Dimensional Letter Signs:

1. Gemini, Inc: https://geminimade.com/company/.

2. Or approved equal.

2.2 REGULATORY REQUIREMENTS

A. Accessibility Requirements: Comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most restrictive requirements.

2.3 DIMENSIONAL LETTERS

A. Applications: Building and room identification.

1. Use individual metal letters.

2. Mounting Location: Exterior and interior as indicated on drawings.

B. Metal Letters:

1. Material: Aluminum casting.

2. Thickness: 1/8 inch minimum.

3. Letter Height: As indicated on drawings.

4. Text and Typeface:

a. Character Font: Festivo or Lato and is compliant with the Delaware State Parks Official Style Guide.

b. Character Case: Upper and lower case (title case)

5. Finish: As selected by Architect from manufacturer's full range.

6. Color: As selected. Color to have good contrast against building cladding at various locations.

7. Mounting: concealed for interior signage or projected stand-off mounting for exterior signage.

2.4 ACCESSORIES

A. Concealed Screws: Noncorroding metal; stainless steel, galvanized steel, chrome plated, or other.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install with horizontal edges level.

C. Locate dimensional letter signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

END OF SECTION 10 14 19

(This page intentionally left blank)

SECTION 10 14 23 - PANEL SIGNAGE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Panel signage.

1.2 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.

B. ICC A117.1 - Accessible and Usable Buildings and Facilities.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product literature for each type of panel sign, indicating styles, font, foreground and background colors, locations, and overall dimensions of each sign.

B. Shop Drawings:

1. Include dimensions, locations, elevations, materials, text and graphic layout, attachment details, and schedules.

2. Schedule: Provide information sufficient to completely define each panel sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.

a. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.

b. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.

c. Submit for approval by Owner through Architect prior to fabrication.

C. Samples: Submit two samples of each type of sign, of size similar to that required for project, indicating sign style, font, and method of attachment.

D. Selection Samples: Where colors, materials, and finishes are not specified, submit two sets of color selection charts or chips.

E. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store tape adhesive at normal room temperature.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Panel Signage:

1. Best Sign Systems, Inc: www.bestsigns.com/#sle.

2. FASTSIGNS International, Inc: www.fastsigns.com/#sle.

3. Inpro Corporation: www.inprocorp.com/#sle.

4. Or approved equal.

2.2 REGULATORY REQUIREMENTS

A. Accessibility Requirements: Comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most restrictive requirements.

2.3 PANEL SIGNAGE

A. Panel Signage:

1. Application: Room and door signs.

2. Description: Flat signs with engraved panel media, tactile characters.

3. Sign Size: As indicated on drawings.

4. Total Thickness: 1/8 inch.

5. Color and Font, unless otherwise indicated:

a. Character Font: Helvetica, Arial, or other sans serif font.

b. Character Case: Upper and lower case (title case).

c. Background Color: As selected from manufacturers range.

d. Character Color: Contrasting color.

6. Material: Laminated colored plastic engraved through face to expose core as background color.

7. Profile: Flat panel without frame.

8. Tactile Letters: Raised 1/32 inch minimum.

9. Braille: Grade II, ADA-compliant.

2.4 SIGNAGE APPLICATIONS

A. Room and Door Signs:

1. Office Doors: Identify with room names and numbers to be determined later, not those indicated on drawings.

2. Conference and Meeting Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.

3. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.

4. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers to be determined later, and braille.

B. Emergency Evacuation Map Panel Signs:

1. Allow for one map per elevator lobby.

2. Use clear plastic silk-screened, in brusehd aluminum frame, screw mounted.

3. Size: Frame to hold a 8 1/-2x11" insert.

4. Map content to be provided by Owner.

2.5 ACCESSORIES

A. Tape Adhesive: Double-sided tape, permanent adhesive.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install with horizontal edges level.

C. Locate panel signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

END OF SECTION 10 14 23

(This page intentionally left blank)

SECTION 10 22 26 - OPERABLE PARTITIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrically operated, continuously hinged accordion folding partitions.

B. Track, ceiling guards, and operating hardware.

1.2 REFERENCE STANDARDS

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

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

C. ASTM E413 - Classification for Rating Sound Insulation.

D. ASTM E557 - Standard Guide for Architectural Design and Installation Practices for Sound Isolation between Spaces Separated by Operable Partitions.

E. ASTM F793 - Standard Classification of Wall Covering by Use Characteristics.

F. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

A. Shop Drawings: Indicate opening sizes, track layout, details of track and required supports, static and dynamic loads, adjacent construction and finish trim, and stacking sizes.

B. Product Data: Provide data on partition operation, hardware and accessories, electric operating components, track switching components, colors and finishes available.

C. Samples for Selection: Submit two samples of full manufacturer's color range for selection of colors.

D. Samples for Review: Submit two samples of surface finish, 12 by 12 inches size, illustrating quality, colors selected, texture and weight.

E. Certificates: Certify that partition system meets or exceeds specified acoustic requirements.

F. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods. Describe cleaning materials detrimental to finish surfaces and hardware finish.

1.4 QUALITY ASSURANCE

A. Sound Transmission Class (STC): As indicated, calculated in accordance with ASTM E413, based on tests performed in accordance with ASTM E90, on panel size of 100 sq ft.

B. Design Requirements: Design partition track and anchors to support imposed loads with maximum deflection of 1/360 of span, attached to structural members indicated.

1.5 WARRANTY

A. Provide written warranty by manufacturer of operable partitions agreeing to repair or replace any components with manufacturing defects.

B. Warranty period: Five (5) years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Modernfold 933E Acoustic Seal Premier Electric Panel.

B. Other Acceptable Manufacturers:

1. Hufcor, Inc; 643E: www.hufcor.com/#sle.

2. Woodfold Manufacturing, Inc.: https://woodfold.com/

3. Or approved equal.

2.2 ACCORDION FOLDING PARTITIONS

A. Panel Construction: Acoustical.

1. Nominal 3-inch (76 mm) thick panels in manufacturer's standard 48-inch (1220 mm) widths. All panel horizontal and vertical framing members fabricated from minimum 18-gage formed steel with overlapped and welded corners for rigidity. Top channel is reinforced to support suspension system components. Frame is designed so that full vertical edges of panels are of formed steel and provide concealed protection of the edges of the panel skin.

2. Substrate: Medium density fiberboard

3. Acoustic seals at top, meeting mullions, jambs, and bottom.

B. Operation:

1. Partition shall be operated by: Two push button control stations wired in series and located on opposites sides and opposite ends of the partition. Control stations shall be activated by key switch at stack end of partition.

2. Motor unit shall be reversible, continuous duty, and class A insulated. Motor unit shall have NEMA MG 1 service factor, high starting torque, thermal overload protection, and open/drip proof enclosure. Motor assembly shall have wiring compliant with NFPA 70, 24-volt controls, compliant with UL 508A, and speed of 28 feet/minute. The drive unit motor shall be equipped with outboard limit switches to prevent over-extension. A positive chain drive attached to the lead panel shall pull the partition across the opening. Cable, belt, or other friction type drives will not be accepted.

C. Performance: Sound Transmission Class (STC): 50.

D. Finish Materials:

1. Vinyl Coated Fabric: ASTM F793 Category VI, polyvinyl fluoride finish.

a. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.

b. Color: As selected from manufacturer's standard range.

1) Basis of Design: Modernfold Threads

E. Components:

1. Suspension System:

a. Track: 7-gague, 0.18 inch roll-formed steel. Track shall be supported by adjustable steel hanger brackets connected to structural support by pairs of 1/2 inch diameter threaded rods. Brackets must support the load beaing surface of the track.

2. Pocket Doors: Door, frame, and trim to match adjacent walls; design trailing jamb to latch on face of closed pocket door.

a. Basis of Design: ModernFold Pocket Door II or approved equal.

3. Hardware: Latching door handles of cast steel, satin chrome finish; master keyed to building keying system; jamb lock and pull bars.

4. Trim: Aluminum moldings, clear anodized.

F. Carriers: Nylon wheels on trolley carrier at top center of every second fold, with threaded pendant bolt for vertical adjustment.

2.3 FINISH MATERIALS

A. Vinyl Coated Fabric: ASTM F793 Category VI, polyvinyl fluoride finish.

2.4 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Electrical Characteristics:

1. 115-volt, 1-phase, 1 HP, 14.0 FLA.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify track supports are laterally braced and will permit track to be leveled within 1/4 inch of required position and parallel to the floor surface.

C. Verify floor flatness of 1/8 in 10 feet, non-cumulative.

D. Verify wall plumbness of 1/8 in 10 feet, non-cumulative.

3.2 INSTALLATION

A. Install partition in accordance with manufacturer's instructions and ASTM E557.

B. Install electric operator, wiring, and controls. Locate control station(s) as indicated.

C. Fit and align partition assembly level and plumb.

D. Lubricate moving components.

3.3 ADJUSTING

A. Adjust partition assembly to provide smooth operation from stacked to full open position.

B. Visually inspect partition in full extended position for light leaks to identify a potential acoustical leak.

C. Adjust partition assembly to ahieve lightproof seal.

3.4 CLOSEOUT ACTIVITES

A. Demonstrate operation of partition and identify potential operational problems.

END OF SECTION 10 22 26

(This page intentionally left blank)

SECTION 10 28 00 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Commercial toilet accessories.

B. Electric hand dryers.

C. Diaper changing stations.

D. Utility room accessories.

1.2 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

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

E. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

F. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

G. ASTM C1036 - Standard Specification for Flat Glass.

H. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.4 SUBMITTALS

A. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Commercial Toilet, Shower, and Bath Accessories:

1. SC Johnson Professional: https://www.scjp.com/en-us
2. Georgia Pacific Pro: https://www.gppro.com/gp/gppro/USD/
3. AJW Architectural Products: www.ajw.com/#sle.
4. American Specialties, Inc: www.americanspecialties.com/#sle.
5. Bradley Corporation: www.bradleycorp.com/#sle.
6. Bobrick Washroom Equipment Inc.: www.bobrick.com.
7. Toto USA: https://www.totousa.com/
8. Or approved equal.

B. Electric Hand Dryers:

1. Toto USA: https://www.totousa.com/
2. Or approved equal.

C. Provide products of each category type by single manufacturer.

2.2 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

1. Grind welded joints smooth.

B. Keys: Provide 4 keys for each accessory to Owner; master key lockable accessories.

C. Stainless Steel Sheet: ASTM A666/A666M, Type 304.

D. Stainless Steel Tubing: ASTM A269/A269M, Grade Type 304 or Type 316.

E. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

F. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.

G. Adhesive: Two component epoxy type, waterproof.

H. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

I. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.3 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

B. Chrome/Nickel Plating: ASTM B456, SC 2, polished finish, unless otherwise noted.

C. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.

D. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.

E. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.

F. Back paint components where contact is made with building finishes to prevent electrolysis.

2.4 COMMERCIAL TOILET ACCESSORIES

A. Toilet Paper Dispenser: High Capacity Double roll, surface mounted bracket type, plastic.

1. Color: Black

2. Products:

a. Georgia-Pacific Jumbo Toilet Paper Dispenser

b. Or approved equal.

B. Soap Dispenser: Foam soap dispenser, wall-mounted, plastic.

1. Minimum Capacity: 1 L
2. Color: White
3. Products:
    a. SC Johnson, SCJ Professional Cleanse Antimicrobial 1L Dispenser.
    b. Or approved equal.

C. Mirrors: Stainless steel framed, 1/4 inch thick tempered safety glass; ASTM C1048.
1. Size: As indicated on drawings.
2. Frame: 0.05 inchangle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
    a. Frame thickness: 3/4 inch.
3. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material.
4. Attachment: Vandal resistant stainless steel clips.

D. Grab Bars: Stainless steel, smooth surface.
1. Standard Duty Grab Bars:
    a. Push/Pull Point Load: 250 pound-force, minimum.
    b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
    c. Length and Configuration: As indicated on drawings.

E. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.

F. Wall Splash Guard (Keynote: 102800): Stainless steel, surface-mounted panel.

G. Coat Hook: Heavy-duty stainless steel, single prong, rectangular-shaped braket and backplate for concealed attachment, satin finish.

1. Locate a cook hook on the inside of each of the doors in the individual restrooms (Restroom 114, 113, 112, 111, 206, 205, 204, 203).
2. Locate four additional coat hooks in Restroom 203. Review location with owner.
3. Locate a cook hook on the inside of the door in the Lactation/Quiet Room 208.

2.5 ELECTRIC HAND/HAIR DRYERS

A. Electric Hand Dryers: High Speed Hand dryer.

1. Operation: Automatic, sensor-operated on and off.
2. Mounting: Flush mount.
3. Cover: Stainless steel with brushed finish.
    a. Tamper-resistant screw attachment of cover to mounting plate.
4. Touch free operation.
5. ADA Compliant.
6. Low operating noise: 56dB(A) or less.
7. Electric Hand Dryer Products: TODO Clean Dry HDR 111#SS or approved equal.

2.6 DIAPER CHANGING STATIONS

A. Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.

1. Material: Stainless steel.
2. Mounting: Surface.

2.7 UTILITY ROOM ACCESSORIES

A. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.

1. Drying rod: Stainless steel, 1/4 inch diameter.
2. Hooks: Two, 0.06 inch stainless steel rag hooks at shelf front.
3. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.

4. Length: Manufacturer's standard length for number of holders/hooks.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.

D. Verify that field measurements are as indicated on drawings.

3.2 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.3 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

1. Grab Bars: As indicated on drawings.

3.4 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION 10 28 00

SECTION 10 44 00 - FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.2 REFERENCE STANDARDS

A. FM (AG) - FM Approval Guide.

B. NFPA 10 - Standard for Portable Fire Extinguishers.

C. UL (DIR) - Online Certifications Directory.

1.3 SUBMITTALS

A. Product Data: Provide extinguisher operational features.

B. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.

C. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.4 FIELD CONDITIONS

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Fire Extinguishers:

1. Larsen's Manufacturing Co: www.larsensmft.com

2. Ansul, a Tyco Business; Cleanguard: www.ansul.com/#sle.

3. Pyro-Chem, a Tyco Business: www.pyrochem.com/#sle.

4. or approved equal.

B. Fire Extinguisher Cabinets and Accessories:

1. Larsen's Manufacturing Co: www.larsensmfg.com/#sle.
2. Ansul, a Tyco Business: www.ansul.com
3. Pyro-Chem, A Tyco Business: www.pyrochem.com.
4. Or approved equal.

2.2 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
   1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
   1. Class: A:B:C type.
   2. Size: 10 pound.
   3. Temperature range: Minus 40 degrees F to 120 degrees F.

2.3 FIRE EXTINGUISHER CABINETS

A. Cabinet Construction: Non-fire rated.
   1. Formed primed steel sheet; 0.036 inch thick base metal.

B. Cabinet Configuration: Recessed type.
   1. Size to accommodate accessories.
   2. Trim: Flat square edge, with 1-1/2 inch wide face.

C. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinges.

D. Door Glazing: Tempered glass, clear, 1/8 inch thick, and set in resilient channel glazing gasket.

E. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

F. Fabrication: Weld, fill, and grind components smooth.

G. Finish of Cabinet Exterior Trim and Door: No.4 - Brushed stainless steel.

H. Finish of Cabinet Interior: White colored enamel.

2.4 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

END OF SECTION 10 44 00

(This page intentionally left blank)

SECTION 10 73 10 - METAL CANOPIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Engineering design, fabrication and installation of complete welded, extruded aluminum canopies.

1.2 REFERENCE STANDARDS

A. AAMA 605.2 - Voluntary Specification For High Performance Organic Coatings On Architectural Extrusions And Panels.

B. AWS D1.1/D1.1M - Structural Welding Code - Steel.

C. AWS D1.2/D1.2M - Structural Welding Code - Aluminum.

1.3 REFERENCE STANDARDS

A. ASCE 7-95 - Minimum Design Loads for Buildings and Other Structures.

B. AWS D1.1/D1.1M - Structural Welding Code - Steel.

C. AWS D1.2 - Structural Welding Code - Aluminum.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product information, specifications and installation instructions for building components and accessories.

B. Shop Drawings: Submit detailed drawings, all mechanical joint locations with complete details, connections, jointing and accessories.

C. Certification: Submit design calculations signed by a Registered Professional Engineer, licensed in the State of Maryland. Design calculations shall state that the protective cover system design complies with the wind requirements of ASCE 7-95, the stability criteria of applicable building code, and all other governing criteria.

D. Samples for Initial Selection: For each colored or finished component of each type of protective cover indicated.

1. Include similar Samples of accessories involving color selection.

E. Welding certificates.

F. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Protective cover shall be wholly produced by a recognized manufacturer with at least five years'experience in the design and fabrication of extruded aluminum protective cover systems. Components shall be assembled in shop to greatest extent possible to minimize field assembly. Protective cover shall be installed by manufacturer. Third party installation is not acceptable.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.6 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit installation of awnings in exterior locations to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Where awning installation is indicated to fit to other work, verify dimensions of other work by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for fenestration operation throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 PERFORMANCE REQUIREMENTS

A. Canopy must conform to local building codes.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and fabricator agree to repair or replace components that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.

b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: 5 years from date of Substantial Completion.

B. 20-year warranty on finish including checking, crazing, peeling, chalking, fading and/or adhesion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design: Mapes Canopies, LLC; Super Lumideck, Flat Soffit, Hanger Rod Supported Canopy.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering covers that may be incorporated into the Work include the following:

1. American Walkway Covers.

2. Dittmer Architectural Aluminum.

3. Perfection Architectural Covers, Inc.

4. Or approved equal.

2.2 MATERIALS

A. Aluminum Members: All sections shall be extruded aluminum 6063 alloy, heat treated to T-6 temper.

B. Fasteners: Fasteners shall be aluminum, 18-8 stainless steel or 300 series stainless steel.

C. Gaskets: Gaskets shall be dry seal santoprene pressure type.

D. Sealants: Single component silicone, in color to match sheets and extrusions; refer to Section 07 9200 - Joint Sealants.

2.3 COMPONENTS

A. Beams: Beams shall be open-top tubular extrusion of size and shape shown on drawings, top edges thickened for strength and designed to receive deck members in self-flashing manner. Structural ties shall be installed in tops of all beams.

B. Deck: Deck shall be extruded self-flashing sections interlocking into a composite unit. Closures at deck ends shall be welded plates.

1. Type: 3 inch extruded flat soffit .078 decking.

C. Hanger Rods: Galvanized/zinc plated; minimum 3/4 inch diameter pipe with attachment hardware. Hanger rods and attachment hardware shall be powder coated to match canopy.

1. Provide compression sleeves as shown on drawings.

D. Fascia:

1. Fascia shall be aluminum, standard 8” extruded J style.

2. Provide on all sides of protective cover, including side against exterior wall construction.

E. Flashing: Flashing shall be 0.040 aluminum (min.).

F. Accessories: Flashings, brackets and other items necessary for a complete installation.

1. Connect to adjacent downspouts draining into storm drain system, as available to location; perforated drainage at other locations.

2.4 FABRICATION

A. Beam Construction: Beams shall be factory welded with neatly mitered corners into one-piece rigid bents. All welds shall be smooth and uniform using an inert gas shielded arc. Suitable edge preparation shall be performed to assure 100% penetration. Grind welds only where interfering with adjoining structure to allow for flush connection. Field welding is not permitted. Rigid mechanical joints shall be used when shipping limitations prohibit the shipment of fully welded bents.

B. Deck Construction: Deck shall be manufactured of extruded modules that interlock in a self- flashing manner. Interlocking joints shall be positively fastened at 8" O.C. creating a monolithic structural unit capable of developing the full strength of the sections. The fastenings must have minimum shear strength of 350 pounds each. Deck shall be assembled with sufficient camber to offset dead load deflection.

C. Concealed Drainage: Water shall drain from covered surfaces into intermediate trough and be directed to downspout.

D. Form exposed field connections with hairline joints, flush and smooth, using concealed fasteners where possible.

2.5 FINISHES

A. Flouropolymer Finish: AAMA 605.2, two coat; color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight.

1. Basis of Design: Mapes Bronze

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, ares, and conditions, with Installer present, for compliance with requirements for supporting members, inserts, installation folerances, and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

A. Erection:

1. Installation to be in strict accordance with manufacturer's shop drawings.

2. Protect the finish of components during handling and erection.

3. Protective cover shall be erected true to line, level and plumb.

B. Protective cover components shall be cleaned promptly after installation.

C. Extreme care shall be taken to protect materials during and after installation.

END OF SECTION 10 73 10

(This page intentionally left blank)

SECTION 12 24 00 - WINDOW SHADES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interior manual roller shades.

1.2 REFERENCE STANDARDS

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

1.3 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.

B. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.

C. Selection Samples: Include fabric samples in full range of available colors and patterns.

D. Verification Samples: Minimum size 6 inches square, representing actual materials, color and pattern.

E. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.

F. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

1.5 WARRANTY

A. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:

1. Shade Hardware: 25 years.

2. Installation: One year.

PART 2 PRODUCTS

2.1 ROLLER SHADES

A. General:

1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.

2. Provide shade system that operates smoothly when shades are raised or lowered.

B. Roller Shades: Keynote: 122400-C

1. Basis of Design: Mecho: 5 Manual Shade System DoubleShade #15 or Approved Equal.

2. Description - Interior Roller Shades: Double roller, manually operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.

a. Roll Direction: Roll down, closed position is at window sill.

b. Size: As indicated on drawings.

c. Fabric: As indicated under Shade Fabric article.

3. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.

a. Double Roller Brackets: Configured for light-filtering and room-darkening shades in one opening.

1) Light-Filtering Fabric: Room-side of opening.

2) Room-Darkening Fabric: Glass-side of opening.

b. Multiple Shade Operation: Provide hardware as necessary to operate more than one shade using a single clutch operator.

4. Roller Tubes: As required for type of shade operation.

5. Hembars: Designed to maintain bottom of shade straight and flat.

6. Manual Operation for Interior Shades:

    a. Clutch Operator: Manufacturer's standard material and design, permanently lubricated.

    b. Drive Chain: Continuous loop beaded ball chain, 95 lb minimum breaking strength. Provide upper and lower limit stops.

7. Accessories:

    a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; clear anodized finish.

2.2 SHADE FABRIC

A. Fabric for Light-Filtering Shades: Nonflammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.

1. Manufacturers:

    a. MechoShade Systems LLC; Soho - 1600 Series (3% open): www.mechoshade.com/#sle.

    b. Or approved equal.

2. Material: Vinyl coated polyester.

3. Performance Requirements:

    a. Flammability: Pass NFPA 701 large and small tests.

4. Color: As selected by Architect from manufacturer’s full range of colors.

B. Fabric for Room Darkening: Nonflammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.

1. Manufacturers:

    a. MechoShade Systems LLC; ThermoVeil- 0900 Series (opaque 1% open): www.mechoshade.com/#sle.

    b. Or approved equal.

2. Performance Requirements:

   a. Flammability: Pass NFPA 701 large and small tests.

3. Color: As selected by Architect from manufacturer's full range of colors.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine finished openings for deficiencies that may preclude satisfactory installation.

B. Start of installation shall be considered acceptance of substrates.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.

B. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.3 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.

B. Replace shades that cannot be cleaned to "like new" condition.

3.4 PROTECTION

A. Protect installed products from subsequent construction operations.

END OF SECTION 12 24 00

SECTION 12 48 13 - ENTRANCE FLOOR MATS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Carpet mat.

1.2 SUBMITTALS

A. Product Data: Provide data indicating properties of walk-off surface, component dimensions.

B. Shop Drawings: Indicate dimensions.

C. Samples: Submit two samples, 6 by 6 inch in size illustrating pattern, color, and finish.

D. Maintenance Data: Include cleaning instructions, and stain removal procedures.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Floor Mats:

1. American Floor Mats: https://www.americanfloormats.com/

2. Mats, Inc: https://mats-inc.com/

3. Pawling Corporation: www.pawling.com/#sle.

4. Or approved equal.

2.2 MATS

A. Carpet Mat: Cut nylon pile permanently bonded to vinyl backing; 48 inch wide by 96 inch long with one inch black matching vinyl border on all edges.

1. Colors: To be selected by Architect from manufacturer's standard range.

2.3 FABRICATION

A. Fabricate mats in single unit sizes; fabricate multiple mats where indicated on drawings.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install walk-off surface after cleaning of finish flooring.

END OF SECTION 12 48 13

SECTION 12 93 13 - BICYCLE RACKS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. General Conditions, Special Contract Requirements and Division 01 Specification sections are a part of and govern work under this section.

B. Section 32 13 13 – SITE CONCRETE for furnishing footers

1.2 SUMMARY

A. The work required under this section consists of furnishing all labor, materials, equipment, services and related items necessary to supply and install the site furnishings listed below, and all related work, complete, as indicated on the drawings or specified herein.

B. This section includes the following site and street furnishings:

1. Bike Racks

1.3 SUBMITTALS.

A. Product Data: Bike Rack model information and each type of anchor bolts.

B. Provide recommended methods for repairing damage and abrasions to the powder coat finish.

1.4 QUALITY ASSURANCE AND GUARANTEE

A. Installer Qualification: An experienced installer who has completed installation of site furnishings and whose work has resulted in construction with a record of successful in-service performance for 5 years.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in original undamaged packaging in a dry location until ready for installation.

B. Handle powder coated products carefully to prevent any damage to the finish.

C. to enable snow plow access around a bike if it remains attached to the rack.

PART 2 – PRODUCTS

2.1 EQUIPMENT

A. All park furnishings shall be procured and installed by the contractor.

B. Contractor shall assemble the parts and install them per the Contract Documents.

2.2 MATERIAL

A. BICYCLE RACKS

1. Model: BRWS-101 Cycle Sentry Series or approved equal
Options: in-ground mount (preferred); surface mount is
Available. Color: Black Powder Coat
Capacity: 2 bikes per rack

2. Manufacturer:
Secure Site Design, LLC or approved equal
Phone: (888)268-4726
www.securesitedesign.com

B. ANCHOR BOLTS:

1. Stainless steel expansion anchors for surface mount in concrete footers.

PART 3 EXECUTION

3.1 EXAMINATION

A. Site Examinations: Examine areas to receive benches and tables.

1. Verify that substrates are stable and capable of supporting the weight of items covered under this section.
2. Verify that substrates have been adequately prepared to securely anchor those items that will be anchored.
3. Notify Landscape Architect of conditions that would adversely affect installation or subsequent use.
4. Do not begin installation until unacceptable conditions are corrected.

3.2 INSTALLATION

A. Install furnishings in accordance with manufacturer's instructions at locations indicated on the Drawings.

B. Install benches on hard level surface.

3.3 ADJUSTING

A. Finish Damage: Repair minor damage to finish in accordance with manufacturer's instructions and as approved by Landscape Architect.

B. Component Damage: Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.4 CLEANING

A. Clean benches promptly after installation in accordance with manufacturer's instructions.

B. Do not use harsh cleaning materials or methods that could damage the finish.

3.5 PROTECTION

A. Protect installed benches to ensure that, except for normal weathering, benches will be without damage or deterioration at time of Substantial Completion.

END OF SECTION 12 93 13

(THIS PAGE INTENTIONALLY LEFT BLANK)

SECTION 14 24 00 - HYDRAULIC ELEVATORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Complete hydraulic elevator systems.

1. Passenger type.

B. Elevator Maintenance Contract.

1.2 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.

B. AAMA 611 - Specification for Anodized Architectural Aluminum.

C. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.

D. AISC 360 - Specification for Structural Steel Buildings.

E. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test.

F. ASME A17.1 - Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices.

G. ASME A17.2 - Guide for Inspection of Elevators, Escalators, and Moving Walks Includes Inspection Procedures for Electric Traction and Winding Drum Elevators, Hydraulic Elevators, Inclined Elevators, Limited-Use/Limited-Application Elevators, Private Residence Elevators, Escalators, Moving Walks, Dumbwaiters, and Material Lifts.

H. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

I. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

J. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

K. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.

L. AWS D1.1/D1.1M - Structural Welding Code - Steel.

M. NEMA MG 00001 - Motors and Generators.

N. NFPA 70 - National Electrical Code.

O. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate work with other installers to provide conduits necessary for installation of wiring including but not limited to:

a. Elevator equipment devices remote from elevator machine room or hoistway.

b. Remote group automatic panel in lobby from controller cabinet.

c. Telephone service for machine room.

d. Elevator pit for lighting and sump pump.

e. Automatic transfer switch from controller cabinet.

f. Fire alarm panel from controller cabinet.

2. Coordinate work with other installers for equipment provisions necessary for proper elevator operation, including but not limited to, the following:

a. Automatic transfer switches with auxiliary contacts for emergency power transfer status indication.

b. Shunt trip devices for automatic disconnection of elevator power prior to fire suppression system activation.

c. Overcurrent protection devices selected to achieve required selective coordination.

B. Preinstallation Meeting: Convene meeting at least one week prior to start of this work.

1. Review schedule of installation, proper procedures and conditions, and coordination with related work.

1.4 SUBMITTALS

A. Product Data: Submit data on following items:

1. Signal and operating fixtures, operating panels, and indicators.
2. Car design, dimensions, layout, and components.
3. Car and hoistway door and frame details.
4. Electrical characteristics and connection requirements.

B. Shop Drawings: Include appropriate plans, elevations, sections, diagrams, and details on following items:

1. Elevator Equipment and Machines: Size and location of driving machines, power units, controllers, governors, and other components.
2. Hoistway Components: Size and location of car guide rails, buffers, jack unit and other components.
3. Rail bracket spacing; maximum loads imposed on guide rails requiring load transfer to building structural framing.
4. Clearances and over-travel of car.
5. Locations in hoistway of traveling cables and connections for car lighting and telephone.
6. Location and sizes of hoistway and car doors and frames.
7. Signal fixture drawings.
8. Electrical characteristics and connection requirements.
9. Indicate arrangement of elevator equipment and allow for clear passage of equipment through access openings.

C. Samples: Submit samples illustrating car interior finishes, car and hoistway door and frame finishes, and handrail material and finish in the form of cut sheets or finish color selection brochures.

D. Testing Agency's Qualification Statement.

E. Initial Maintenance Contract.

F. Operation and Maintenance Data:

1. Parts catalog with complete list of equipment replacement parts; identify each entry with equipment description and identifying code.

2. Operation and maintenance manual.

3. Schematic drawings of equipment and hydraulic piping, and wiring diagrams of installed electrical equipment with list of corresponding symbols to identify markings on machine room and hoistway apparatus.

1.5 QUALITY ASSURANCE

A. Designer Qualifications: Design guide rails, brackets, anchors, and machine anchors under direct supervision of a licensed Professional Structural Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and approved by elevator equipment manufacturer.

D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of type specified in this section.

E. Permits, Inspections and Certificates: The Elevator Contractor shall obtain and pay for necessary Municipal or State Inspection and permit as required by the elevator inspection authority, and make such tests as are called for by the regulations or such authorities. These tests shall be made in the presence of such authorities or their authorized representatives.

1.6 WARRANTY

A. Provide manufacturer's warranty for elevator operating equipment and devices for one year from Date of Substantial Completion.

1.7 MAINTENANCE AND SERVICE

A. Maintenance service consisting of regular examinations and adjustments of the elevator equipment shall be provided by the elevator contractor for a period of 12 Months after the elevator has been turned over for the customer's use. This service shall not be subcontracted but shall be performed by the elevator contractor. All work shall be performed by competent employees during regular working hours of regular working days. This service shall not cover adjustments, repairs, or replacement of parts due to negligence, misuse, abuse, or accidents caused by persons other than the elevator contractor.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Hydraulic Elevator Manufacturers:

1. Basis of Design: Delaware Elevator, Dual Piston Holelesss MRL Hydraulic Passenger Elevator: https://delawareelevator.com/company/

2. Or approved equal.

B. Source Limitations: Provide elevator and associated equipment and components produced by the same manufacturer as the other elevator equipment used for this project and obtained from a single supplier.

2.2 HYDRAULIC ELEVATORS

A. Hydraulic Passenger Elevator:

1. Hydraulic Elevator Equipment:

a. Single stage Piston Holeless Machine Room-less hydraulic elevator. The entire hydraulic system and the controller shall be located inside the hoistway. No extra machine room or control closet space is required.

2. Drive System:

a. Variable voltage variable frequency (VVVF) to modulate motor speed.

3. Operation Control Type:

a. Simplex Collective Operation: Using a microprocessor-based controller, operation shall be automatic by means of the car and hall buttons. If all calls in the system have been answered, the car shall park at the last landing served.

b. _____.

4. Service Control Type:

   a. Standard service control only.

5. Interior Car Height: 96 inch.

6. Electrical Power: 208 volts; alternating current (AC); three phase; 60 Hz.

7. Car Lighting Power Supply: 120 volts; single phase

8. Loading Classification: Passenger/ Class "A"

9. Rated Net Capacity: 3500 pounds.

10. Rated Speed: 100 feet per minute.

11. Hoistway Size: As indicated on drawings.

12. Platform Size: 7'-0" wide x 6'-3" deep.

13. Finish Floor Recess: 1/4" standard.

14. Elevator Pit Depth: 5'-0" minimum; as indicated on drawings.

15. Overhead Clearance at Top Floor: As indicated on drawings.

16. Travel Distance: As indicated on drawings.

17. Number of Stops: 2.

18. Number of Openings: 2 Front; 0 Rear.

19. Hydraulic Equipment Location: Hydraulic power unit & controller to be within hoistway spae in pit with 3'-0" wide x 7'-0" high access door to these devices.

2.3 COMPONENTS

A. Elevator Equipment:

1. Motors, Hydraulic Equipment, Controllers, Controls, Buttons, Wiring, Devices, and Indicators: Comply with NFPA 70; see Section 26 05 21.

2. Guide Rails, Cables, Buffers, Attachment Brackets and Anchors: Design criteria for components includes safety factors in accordance with applicable requirements of Elevator Code, ASME A17.1.

3. Buffers:

   a. Spring type for elevators with speed less than or equal to 200 fpm.

4. Lubrication Equipment:

   a. Provide grease fittings for periodic lubrication of bearings.

   b. Lubrication Points: Visible and easily accessible.

B. Electrical Equipment:

1. Motors: NEMA MG 1.

2. Boxes, Conduit, Wiring, and Devices: As required by NFPA 70; see Sections 26 05 33.13 and 26 05 83.

3. Spare Conductors: Provide ten percent in extra conductors and two pairs of shielded audio cables in traveling cables.

4. Include wiring and connections to elevator devices remote from hoistway and between elevator machine room. Provide additional components and wiring to suit machine room layout. See Section 26 05 21.

2.4 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with ASME A17.1, applicable local codes, and authorities having jurisdiction (AHJ).

B. Accessibility Requirements: Comply with ADA Standards.

C. Perform structural steel design, fabrication, and installation in accordance with AISC 360.

D. Perform welding of steel in accordance with AWS D1.1/D1.1M.

E. Fabricate and install door and frame assemblies in accordance with NFPA 80 and in compliance with requirements of authorities having jurisdiction.

F. Perform electrical work in accordance with NFPA 70.

G. Comply with venting or pressurization of hoistway design in accordance with HVAC system requirements and authorities having jurisdiction (AHJ).

2.5 OPERATION CONTROLS

A. Elevator Controls: Provide landing operating panels and landing indicator panels.

1. Landing Operating Panels: Metallic type, one for originating "Up" and one for originating "Down" calls, one button only at terminating landings; with illuminating indicators.

2. Landing Indicator Panels: Illuminating.

3. Comply with ADA Standards for elevator controls.

B. Interconnect elevator control system with building security, fire alarm, and smoke alarm systems.

C. Door Operation Controls:

1. Program door control to open doors automatically when car arrives at floor landing.

2. Render "Door Close" button inoperative when car is standing at dispatch landing with doors open.

3. Door Safety Devices: Moveable, retractable safety edges, quiet in operation; equipped with photo-electric light rays.

D. Provide "Firefighter's Emergency Operation" in accordance with ASME A17.1, applicable building codes, and authorities having jurisdiction (AHJ).

2.6 OPERATION CONTROL TYPE

A. Single Automatic (Push Button) Operation Control: Applies to car in single elevator shaft.

1. Refer to description provided in ASME A17.1.

2. Set system operation so that momentary pressure of landing button dispatches car from other landing to that landing.

3. Allow call registered by momentary pressure of landing button at any time to remain registered until car stops in response to that landing call.

4. If elevator car door is not opened within predetermined period of time after car has stopped at terminal landing allow car to respond to call registered from other landing.

2.7 EMERGENCY POWER

A. Set-up elevator operation to run with building emergency power supply when the normal building power supply fails, and in compliance with ASME A17.1 requirements.

B. Building Emergency Power Supply: Supplied by backup generator; provide elevator system components as required for emergency power characteristics with phase rotation the same as for normal power.

1. Provide transfer switches and auxiliary contacts.

2. Install connections to power feeders.

C. Emergency Lighting: Comply with ASME A17.1 elevator lighting requirements.

D. Provide operational control circuitry for adapting the change from normal to emergency power.

E. Upon transfer to emergency power, advance one elevator at a time to a pre-selected landing, stop car, open doors, disable operating circuits, and hold in standby condition.

2.8 MATERIALS

A. Stainless Steel Sheet: ASTM A666/A666M, Type 304; No. 4 Brushed finish unless otherwise indicated.

B. Extruded Aluminum: ASTM B221 (ASTM B221M), natural anodized finish unless otherwise indicated.

C. Tempered Glass: 3/8 inch minimum thickness, fully tempered in compliance with ASME A17.1, 16 CFR 1201, ANSI Z97.1, and ASTM C1048 tempered glass requirements.

2.9 CAR AND HOISTWAY ENTRANCES

A. Elevator:

1. Car and Hoistway Entrances:

a. Hoistway Fire Rating: As indicated on drawings.

b. Framed Opening Finish and Material: Brushed stainless steel.

c. Car Door Material: Stainless steel, with rigid sandwich panel construction.

d. Hoistway Door Material: Stainless steel, with rigid sandwich panel construction.

e. Door Operation: single speed, side opening.

f. Paint Color: As selected by Architect from manufacturer's standard line.

g. Sills: Extruded aluminum.

B. Sills/Thresholds: Configure to align with frame return and coordinate with floor finish.

2.10 CAR EQUIPMENT AND MATERIALS

A. Elevator Car:

1. Car Operating Panel: Provide main and auxiliary; flush-mounted applied face plate, with illuminated call buttons corresponding to floors served with "Door Open/Door Close" buttons, "Door Open" button, "Door Close" button, and alarm button and in-car emergency two-way communications.

a. Panel Material: Integral with front return; one per car.

b. Car Floor Position Indicator: Above door with illuminating position indicators.

c. Locate alarm button where it is unlikely to be accidentally actuated; not more than 54 inch above car finished floor.

d. In-Car Emergency Two Way Communications System

1) Provide a hands-free emergency voice commnication system mounted as an integral part of the car operating panel.

(a) Necessary wires shall be included in the car traveling cable.

(b) Conversation levels shall measure 60 dbA or higher and measure 10 dbA above ambient noise levels.

(c) Each device shall be provided with a self-diagnostic capability in order to automatically alert building personnel should an operational problem be detected.

2. Flooring: plastic laminate .

3. Front Return Panel: Match material of car door.

4. Door Wall: Stainless steel.

5. Side Walls: Stainless steel.

6. Rear Wall: Stainless steel.

7. Hand Rail: Aluminum, at all three sides. Provide open clearance space 1-1/2 inch (38 mm) wide to face of wall.

   a. Aluminum Finish: Clear anodized.

B. Car Accessories:

1. Certificate Frame: Stainless steel frame glazed with tempered glass, and attached with tamper-proof screws.

2.11 MACHINE ROOM FITTINGS

A. Wall-Mounted Frames: Glazed with clear plastic; sized as required. Provide one chart each for master electric and hydraulic schematic and for lubrication chart. Install charts.

B. Key Cabinet: Wall-mounted, lockable, keyed to building keying system, for control and operating panel keys.

2.12 FINISHES

A. Powder Coat on Steel: Clean and degrease metal surface; apply one coat of primer; two coats of powder coat.

B. Clear Anodized Finish: Class I, AAMA 611 AA-M12C22A41, clear anodic coating with electrolytically deposited organic seal; not less than 0.7 mil, 0.0007 inch thick.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting this work.

B. Verify that hoistway, pit, and machine room are ready for work of this section.

C. Verify hoistway shaft and openings are of correct size and within tolerance.

D. Verify location and size of machine foundation and position of machine foundation bolts.

E. Verify that electrical power is available and of correct characteristics.

3.2 PREPARATION

A. Maintain elevator pit excavation free of water.

3.3 INSTALLATION

A. Coordinate this work with installation of hoistway wall construction.

B. Install system components, and connect equipment to building utilities.

C. Provide conduit, electrical boxes, wiring, and accessories; see Sections 26 05 33.13 and 26 05 83.

D. Install hydraulic piping between cylinder and pump unit.

E. Mount machines, motors, and pumps on vibration and acoustic isolators.

1. Place on structural supports and bearing plates.

2. Securely fasten to building supports.

3. Prevent lateral displacement.

F. Install hoistway, elevator equipment, and components in accordance with approved shop drawings.

G. Install guide rails to allow for thermal expansion and contraction movement of guide rails.

H. Accurately machine and align guide rails, forming smooth joints with machined splice plates.

I. Install hoistway door sills, frames, and headers in hoistway walls; grout sills in place, set hoistway floor entrances in alignment with car openings, and align plumb with hoistway.

J. Structural Metal Surfaces: Clean surfaces of rust, oil or grease; wipe clean with solvent; prime two coats.

K. Wood Surfaces not Exposed to Public View: Finish with one coat primer; one coat enamel.

L. Adjust equipment for smooth and quiet operation.

3.4 TOLERANCES

A. Guide Rail Alignment: Plumb and parallel to each other in accordance with ASME A17.1 and ASME A17.2.

B. Car Movement on Aligned Guide Rails: Smooth movement, without any objectionable lateral or oscillating movement or vibration.

3.5 ADJUSTING

A. Adjust for smooth acceleration and deceleration of car to minimize passenger discomfort.

B. Adjust with automatic floor leveling feature at each floor landing to reach 1/4 inch maximum from flush with sill.

3.6 CLOSEOUT ACTIVITIES

A. Demonstrate proper operation of equipment to Owner's designated representative.

3.7 PROTECTION

A. Do not permit construction traffic within car after cleaning.

B. Protect installed products until Date of Substantial Completion.

C. Touch-up, repair, or replace damaged products and materials prior to Date of Substantial Completion.

3.8 MAINTENANCE

A. Provide Initial Maintenance Contract of elevator system and components in accordance with ASME A17.1 and requirements as indicated for 3 months from Date of Substantial Completion.

B. Perform maintenance contract services using competent and qualified personnel under the supervision and direct employ of the elevator manufacturer or original installer.

C. Include systematic examination, adjustment, and lubrication of elevator equipment.

D. Perform work without removing cars from use during peak traffic periods.

END OF SECTION 14 24 00

SECTION 22 01 01 - PLUMBING GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. General provisions and requirements for all plumbing work.

1.2 RELATED SECTIONS

A. Requirements of this section generally supplement requirements of Division 01.

B. Commissioning requirements: Divisions 01 and 23

1.3 REFERENCES

A. NFPA 10: Portable Fire Extinguishers.

B. NFPA 241: Safeguarding Construction, Alteration, and Demolition Operations.

1.4 SYSTEM DESCRIPTION

A. The full set of Contract Documents applies to work of Division 22.

B. Visit the site and study all aspects of the project and working conditions, as required by General and Supplementary Conditions, Bidding and Contracting Requirements, Drawings, and Specifications. Verify field dimensions.

C. The work covered in technical sections includes the furnishing of all labor, equipment and materials, and the performance of all operations pertinent to the work described.

D. Except as required otherwise in Division 01, promptly obtain and pay for, including all necessary signatures and paperwork, all permits, fees and inspections required for work of this division by authorities having jurisdiction, including any utility connection or extension charge. No payment will be made until a copy of the permit is forwarded to the Owner.

E. Plumbing work of this project includes, as a brief general description, the following:

1. A completely new plumbing system consisting of a new domestic water service extending from an existing domestic water well. New pressure tanks will be located in the existing Chambers House. Domestic water supply will route from the Chambers House to the new nature center.
2. New sanitary piping mains will extend out of the building and connect to the new septic system, designed by others.

3. New stormwater piping will connect to roof drains will extend out of the building for continuation to the site stormwater system.
4. The project includes commissioning under the direction of a Commissioning Agent (CxA).

F. See Division 01 for requirements related to Owner's occupancy of the premises, limits on use of site, time restrictions on work, limits on utility outages or shutdowns, and phasing (sequencing) and scheduling.

1.5 PRODUCT OPTIONS

A. Except as modified by provisions of Bidding and Contracting Requirements and Division 01, the following options apply to Division 22 specifications.

1. Products specified by reference standards or by description only: Any product meeting those standards or description.
2. Products specified by naming one or more manufacturers, or model name or catalog reference number: Products specified establish a standard of quality, options to be included, and performance.

    a. Where other acceptable manufacturers are named, Contractor may provide products of those named manufacturers only, which meet the specifications.
    b. Where specification permits "equal" products, without naming other acceptable manufacturers, Contractor may use products of any manufacturer, which meet the specifications.

3. Products specified by naming one manufacturer and particular product, with no provision for other options: No options or substitutions allowed.

B. General: Where Contractor is permitted to use a product other than the specified item and model named as the basis of design, Contractor is responsible for all coordination and additional costs as specified in the article "Substitutions," below for substitutions.

1.6 SUBSTITUTIONS

A. Substitutions will be considered only as permitted or required by the Bidding and Contracting Requirements and Division 01. Except as modified by those requirements, the requirements below apply to Division 22 specifications.

B. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

C. Document each request with complete data substantiating compliance of proposed substitution with contract documents.

D. A request constitutes a representation that the Bidder or Contractor:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.

2. Will provide the same warranty for the substitution as for the specified product.
3. Will coordinate installation and make changes to other work which may be required for the work to be complete with no additional cost to Owner.
4. Waives claims for additional costs or time extension which may subsequently become apparent.
5. Will reimburse Owner for review or redesign services associated with re-approval by authorities.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

F. Substitution submittal procedure is specified in Bidding and Contracting Requirements and Division 01.

1.7 MATERIALS AND EQUIPMENT

A. All materials and equipment shall be new and the best of their respective kinds, suitable for the conditions and duties imposed on them by the project, and of representative manufacturer. The description, characteristics and requirements of the materials to be used shall be in accordance with the specifications.

B. All equipment, construction and installation must meet requirements of local, state and federal governing codes.

C. Singular number: In cases where material, a device, or part of the equipment is referred to in the singular number in the specifications, it is intended that such reference shall apply to as many items of material, devices, or parts of the equipment as are required to complete the installation as shown on the drawings or required for proper operation of the system.

D. Terms have the following meanings:

1. Furnish: Supply item
2. Install: Mount and connect item
3. Provide: Furnish and install.

E. All materials and equipment shall be installed and completed in a first class and workmanlike manner and in accordance with the best modern methods, practice and manufacturers' instructions. Any work which shall not present an orderly and neat or workmanlike appearance shall be removed and replaced with satisfactory work when so directed in writing by the Architect.

F. The specifications and drawings are intended to define the minimum requirements, as to quality of materials, construction, finish and overall workmanship.

G. General Conditions describe the correlation and intent of the Contract Documents. In case of discrepancies between the specifications and drawings, the specifications should be followed as to the general methods and principles and the drawings followed as to sizes, capacities and specifics for corresponding parts. If sizes are omitted, the Architect will determine sizes to be utilized.

H. In all cases of doubt, uncertainty, or conflict as to the true meaning of the specifications or drawings, it is the responsibility of the Contractor to notify the Architect of said uncertainty, doubt, or conflict and obtain a decision as to the intent before starting any work which may be affected by this decision.

1.8 COORDINATION

A. Should a situation develop during construction to prevent the proper installation of any equipment or item where shown on the drawings, call the situation to the attention of the Architect and await a written decision.

B. Plan and coordinate all work to proceed in an orderly and continuous manner without undue delay, and in conformance with project schedule. Submit samples, shop drawings, schedules, insurance policies and certificates, and the like in time to avoid delays in actual construction. Coordinate plumbing work so that work of each trade is completed before other construction begins which would obstruct it.

C. Coordinate trades to ensure that proper clearances between work of the various trades allow access to items which require operation and maintenance.

D. Coordinate location and elevation of all piping, ductwork, light fixtures, equipment, and appurtenances in such a manner that the finished installation is as indicated on drawings. In the event difficulties are encountered which prevent this, it is the Contractor’s responsibility to bring this to the attention of the Architect prior to initiation of work. Correct improperly coordinated installation at no additional cost.

E. The Contractors' assistants shall include a competent foreman, who shall be on the premises at all times to check, layout, coordinate and superintend the installation of work. The foreman shall establish all grades and lines relative to the work before starting, and be responsible for the accuracy thereof.

1.9 SUBMITTALS

A. Manufacturers’ and subcontractors' lists:

1. As specified in Division 01, submit a complete list of proposed manufacturers for all equipment, materials and subcontractors used for the work of this division. Lists shall follow the sequence of the specifications. No considerations will be given for partial or incomplete lists. After review of lists, submit shop drawings and product data.

B. Shop drawings and product data:

1. Submit in accordance with the requirements of Division 01 or as established at the preconstruction conference, the required number of copies of shop drawings and product data for every item of equipment. Shop drawings or product data will not be considered until manufacturers' lists have been approved. Shop drawings and product data shall be submitted, as required by the General Conditions, with sufficient time for checking, return to Contractor, and resubmission as required before Contractor shall install any item.

2. Each item submitted shall be properly labeled, indicating the specific service for which the equipment or material is to be used, section and paragraph number of specification or drawing number to which it applies, Contractor's name and project name and number. Data submitted shall be specific and shall include product data and printed information in sufficient detail and scope to verify compliance with requirements of the contract documents. Clearly identify each item within the data. Data of a general nature will not be accepted. Each sheet must clearly show the project name and number.
3. The review of a shop drawing or product data shall not be considered as a guarantee of the measurements or building conditions or that the shop drawings or product data have been checked to see that item submitted properly fits the building conditions. This review shall not relieve the Contractor of the responsibility for furnishing material or performing work as required by the contract documents, for correctness of dimensions and quantities, or for proper coordination of details and interfaces among trades.
4. All exclusively electrical items furnished as items associated with plumbing items but not specifically described in the plumbing item submission, shall be submitted as a separate submittal but shall be clearly marked as associated with the plumbing item by identification specification paragraph.
5. Product data sheets shall be 8.5-inch by 11-inch cut sheets for operating and maintenance manual.

C. Submit at least three copies of the results of every test required under any section in this division.

D. Specialist shall submit a list of at least three projects similar to this project in type, size, and quality, which have been in place and operating satisfactorily for at least five years.

1. Include project name, address, name and phone number of owner's representative, and project type and size.

E. After the work is completed, submit all required certificates of approval from approved inspection agencies and authorities having jurisdiction over work of this division. Certificates of approval must be received by the Architect prior to final acceptance of the work.

1.10 SPECIALIST

A. The term "Specialist" as used in the specification shall mean an individual or firm of established reputation (or, if newly organized, whose personnel have previously established a reputation in the same field,) which is regularly engaged in, and which maintains a regular force of workers skilled in either (as applicable) manufacturing or fabricating items required by the contract, installing items required by the contract, or otherwise performing work required by the contract. Where the specification requires installation by a specialist, the term shall also be deemed to mean the manufacturer of the item, an individual or firm licensed by the manufacturer, or an individual or firm who will perform the work under the manufacturer's direct supervision.

1.11 CONTRACT CLOSEOUT SUBMITTALS

A. Project record documents:

1. Maintain on site one set of the following record documents; record actual revisions to the work of this division:

    a. Contract drawings.
    b. Specifications
    c. Addenda
    d. Change orders and other modifications to the Contract
    e. Reviewed shop drawings, product data, and samples

2. Maintain record documents separate from documents used for construction.
3. Record information concurrent with construction progress.
4. Specifications: Legibly mark and record in each section a description of actual products installed, including the following:

    a. Manufacturer's name and product model and number
    b. Product options, substitutions, or alternates utilized
    c. Changes made by addenda and modifications

5. Record documents and shop drawings: Legibly mark each item to record actual construction, including:

    a. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
    b. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the work.
    c. Field changes of dimension and detail.
    d. Details not on original Contract Drawings.

6. Submit documents as specified in Division 01.

B. Operation and maintenance data:

1. Submit sets prior to final inspection as specified in Division 01. Unless otherwise specified in Division 01, submit no fewer than three sets. In addition to requirements specified in Division 01, submit operating and maintenance manuals for the work of this division as specified below.
2. Lubrication charts: Prepare lubrication charts for each piece of mechanical equipment that requires grease or oil.

    a. Include the following:

        (1) Types of lubricants required
        (2) Locations of lubrication points
        (3) Frequency of lubrication.

    b. Provide one extra set of lubrication charts mounted in plastic covers, besides those required in Operating and Maintenance Manuals.

3. Binders: Three-ring binders with vinyl-covered hard covers. Provide large enough binders, and sufficient quantity, that the required contents can be easily turned, removed, and reinserted.
4. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS," and title of project. Print on spine of binder "O & M INSTRUCTIONS." If more than one binder is required, print covers and spines with volume numbers. Include in the front of every binder an index to all binders.
5. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
6. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, typed on white paper.
7. Part 1: Directory, listing names, addresses, and telephone numbers of mechanical engineers; Contractor; mechanical subcontractors; and major mechanical equipment suppliers.
8. Part 2: Operation and maintenance instructions, arranged by specification section. For each category, identify names, addresses, and telephone numbers of subcontractors and suppliers. Identify the following:

    a. Significant design criteria, including pump curves and similar performance charts.
    b. List of plumbing equipment, including operating weight of each.
    c. Parts list for each plumbing fixture, faucet, and pump, including recommended spare parts list.
    d. Operating instructions.
    e. Maintenance instructions for plumbing equipment and systems.
    f. Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.
    g. Valve charts, including locations of flow fittings.

9. Part 3: Project documents and certificates, including the following:

    a. Shop drawings and product data for plumbing systems.
    b. Water balance reports.
    c. Photocopies of certificates.
    d. Photocopies of warranties and guarantees.
    e. Test reports: Copies of the results of all tests required under all sections of specifications.

10. Submit one copy of completed volumes in final form 15 days prior to final inspection. This copy will be returned after final inspection, with Engineer comments. Revise content of documents as required prior to final submittal.
11. Submit final volumes revised, within ten days after final inspection.

1.12 REGULATORY REQUIREMENTS

A. When these specifications call for materials or construction of a better quality or larger sizes than required by the following codes and standards, the provisions of the specifications shall take precedence.

B. Provide, without extra charge, any additional materials and labor which may be required for compliance with these codes and standards even though the work is not mentioned in these specifications or shown on the contract drawings.

C. Perform the work of this division in strict accordance with the following authorities. The latest revision of these codes accepted by the authority having jurisdiction as of the date of the contract documents shall apply.

1. The plumbing, mechanical, electrical, building, fire, and safety codes of the state and county or city in which the work is being performed.
2. The National Electric Code, NFPA 70 (NEC).
3. The National Fire Protection Association Code. (NFPA).
4. International Energy Conservation, Fire, Fuel Gas, Mechanical, and Plumbing Codes (ICC).

1.13 REFERENCE STANDARDS

A. Perform the work of this division using the standards of the following organizations, as referred to in technical sections, as a minimum requirement for construction and testing. Unless specified otherwise in Bidding and Contract Documents or Division 01, the latest revision current as of the date of the contract documents shall apply. Products shall be certified by manufacturers to meet the requirements of referenced standards.

1. Federal Specifications (FS)
2. Military Specification (MS)
3. Military Standards (Mil. Std.)
4. Air Conditioning, Heating, and Refrigeration Institute (AHRI)
5. Air Movement and Control Association (AMCA)
6. Associated Air Balance Council (AABC)
7. American Association State Highway and Transportation Officials (AASHTO)
8. American National Standards Institute (ANSI)
9. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
10. ASME International (ASME)
11. American Society for Testing and Materials (ASTM)
12. American Society of Sanitary Engineering (ASSE)
13. American Water Works Association (AWWA)
14. International Code Council (ICC)
15. Manufacturer's Standardization Society of the Valve and Fittings Industry Inc. (MSS)
16. National Electrical Code, NFPA 70 (NEC)
17. National Electrical Manufacturer's Association (NEMA)
18. National Fire Protection Association (NFPA)
19. National Fuel Gas Code, NFPA 54
20. National Sanitary Foundation (NSF)
21. National Standard Plumbing Code (NSPC)
22. The Occupational Safety and Health Act (OSHA)
23. Piping and Drainage Institute (PDI)
24. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)
25. Underwriters Laboratory Inc. (UL)
26. Delaware Occupational Safety and Health Act

1.14 TEMPORARY STORAGE

A. Maintain upon premises, where directed, a storage area, and be responsible for all contents within these areas. Provide all security measures necessary for this area.

B. Maintain the area and return it to its original condition at project completion.

1.15 PROTECTION

A. Control dust resulting from construction work to prevent its spread beyond the immediate work area, and to avoid creation of a nuisance.

1. Do not use water to control dust. Use drop cloths or other suitable barriers.
2. In areas where dirt or dust is produced as a result of the work, sweep daily, or more often as required.
3. Provide walk-off mats at entries and replace them at regular intervals.
4. Construct dust partitions, where indicated on the drawings or as required.
5. Protect areas occupied by Owner's personnel or equipment.
6. Seal off all return air registers and other mechanical systems to prevent dust from entering.

B. Each trade and subcontractor is responsible for preventing damage and soiling of work performed by other trades or subcontractors. Each trade and subcontractor is responsible for providing temporary protection of its own work.

1. Protect work from spills, splatters, drippings, adhesives, bitumens, mortars, paints, plasters, and damage from welding or burning.
2. Protect finished work from damage, defacement, staining, or scratching.
3. Protect finishes from cleaning agents, or grinding and finishing equipment.
4. Protect adjacent and finished work from damage, using tape, masking, covers or coatings and protective enclosures.
5. Coordinate installations and temporarily remove items to avoid damage from finishing work.

C. Repair all damage or soiling to the complete satisfaction of the Architect; replace any materials or work damaged to such an extent that they cannot be restored to their original condition, all at no addition to the Contract Sum.

D. Protect work stored in place and supplies stored in the building.

1. Store materials and products, subject to damage from moisture, in dry locations. If necessary, protect in wraps or covers.
2. Store plastics, other materials, and products subject to damage from heat or cold at manufacturer’s recommended temperatures.

E. Use of sidewalk or roadway areas outside of the property lines shall be with permission and approval of the local authorities having jurisdiction.

1.16 FIRE PROTECTION

A. As a minimum, provide hand-carried, portable, UL-rated extinguishers with each work crew working inside the building.

B. Select extinguishers in accordance with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

1.17 PROJECT CONDITIONS

A. Drawings showing utilities in concealed locations are based on the best information available but are not represented as being precisely correct. Work of the contract includes digging, cutting, drilling, using nondestructive methods, and other methods of locating concealed utilities in the field, as well as patching and repairing as specified in "Cutting and Patching" below.

B. If, in the course of the work, workers encounter a material they suspect to present some hazard:

1. Promptly notify the Owner and Architect in writing.
2. Do not perform any work which would disturb the suspected material until written instructions have been received.

1.18 WARRANTY

A. All work and equipment provided as work of this division shall be fully warranted under the general project warranty. In addition, provide added special warranties specified in individual sections.

B. During the correction period, the Contractor shall begin correcting any work found to be not in accordance with the requirements of the Contract Documents within 4-hours of receiving written notice from the Owner. Provide detailed schedule for completion of work within 24-hours of receiving written notice from the Owner and revise schedule based on any Owner comments generated. Except as otherwise required in General Conditions and Division 01, the correction period is one year after the date of substantial completion of the work. Work requiring correction shall promptly be repaired or completely replaced at no addition to the Contract Sum.

1. Service reports for warranty work shall be provided to the Owner.

C. When use of the permanent equipment has been permitted for temporary heating or ventilation of the building, the warranty and correction periods shall nevertheless begin at the time of substantial completion, unless another date of acceptance has been agreed to by the Owner.

D. Special warranties are warranties required by individual specification sections, incidental product warranties, manufacturers' standard warranties, installer or subcontractor service agreements, and other individual warranties in addition to the general project warranty.

E. Provide copies of warranties as required for Operation and Maintenance Manual specified above, and by Division 01.

F. For items of work delayed beyond date of substantial completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

1.19 COMMISSIONING

A. This project includes commissioning under the direction of a Commissioning Agent (CxA). Contractor's and subcontractors' responsibilities are described in Divisions 01 and 23.

B. Cooperate with the CxA to accomplish the requirements of the Commissioning Plan during the construction and correction periods.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

B. Cut walls, floors, partitions, roofs, and other appurtenances for the passage or accommodation of pipes, ducts and appurtenances. Close superfluous openings and remove all debris caused by work of this division.

C. No cutting of any structure or finish shall be done until the condition requiring such cutting has been examined and approved by the Architect.

D. New or existing surfaces disturbed as a result of such cutting or otherwise damaged shall be restored to match original work and all materials used for any patching or mending shall conform to the class of materials originally installed.

E. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

3.2 TEMPORARY FACILITIES

A. Temporary water facilities, electricity, telephone, toilet facilities, and temporary heat, shall be provided as specified in Division 01.

3.3 PROGRESS MEETINGS

A. Progress meetings shall be held as specified in Division 01, and also when and if the Contractor or Architect finds them necessary or advantageous to progress of work.

B. Contractor, those subcontractors and those material suppliers concerned with current progress or with the scheduling of future progress, Architect and Owner shall each be represented at these meetings by persons familiar with the details of work and authorized to conclude matters relating to work progress.

3.4 COMMISSIONING

A. Comply with requirements of "Commissioning" in Part 1 above.

END OF SECTION 22 01 01

SECTION 22 05 00 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements applicable to more than one section of Division 22.

B. Equipment installation requirements.

C. Basic material and equipment required for the plumbing piping work.

D. Underfloor piping installation.

E. Identification of plumbing systems and equipment.

F. Cleaning and painting.

G. Backboards for piping specialties.

H. Treated wood lumber.

I. Operating instructions.

J. Piping tests.

1.2 RELATED SECTIONS

A. Project and special warranties: Division 01 and Section 22 01 01.

B. Operation and Maintenance Manuals: Division 01 and Section 22 01 01.

C. Painting: Division 09.

D. Commissioning requirements: Division 01 and Division 23.

1.3 REFERENCES

A. American Society of Mechanical Engineers

1. ASME A 13.1: Scheme for the Identification of Piping Systems
2. ASME B 31.9: Building Services Piping

B. American Society of Testing and Materials

1. ASTM B 32: Standard Specification for Solder Metal

2. ASTM B 88: Standard Specification for Seamless Copper Water Tube
3. ASTM B 813: Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
4. ASTM D 635: Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
5. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials
6. ASTM E 548: Standard Guide for General Criteria Used for Evaluating Laboratory Competence
7. ASTM D 2564: Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems
8. ASTM F 656: Standard Specification for Primers for use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings

C. American Welding Society

1. AWS D1.1: Structural Welding - Steel
2. AWS D10.9: Specification for Qualification of Welding Procedures and Welders for Piping and Tubing

D. NSF

1. NSF/ANSI 61: Drinking Water System Components - Health Affects

1.4 DEFINITIONS

A. Project correction period: A period after Substantial Completion of the work during which the Contractor shall correct every part of the work found to be not in accordance with the requirements of the contract documents, promptly after receipt of written notice.

B. Qualified testing agency: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

C. DN: Dimension Nominale, nominal pipe size in millimeters, in accordance with the metric system for construction, Systeme Internationale (SI).

D. NPS: Nominal pipe size in inches, in accordance with standard U.S. designations for manufactured pipe. Pipe sizes do not change when projects are designed and built in metric units; each size has a consistent name (nominal dimension) in each system.

1.5 DESIGN REQUIREMENTS

A. The drawings and system performances have been designed based on use of the particular manufacturer's products specified and scheduled on the drawings.

B. Products of other manufacturers that are listed under the article "Acceptable Manufacturers," or permitted as "equal," are permitted provided:

1. Product shall meet the specifications.
2. Contractor shall make, without addition to the contract sum, all adjustments for deviations so that the final installation is complete and functions as the design basis product is intended.

C. Do not propose products with dimensions or other characteristics different from the design basis product that render their use impractical, or cause functional fit, access, or connection problems.

1.6 SUBMITTALS

A. Shop drawings:

1. Schedule of welding and brazing procedures proposed for each piping system in the project.
2. Shop drawings of backboards for piping specialties.

B. Certifications: Proof of operator and testing agency personnel qualifications as required for welding and brazing in the article "Quality Assurance" below.

C. Test reports: Field test results for each piping system as specified in Part 3 below.

1.7 QUALITY ASSURANCE

A. Provide materials and perform work in accordance with the plumbing, mechanical, electrical, building, fire, health and safety, and other applicable codes and regulations of the state, county or city in which the work is performed.

B. Product NSF/ANSI 61 certified products where in contact with the domestic water supply.

C. Welding procedures and operator qualifications for structural welding: AWS D1.1, Structural Welding Code Steel, electric arc process.

D. Brazing, and soldering procedures and operator qualifications for building systems piping:

1. ASME B31.9, Building Services Piping.
2. Copper Development Association "Copper Tube Handbook."
3. Safe Drinking Water Act.

E. UL label:

1. Electrical control panels, equipment, materials and devices provided or installed as work of Division 23 shall be UL listed and shall bear a UL label.
2. Equipment, including custom assemblies, shall be listed and labeled as an assembly.
3. If a UL label is not available, the item shall be tested and labeled by a qualified nationally recognized testing agency, acceptable to authorities having jurisdiction, and in accordance with NFPA 70 (NEC).
4. Provide testing, if required, without addition to the contract sum.

F. VOC content: Field-applied adhesives and sealants, limits per South Coast Air Quality Management District (SCAQMD), Rule No. 1168.

G. Products shall contain no urea-formaldehyde content.

1.8 COMMISSIONING

A. This project includes commissioning under the direction of a Commissioning Agent. Contractors' and subcontractors' responsibilities are described in Divisions 01 and Division 23.

PART 2 - PRODUCTS

2.1 GENERAL

A. General piping techniques, testing, identification, painting, and operating instructions specified in this section apply to products specified in other sections of Division 22.

B. Equipment that uses or processes date and time data to perform its function shall be warranted by the manufacturer to properly function and correctly use or process all time-related data for all dates and times which occur during a reasonable life expectancy of the equipment.

2.2 PIPING MATERIALS

A. Soldering materials:

1. Solder: Free of lead, antimony, and zinc and meeting the requirements of ASTM B 32. No solder containing lead is permitted.

a. Tin 95.5 percent, copper 4 percent, and silver 0.5 percent.

(1) Equal to "Silvabrite 100" manufactured by Engelhard Corporation.

b. Tin, copper, bismuth, and silver.

(1) Equal to "Oatey Silver" manufactured by Oatey.

2. Flux:

    a. Meeting the requirements of ASTM B 813 and NSF 61 certified.
    b. Equal to Oatey H-2095.

B. Threaded pipe joint materials:

1. Pipe jointing compound:

    a. Pipe joint compound recommended by the manufacturer for use at the temperature and pressure of the system.
    b. For sanitary piping overhead of food storage, preparation, and serving and dining areas: Litharge and glycerin.

2. Pipe joint tape: Polytetrafluoroethylene (PTFE) pipe thread tape, “Teflon.”

C. Plastic PVC pipe joint materials:

1. Primer: ASTM F 656 and containing methyl ethyl ketone or acetone.
2. Solvent cement : ASTM D 2564.

2.3 MATERIALS FOR UNDERFLOOR INSTALLATION

A. Pipe: Copper tubing, ASTM B 88, Type L annealed temper (soft drawn), no joints under floor.

B. Conduit: Schedule 40 PVC pipe with long-radius elbows, size to accommodate copper tubing and insulation.

C. Insulation: Flexible elastomeric, as specified in Section 22 07 19, Plumbing Piping Insulation.

D. Firestopping caulk:

1. Intumescent caulk, which, under heat, expands to five times its original volume, creating a char which can withstand flames and smoke for at least three hours.
2. Equal to 3M CP 25WB.

2.4 IDENTIFICATION DEVICES AND MATERIALS

A. Stenciling materials:

1. Stencils: Manufactured standard stencils prepared for required applications, conforming to ASME A 13.1 for color and size of legend letters, including arrows showing direction of flow.
2. Paint: Exterior type enamel, colors conforming to ASME A 13.1, or black.

B. Equipment identification tags:

1. Laminated plastic with adhesive back, white core and black outer layers, which, when engraved, will produce white letters and numerals on a black background.
2. Tags installed on curved surfaces shall be aluminum or brass.

C. Valve tags: Brass, 1.5 inch (40 mm) in diameter with black-filled numbers not less than 0.25 inch (6 mm) high, complete with brass attachment chains.

D. Ceiling identification tags: Laminated plastic with adhesive back, engraved black letters on white background, minimum 0.5 inch (15 mm) wide and length as required for 0.375 inch (10 mm) high letters for name of concealed device and number.

2.5 RUST INHIBITIVE PAINT

A. Rust-inhibitive paint:

1. Alkyd based, white, black, or bronze tone.
2. Applied in a wet film thickness of at least 2.9 mils (0.07 mm).
3. Equal to Benjamin Moore Super Spec HP D.T.M. Alkyd Low Lustre P23.

2.6 MATERIALS FOR BACKBOARDS FOR PIPING SPECIALTIES

A. Backboards: Marine plywood: BS-1080, Veneer Grade A/B, moisture-resistant, spruce-pine-fir multiple ply, 5-ply minimum, pressure-treated construction, 0.563-inch (14-mm) thick minimum.

B. Supports: Fiber reinforced plastic (FRP) composite structural shapes: ASTM D 635 and E 84, Pultruded FRP structural shapes, non-corrosive, flame retardant, thermosetting polyester resin, composite factory-fabricated shapes for assorted assemblies and field erection.

1. Ultimate tensile strength: 30,000 psi (207 MPa).
2. Modulus of elasticity: 2.8 x 106 psi (19,300 MPa).
3. Specific gravity: 1.6 to 1.75.
4. Density: 0.062 to 0.070 pounds/cubic inch (1.72 to 1.94 grams/cubic centimeter).
5. Flame spread: ASTM E 84 Class A, 25 maximum.
6. Color: Yellow.
7. Shapes and sizes as required to support the load, and in accordance with minimum sizes indicated on the drawings
8. Acceptable manufacturers:

a. Bedford Reinforce Plastics Company
b. Composites USA, Inc.
c. Liberty Pultrusions, Inc.
d. Strongwell Corporation
e. Structural Fiberglass, Inc.
f. Or approved equal.

C. Fasteners: Corrosion-resistant and suitable for secure anchorage into wall behind backboards.

2.7 TREATED WOOD LUMBER

A. Wood-preservative-treated lumber: Treated by pressure process, AWPA C2, with chemicals acceptable to authorities having jurisdiction, and marked with treatment quality mark of an inspection agency approved by ALSC Board of Review.

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS AND EQUIPMENT

A. Manufacturers' instructions: Except as modified by drawings or specifications, install products and equipment in accordance with manufacturers' instructions and recommendations applicable to the project conditions.

1. Immediately notify Architect if a difference or discrepancy is found between manufacturers' instructions and the drawings or specifications.

B. The contract drawings are diagrammatic and do not indicate all fittings or offsets in pipe, all access panels, or all specialties required. Provide required fittings, offsets, access panels, and specialties to coordinate the work.

C. No pipe shall be run below the head of a window or door.

D. Equipment and pipes installed in areas without a suspended ceiling shall be as tight to structure as possible, but at least above a height of 6'-8", unless otherwise noted.

E. Items which require access for operation or maintenance shall be easily accessible. Do not cut or form hand holes for operation or maintenance of appliances through walls or ceilings.

F. Provide installations compliant with NFPA 70.

3.2 EQUIPMENT INSTALLATION

A. Prepare for installation:

1. Coordinate work to assure that any required recesses for equipment are correct.
2. Examine areas and conditions where equipment will be installed for rough in locations, compliance with installation requirements and tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.
3. Visually check equipment. Replace any damaged components prior to installation.
4. Remove temporary devices used for equipment transport.
5. Assemble equipment that is not assembled in the factory.

B. Install equipment:

1. Set equipment plumb and level.
2. Install such that labels and safety instructions are clearly visible.
3. Drawings show the general arrangement of piping, ductwork, conduit and other elements. Coordinate elements to allow access doors to open fully, allow access to removable access panels or casing panels, maintain clearances in front of control panels and electrical components required by the NFPA 70, and maintain the manufacturer's recommended service clearances.
4. Install components inside of equipment enclosures such that they are serviceable when access panels are removed.
5. Extend grease fittings to accessible locations.
6. Install piping hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment. Support equipment independently from piping.
7. Support:

    a. Floor-mounted equipment:

        (1) Securely fasten in place with connections to wall and floor.
        (2) Provide supplemental structure as required.
        (3) Provide a concrete equipment foundation where indicated. Comply with requirements of Section 22 05 29.

    b. Suspended equipment: Securely hang from structure above. Comply with requirements of Section 22 05 29. Provide 0.5 inch (12.5 mm) minimum diameter threaded rods.
    c. Wall-mounted equipment: Securely fasten to wall with metal fasteners, anchors, brackets, sleeves or other devices recommended by the equipment manufacturer. Provide blocking where required.
    d. Curb-mounted and rail-mounted equipment: Securely fasten to curb and provide flashing to make the installation weather tight. Comply with requirements of Section 22 05 06.
    e. Structural frame-mounted equipment: Securely fasten to structural frame.
    f. Equipment mounted at grade: Securely fasten to structural foundation. See drawings for details of construction of structural foundation.
    g. Coordinate supports so they do not interfere with access to other equipment that requires service.
    h. Provide vibration isolation where required.

8. Snugly fit equipment to architectural finishes in finished spaces unless otherwise indicated.
9. Connect associated piping, power, controls, and other associated systems.
10. Conceal associated piping and electrical connections in finished spaces unless otherwise indicated.
11. In rooms without ceilings or other finishes to conceal piping, and electrical connections, arrange these elements to provide a neat and finished appearance.
12. Install dielectric pipe fittings at connections where dissimilar metals are joined.

13. Coordinate with installation of building automation system controls.
14. Install equipment with a safety listing or certification as required to comply with their listing or certification requirements.

C. Install and wire items furnished with equipment:

1. Install control devices, accessories, and appurtenances furnished loose with equipment.
2. Wire devices furnished with equipment that are not factory-wired.

    a. Comply with requirements in Division 26.
    b. Comply with requirements in NFPA 70.
    c. Comply with the manufacturer's installation requirements.

D. Prepare equipment for use:

1. Clean equipment and repair any damaged finishes. Remove paint splatters, dirt, and debris. Repair damaged finish to match original finish.
2. Adjust tension on belts.
3. Lubricate equipment.
4. Adjust equipment packaged controls to put the system into operation as intended.
5. Start up and operate equipment in accordance with manufacturer's instructions.
6. Verify smooth rotation and proper direction of rotation of motors.
7. Test controls, unit operation, and safety devices. Replace any failed components and retest.
8. Provide equipment identification.

3.3 PIPE INSTALLATION

A. Install pipe exposed to view parallel to building lines and as close to walls, columns, and ceilings as may be practical, maintaining proper clearances for access at all parts requiring servicing.

B. Install pipe a sufficient distance from other work to permit a clearance of not less than 0.5 inch (15 mm) between its finished covering and adjacent work.

C. Remove burrs resulting from cutting pipe or from any other operation.

D. Provide for expansion and contraction of piping and connections so that no breakage or excessive strain will occur. Provide anchors and guides of approved design where shown on drawings and where necessary to allow for proper expansion and contraction. At the time of installation, expansion loops shall be cold sprung to one-half of the calculated expansion.

E. Pipe connection flexibility:

1. Connect domestic hot water risers and branch connections to mains with at least five pipe fittings, including tee in main.
2. Connect domestic hot water risers and branch connections to equipment and fixtures with at least four pipe fittings, including tee in riser.

3. Connect mains and branch connections to equipment and fixtures with at least four pipe fittings, including tee in main.
4. Connections shall be arranged so that movement in piping due to expansion and contraction will not transmit excessive force to equipment or fixtures.

F. Install unions or flanges in the piping at each item of equipment, solenoid valve, central thermostatic mixing valve, and appliance, to provide easy removal of the equipment, valve, or appliance.

G. Pitch water piping so that air in the system can be properly vented. Provide shutoff valves where necessary to isolate parts of system for repairs without draining the entire system.

H. Interface with other products:

1. Where pipe is provided through walls, provide finished, permanent, waterproof installation complete with inserts, sleeves, supports or hangers, seals, and other appurtenances as required. Do not pierce, cut, or notch any footing or other structural member.
2. Waterproofing and dampproofing of the building shall be unharmed by the installation of the work. Where pipe has to pierce waterproofing or dampproofing, including outside walls, the penetration shall be made watertight. Waterproofing damaged or destroyed shall be repaired or replaced with new waterproofing.

I. Thoroughly clean pipe and fittings before they are installed, and keep them clean until the acceptance of the completed work. Cap or plug the ends of the lines to prevent earth and other debris from entering during construction.

J. Threaded connections:

1. Cut threads full and clean.
2. Apply specified pipe joint compound or tape on male threads only.
3. Where piping is installed in crawl spaces and tunnels, cover exposed threads with rust-inhibitive paint. Apply after joints have been assembled and tested.

K. Copper tubing installation:

1. Cut pipe with a tubing cutter or fine-tooth saw. Cuts made with a saw shall be true and square, and the end shall be filed smooth with a fine-tooth file. Remove all marks and burrs with sandpaper.
2. Solder joints for copper tubing: Clean ends of tubing and inside of fitting ends thoroughly with emery cloth before applying flux.
3. Provide dielectric fittings between copper and steel piping to prevent electrolysis.
4. Follow the techniques for soldering and brazing pipe, fittings, and valves as recommended by the manufacturer.

L. Plastic piping installation:

1. Cut pipe true and square with a fine-tooth saw and file the end smooth with a fine-tooth file. Remove all saw marks and burrs with sandpaper.

2. Clean connecting surfaces of both pipe and fitting with primer.
3. Apply solvent cement liberally with clean brush, first to fitting and then to pipe (outer surface and end). Lap the solvent cement a minimum of 0.25 inch (6 mm) over depth of fitting.
4. Join pipe and fitting to full depth of fitting, giving fitting at least one-quarter turn on pipe to distribute cement.
5. Pipe and fitting shall show a small fillet or bead completely around pipe without any voids, or fitting shall be cut out and new fitting made up and installed. Allow a minimum of 48 hours drying time for each joint.

3.4 INSTALLING PIPING UNDER FLOOR SLAB

A. Install conduit.

B. Insulate copper tubing and insert in conduit.

C. Where piping rises through floor, cut conduit and insulation flush with floor.

D. Fill annular spaces with firestopping caulk. Use fiberglass insulation as backing.

3.5 IDENTIFICATION

A. General: Do not apply identification until insulation and finish painting work is complete.

B. Equipment:

1. Stencil equipment with minimum two-inch (50-mm) -high letters or provide identification tags. Clearly identify function, equipment served, and area served.
2. Firmly fasten each identification tag to its appropriate piece of equipment with drive screws, sheet metal screws, or rivets. Do not interfere with operation of, or damage the item being marked.

C. Piping:

1. Mark by stenciling.
2. Mark to identify service with arrows showing direction of flow. Apply markings near building walls where pipes enter or leave an accessible space and in intermediate locations so that markings are no more than 30 feet (9 m) apart. They shall be readily visible to a person standing on the floor.
3. Fully identify all piping installed as work of the project.
4. Mark pipe with letters of height and with colors as required by OSHA and conforming to ASME A 13.1.
5. Identify every thermometer, gauge, and control device.
6. Provide valve tags for all valves except shutoff valves on individual fixtures or equipment where their function is obvious, or where the fixture or equipment is immediately adjacent. Numbers shall correspond to those shown on the Valve Chart. Attach tags to valve shaft.

D. Ceiling identification tags: Provide on the access door or, in suspended ceilings, on the ceiling support adjacent to the unit.

1. Valves: Identify with the same number shown on the valve tag.

3.6 CLEANING AND PAINTING

A. Cleaning: Clean all piping and equipment. Where items are to be painted, clean ready for painting.

B. Painting: Coordinate painting with requirements of Division 09. Paint the items identified below to be painted. Use paint materials and systems specified in Division 09.

C. Items to be painted:

1. Items identified below to have protective coating.
2. Items furnished with manufacturer's prime coat.
3. Mechanical rooms (including but not limited to boiler, chiller, and air-handling unit rooms):

a. Insulation and uninsulated steel: Piping, pumps, tanks, and vessels.
b. Hangers and supports.

4. Piping exposed in finished spaces, insulated and uninsulated.

D. Items not to be painted: Copper, stainless steel, and equipment furnished with manufacturer's finish.

E. Protective coating: Piping and fittings installed in the following shall be painted with one priming coat and one finishing coat of rust-inhibitive paint:

1. Crawl spaces

F. Paint systems in mechanical rooms:

1. Galvanized steel: One coat of primer recommended for galvanized surfaces and one coat of glossy alkyd enamel.
2. Ferrous metal: One coat of primer recommended for ferrous metal and one coat of glossy alkyd enamel.
3. Items protected with rust-inhibitive primer: Finish coat of compatible glossy enamel.

G. Paint systems for exposed piping: Primer compatible with the substrate, whether steel, galvanized steel, insulation jacket, or other material; one coat or two, if required to cover, to match adjacent surfaces in color and texture.

3.7 BACKBOARDS FOR PIPING SPECIALTIES

A. Provide wall-mounted backboards, sizes and locations as indicated on the drawings, for mounting piping specialties. Assembly shall consist of plywood board, FRP supports, and fasteners.

3.8 TREATED WOOD LUMBER

A. Provide wood-preservative-treated lumber where wood members are required as detailed on the drawings and in the following applications:

1. Cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, or waterproofing.
2. Sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
3. Framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.

3.9 OPERATING INSTRUCTIONS (DEMONSTRATION)

A. Furnish the necessary technicians, skilled workers, and helpers to operate all the plumbing systems and equipment of the entire project for one 8-hour day.

B. Where specified in technical sections, provide longer periods required for specialized equipment.

C. Instruct the Owner or designated personnel in operation, maintenance, lubrication, and adjustment of all systems and equipment.

1. Instructions by manufacturer’s technical representative for each type of equipment shall include the performance of the recommended preventive maintenance procedures for that equipment.

D. The Operating and Maintenance Manual shall be available at the time of the instructions, for use by instructors and Owner personnel.

E. Schedule the general and specialized instruction periods for a time agreed upon by the Owner and Architect.

3.10 PIPING TESTS

A. Hydrostatic testing:

1. Notify Owner in writing at least 24 hours prior to the test.
2. Test before pipes are concealed or insulated.
3. Piping may be tested in sections as the work progresses.

4. Provide fluid, pumps, valves, and gages required for testing.
5. Where water is used as the test fluid, provide ambient temperature water and provide means to avoid freezing. Drain and dispose of test fluid when testing is concluded.
6. Isolate equipment and expansion tanks during test.
7. Isolate or remove any components with a pressure rating below the required test pressure.
8. Brace and support piping during the test, so that no movement, displacement, or damage results from the application of the test pressure.
9. Provide a pressure relief valve, set at a pressure no more than one-third higher than test pressure, to protect against damage caused by expanding liquid or other source of overpressure during test.
10. Replace piping or fittings found defective with new material.
11. Sanitary and storm drainage piping tests:

    a. Before connection of the plumbing fixtures, and before connection to the sewer, cap or plug all new sanitary and storm drainage piping systems of the building.
    b. Test following the methods of testing required by the plumbing code, and no less than the duration and pressures required in the Schedule of Piping Systems Tests.
    c. Where pipes are in trenches, leave the trenches open until the completion of the test.

12. Air conditioning condensate piping tests:

    a. Before connection of condensate producing HVAC equipment, cap or plug all new air conditioning condensate drain piping systems of the building.
    b. Test following the methods of testing required by the plumbing code, and no less than the duration and pressures required in the Schedule of Piping Systems Tests.
    c. Where pipes are in trenches, leave the trenches open until the completion of the test.

13. Documentation of tests: Prepare a test report for each portion of piping tested, identified by service, material, location, and pipe size. Include these items:

    a. Date of test.
    b. Starting and completion times.
    c. Initial test pressure.
    d. Final test pressure.
    e. Problems or leaks detected.
    f. Corrective actions taken.
    g. Record of successful completion of testing.
    h. Name, title, and signature of person conducting test.

14. Piping Systems Test Schedule:

System	Test Pressure psig (kPa)	Duration	Allowable Drop	Medium
Domestic water service & exterior water piping	150 (1030)	4 Hours	None	Water
Domestic water piping (cold, hot, tempered, & recirculated)	125 (860)	4 Hours	None	Water
Pumped sanitary or storm drainage	125 (860)	4 Hours	None	Water
Air conditioning condensate drain piping	4.3 (30)**	4 Hours	None	Water
Sanitary waste piping	4.3 (30)**	4 Hours	None	Water
Storm drainage piping	4.3 (30)**	4 Hours	None	Water

* If pressure drops, locate leaks with soap and water solution
** Where piping is above food service area, test pressure shall be 11 psig (76 kPa).

END OF SECTION 22 05 00

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 22 05 01 - EXCAVATION AND FILL FOR PLUMBING WORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Trenching, backfilling, and compacting for plumbing work underground inside the building and extending five feet beyond exterior building walls, and outside the building as shown on drawings.

B. Restoring and reseeding grassed areas.

1.2 RELATED SECTIONS

A. Cutting and patching: Division 01 and Section 22 01 01.

B. Repairing pavements: Division 32.

C. Piping:

1. Domestic water piping: Section 22 11 16.
2. Sanitary waste and vent piping: Section 22 13 16.
3. Storm drainage piping: Section 22 14 13.

1.3 REFERENCES

A. ASTM D 1557: Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbs/cu ft (2700 kN-m/cu m).

1.4 SUBMITTALS

A. Shop drawings: At the same scale as the contract drawings, showing field verified locations of utilities, and proposed detailed trenching plan.

B. Product data:

1. Warning tape

C. Certifications: Test reports showing that compaction meets specified requirements.

D. LEED submittal:

1. MR Credit 3 BPDO – Sourcing of raw materials.

a. For recycled content site steel, fill or aggregate: Documentation indicating percentages by weight of pre-consumer and post-consumer recycled content. Include material cost value.
b. For regionally sourced site fill or aggregate: Documentation indicating locations or recovery, manufacture, purchase of recycled raw materials.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Backfill: Earth materials, free from perceptible amounts of wood, debris, or topsoil, free of frost at the time of placement, and not containing marl or other elements which tend to stay in a plastic state.

B. Underground warning tape: Polyethylene 0.004 inch (0.102 mm) thick for metallic lines, and for non-metallic lines polyethylene both sides with metallic lining, six inches (152 mm) wide.

1. Colors: In accordance with APWA and AASHTO standards.
2. Markings: Repeated continuously along the entire length, legend appropriate for line being identified.

2.2 EQUIPMENT

A. Mechanical tampers for compacting backfill: Capable of exerting a blow equal to 250 pounds per square foot (12 kPa) of area of the tamping face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Contact local utility company underground information service (BGE Miss Utility) before beginning excavation outside buildings.

B. The general locations of underground utilities are indicated on the drawings and are not to be assumed to be accurate or complete. Before beginning work, field check the area with the most accurate instruments available, such as Fisher Labs' Pipe and Cable Locators.

3.2 INSTALLATION

A. Perform all excavating, cutting of paved areas, trenching, sheeting, shoring, backfilling, and compacting required for the proper installation of the work. Repair of pavement is specified in Division 32.

B. Where obstructions are encountered, obtain written approval and make necessary changes in line, grade or location.

C. Protect existing utilities from damage during excavation and backfilling. Repair damaged new or existing work at no addition to the contract sum. Bracing, shoring and other protection of existing utilities is part of this work.

D. Do not damage or remove existing shrubs or trees including their root systems, without prior notification to the Architect.

E. Provide temporary roadways over trenches with railings and other safeguards, including amber blinker lamps or other warnings for night use.

F. Note the depths of footings. In cases where piping is in close proximity to or below footings and where the natural earth under footings is disturbed, after the line is installed the voids shall be filled up to bottoms of such footings with solid concrete.

3.3 CUTTING

A. Cut concrete and asphalt concrete with masonry saw prior to breaking it into smaller pieces for removal.

B. Cut sidewalks perpendicular to the length at the closest existing joint that is a minimum of 24 inches back from either side of the top of the new trench.

3.4 TRENCHING

A. Excavations inside the building shall be carefully planned. Stockpile excavated earth so as not to interfere with other construction. Dig trenches to the proper depths, providing extra depressions where required for hubs of pipes.

B. Excavations outside the building shall generally follow the routes indicated on the drawings. Stockpile topsoil separately for later replacement. Excavations shall be of sufficient depths to provide, unless indicated otherwise on the drawings, a minimum cover as follows:

1. Water piping: 48 inches (1219 mm).
2. Sewer lines: Elevations shown on drawings.

C. Trenches shall be of necessary depth and width for the proper laying of pipe with a minimum of 8 inches (205 mm) on each side of the joint.

1. The sides shall be as nearly vertical as practicable. Unless local regulations are more strict, trenches 4 ft. (1220 mm) and deeper shall have shored sides as required by OSHA trenching regulations.

2. The bottoms of trenches shall be accurately graded to provide uniform bearing and support for each section of pipe on undisturbed soil at every point along its entire length, except for bell holes and for the proper sealing of the pipe joints.
3. No greater length of trench shall be left open, in advance of the completed structure placed in it, than can be completed in that day's operation.
4. Except where rock is encountered, do not excavate below the depths required. Where rock excavation is required, excavate to a depth of at least 6 inches (150 mm) below the trench depth and fill the overdepth with compacted crusher run or bank run stone or sand. Unauthorized overdepths in excavation shall be backfilled with crushed stone, slag or gravel, thoroughly compacted.
5. Whenever wet or otherwise unstable soil is encountered, it shall be removed to the depth and extent directed, and the trench backfilled to the proper grade with crushed stone, slag or gravel.

D. Should springs be encountered within the work area, or soft soil conditions at the elevations required for load bearing, immediately notify the Architect and do not place any portion of the work on such surfaces until instructions are received.

E. Furnish and maintain pumps, flumes, gutters, and appurtenances if required to keep the excavations free from water. Water shall be directed to a point remote from building operations, shown on the approved shop drawing.

F. Excavation for manholes and similar structures shall be sufficient to leave a minimum of 12 inches (305 mm) and a maximum of 24 inches (610 mm) clearance on all sides. Fill over-depth excavation with concrete.

3.5 BACKFILL

A. Place no backfill until the adjacent construction or the utility to be covered has been inspected, tested, and approved.

B. Installing underground warning tape: Install in backfill above exterior buried lines not encased in concrete. Select legend and color appropriate for type of line. Install metallic lined tape for non-metallic lines. Install approximately 12 inches (305 mm) below grade.

C. Plumbing systems backfill:

1. Backfill and compact in six-inch (150-mm) layers up to spring line of the pipe. The installations shall then be inspected and tested.
2. Following inspection, backfill in six-inch (150-mm) layers, each compacted, until the pipe has a cover of not less than one foot (305 mm). Place the remainder of the backfill material in the trench in eight-inch (200-mm) compacted layers.
3. Excavations improperly backfilled shall be reopened, then refilled and compacted to the required grade and compaction, and smoothed off.
4. Open trenches across roadways or other areas to be paved shall be backfilled as specified above, except that the entire depth of trench shall be backfilled in six-inch (150-mm) layers, and each layer shall be mechanically compacted.

5. Completed work shall have uniform graded surface, in accordance with the surface and grade indicated on the drawings.

D. Structure backfill:

1. Do not backfill against structures with cement mortar joints until the mortar is at least twelve hours old.

3.6 COMPACTION

A. Test in accordance with the requirements of ASTM D 1557.

B. Compact under slabs, roads, and sidewalks to a 95 percent density.

C. Compact unpaved areas to a 90 percent density.

D. Backfill and compact trench in unpaved areas to within 4 inches (102 mm) of existing grade. Furnish and install compacted select topsoil for the final layer to finish even with existing grade. Remove surplus earth and rake unpaved areas for final planting.

E. Take particular care in compaction of earth under joints of plumbing piping.

3.7 RESURFACING

A. Resurface sidewalks, roads, streets, and other paved areas as work of this section, matching the construction and finish of adjacent paving. Paving shall meet the requirements of Division 32.

END OF SECTION 22 05 01

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 22 05 02 - SLEEVES AND PLATES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Sleeves.

B. Sealing materials.

C. Escutcheon plates.

D. Mechanical penetration seals.

1.2 SUBMITTALS

A. Product data: Sleeves, sealing materials, escutcheon plates, and mechanical penetration seals.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Sleeves without water stops:

1. Steel sleeves: Schedule 40 black steel pipe, ASTM A 53.
2. Copper sleeves: Type L, ASTM B 88 hard drawn.
3. Plastic sleeves: Schedule 40 PVC, ASTM D 1785.

B. Sleeves with water stops:

1. Cast-iron sleeves with water stops: Extra heavy, equal to product of U.S. Pipe Co. with water stop and ends as shown on the drawings.

2.2 SEALING MATERIALS

A. Waterproof sealant:

1. Bare and insulated pipes carrying fluids 150 degrees F (65 degrees C) and below:

a. High-performance, moisture cured, 1-component, polyurethane-based, non-sag, elastomeric sealant. Use a primer for applications required by the manufacturer.
b. Basis of design: Sika Corporation “Sikaflex - la.”

2. Bare and insulated piping carrying fluids 151 degrees F (66 degrees C) and above:

    a. One-part RTV silicone, neutral-cured, architectural grade sealant. Use a primer for applications required by the manufacturer.
    b. Basis of design: Dow Corning Corporation “790 Silicone.”

B. Grout: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout, 5000 psi (34.5 MPa), 28-day compressive strength.

2.3 ESCUTCHEON PLATES

A. Floor, wall, and ceiling escutcheon plates for existing piping: Stamped or cast brass with chrome finish and set screw, split and tabbed.

B. Floor, wall, and ceiling escutcheon plates for new piping: Stamped or cast brass with chrome finish and set screw.

2.4 MECHANICAL PENETRATION SEALS

A. Mechanical penetration seals:

1. Seals shall be modular mechanical type, consisting of interlocking synthetic links shaped to continuously fill the annular space between the pipe and wall opening. Bolt and nut fasteners for the seals shall be stainless steel for units used in penetrations below grade.
2. Basis of design: PSI “Link-Seal Modular Seals” or Calpico Sealing Link “LINX”.

PART 3 - EXECUTION

3.1 INSTALLING SLEEVES

A. Provide sleeves for bare piping, or piping with insulation continuous through sleeve, passing through walls, partitions, beams, or slabs. Sleeves for insulated piping shall be large enough to pass piping and insulation.

B. Sleeve materials:

1. Penetrations in non-fire-rated interior construction:

    a. Provide steel sleeves for penetrations of steel, cast iron, and insulated piping.
    b. Provide copper sleeves for penetrations of uninsulated copper tubing and piping.
    c. Provide plastic or steel sleeves for penetrations of plastic piping.
    d. Plastic piping and sleeves are not permitted in ceiling spaces used as HVAC system plenums, or in shafts used for building HVAC air distribution.
    e. Plastic sleeves are not permitted for penetrations of masonry construction.
    f. A core drill may be provided in cast concrete walls in lieu of a sleeve.

2. Penetrations in fire-rated construction:

    a. Provide sleeves that are acceptable components of the through-penetration firestop assemblies specified in Division 07.
    b. Where acceptable for floor penetration listing, provide sleeve projections above floor slabs in compliance with requirements of this section.
    c. Where pre-manufactured cast in place or drop in fire rated sleeves are used in floors, provide the manufacturer's water dam accessories to achieve compliance.

3. Penetrations in exterior walls and foundations, masonry or concrete:

    a. Provide cast iron sleeves with water stops in new cast concrete walls.
    b. A core drill may be provided in cast concrete walls in lieu of a sleeve.
    c. Provide steel sleeves in masonry walls.

4. Penetrations of steel beams:

    a. Where steel pipe penetrates a steel beam that is not part of a fire- or smoke-rated assembly, no sleeve is required.
    b. Do not cut, drill, or burn structural steel for installation of piping without specific instructions from the Architect.

C. Sleeve projection:

1. Sleeves through typical walls and partitions: Flush with finished surfaces.
2. Sleeves through floors:

    a. Typical floors: Extend 0.375 inch (10 mm) above finished floor.
    b. Kitchens and food service areas: Extend 0.375 inches (10 mm) above finished floor.
    c. Mechanical or equipment room floors: Extend one inch (25 mm) above finished floor.
    d. Finish neat and level.
    e. Provide anchor clips to prevent sleeves from being loosened and knocked down.

3.2 INSTALLING SEALING MATERIALS

A. Penetrations in non-fire-rated interior construction:

1. Seal exterior of sleeve to wall or floor being penetrated:

    a. Provide grout where sleeves penetrate concrete or masonry.
    b. Provide waterproof sealant or wall construction materials where sleeves penetrate gypsum board walls.

2. Sealant between sleeve interior and pipe or pipe insulation:

    a. Typical applications: Seal spaces between sleeves and pipe, or between sleeves and pipe insulation, with mineral wool.

b. Kitchens and food service areas: Seal space between sleeves and pipe, or between sleeves and pipe insulation, with waterproof sealant and finish even with sleeve.

B. Penetrations in fire-rated construction: Seal as required by the through-penetration firestop assembly specified in Division 07.

3.3 INSTALLING ESCUTCHEON PLATES

A. Exposed piping passing through interior walls, partitions, floors, and ceilings shall be fitted with plates of size and depth to conceal sleeves. Secure plates firmly in place with set screws.

B. Do not install floor or wall plates on pipes in the kitchen and food service areas.

3.4 INSTALLING MECHANICAL PENETRATION SEALS

A. Penetrations in exterior masonry or concrete walls and foundations:

1. Above grade: Mechanical penetration seal, at outside face of wall.
2. Below grade:

a. Mechanical penetration seals at outside and inside faces of wall.

END OF SECTION 22 05 02

SECTION 22 05 04 - PLUMBING DEMOLITION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Demolition.

B. Disposal.

C. Protection

1.2 RELATED SECTIONS

A. Demolition: Division 02.

B. Hazardous material removal: Division 02.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 DEMOLITION

A. Extent and location of demolition is indicated on the drawings.

B. Comply with demolition and disposal requirements of Division 02.

C. Perform demolition operations expeditiously and in accordance with accepted practice and applicable building code provisions. Perform demolition operations neatly and with the least possible disturbance to the building.

D. If, in the course of the work, workers encounter a material they suspect to be hazardous:

1. Promptly notify the Owner and in writing.
2. Do not perform any work which would disturb the suspected material until written instructions have been received.

E. Provide temporary barriers, danger signals, and appurtenances for protection of personnel and equipment during demolition operations.

F. Drain and refill portions of existing piping systems necessary for the work.

1. Provide isolation valves, if necessary, to keep systems operational in occupied areas.

2. Schedule and coordinate draining with the Owner in accordance with Division 01 requirements for system shutdowns.

G. Demolish, remove, demount, and disconnect inactive and obsolete piping, fittings, specialties, equipment, ductwork, controls, fixtures, insulation, and associated appurtenances.

1. Piping and ducts embedded in floors, walls, and ceilings may be abandoned in place if they do not interfere with new installations. Cut back to at least one inch (25 mm) below the finished surface.
2. Remove materials above accessible ceilings.
3. Drain and cap items to remain behind finished surfaces.
4. Patch and repair surface materials as required in Division 01 and Section 22 01 01.

H. Remove supports, hangers, anchors, and fasteners associated with piping and equipment being removed.

3.2 DISPOSAL

A. Dispose of equipment and materials removed, and other waste material, as work progresses.

B. Do not allow demolition debris to accumulate on site. Remove products of demolition from the building daily as a minimum.

3.3 PROTECTION

A. Protect existing materials that will remain. Locate, identify, and protect mechanical and electrical services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas.

B. Provide and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Keep standby patching materials on hand to patch and maintain protection as required. Remove protection and barriers after demolition operations are complete.

C. Ensure weathertightness at all times. Prevent the entry of dust or water.

END OF SECTION 22 05 04

SECTION 22 05 05 - EQUIPMENT CONNECTIONS FOR PLUMBING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Equipment connections for plumbing, to and Owner-provided equipment.

1.2 RELATED SECTIONS

A. Piping connections and underfloor installation: Section 22 05 00.

B. Rough-in dimensions and lists of accessories: Suppliers of equipment specified in other divisions.

C. Schedule of roughing-in and connections: Drawings.

D. Wiring connections: Division 26.

1.3 SUBMITTALS

A. Product data: Any product required for connection but not specified in other sections.

B. Certification that products comply with NSF/ANSI 61.

1.4 QUALITY ASSURANCE

A. Lead free requirements:

1. Potable water system components intended to dispense water for human consumption, including pipe and joining materials, shall comply with NSF/ANSI 61 and with requirements for “lead-free” plumbing as defined by state laws and U.S. Safe Drinking Act.
2. Acceptance product marking: NSF®-61.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Traps NPS 2 (DN 50) and larger shall be galvanized cast iron P traps. NPS 1.5 (DN 40) P traps shall have cleanout plug and chrome finish. Those concealed within base cabinets of equipment may be rough brass.

B. Solids interceptor (sediment trap): Zurn Series Z-1180, as specified in Section 22 42 00.

C. Acid-resistant traps: Material to suit waste piping system to which they are connected, Style P or S as required.

D. Shutoff valves for plumbing fixtures:

1. Concealed: Ball valve, lead free, NSF/ANSI-61 certified, bronze body, bronze ball, PTFE seat, full port, two-piece, blowout-proof stem, soldered, rated for operation at 100 psi (689 kPa) at 300 degrees F (149 degrees C).

   a. Basis of design: Nibco Inc. No. S-685-80-LF.

2. Exposed: Chrome-plated, 1/2-inch FIP straight stop valve, lead free, NSF/ANSI-61 certified. Rated at 140 degrees F (60 degrees C).

   a. Basis of design: Chicago Faucet Co. No. 45-LKABCP.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Rough in and connect to plumbing equipment. Install valves, balancing cocks, thermometer wells, gauge tappings, control valves, air vents, traps, strainers, drains, and appurtenances as shown on diagrams on drawings and specified under other sections of the specifications.

B. Rough in and connect to owner-supplied, sinks, and other equipment requiring water, drain, or other piping connections, that is specified, furnished and set in place in other divisions or listed in the Schedule of Roughing-in and Connections on the drawings.

1. Faucets, drains, trim, and necessary vacuum breakers, solenoid valves, flow control fittings supplied with the sinks and equipment are specified herein or under other divisions.
2. Rough-in dimensions and list of accessories shall be provided by the equipment supplier.

C. Install the faucets, drains, trim, and accessories and provide necessary supply stops, P traps, and shock absorbers with necessary fittings to make a complete and satisfactory installation of every item of equipment.

D. Provide water supply shutoff valves, and unions at each item of equipment. Where exposed adjacent to chromium-finished piping, the water shutoff valves shall be chromium plated.

END OF SECTION 22 05 05

SECTION 22 05 06 - FLASHINGS AND ROOFTOP SUPPORTS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Plumbing vent flashing.

B. Single pipe flashing.

C. Rooftop pipe support systems.

1.2 RELATED SECTIONS

A. Roofing: Division 07.

B. Curbs and rails: Division 23.

1.3 SUBMITTALS

A. Shop drawings: Flashing assemblies showing compatibility with roof membrane, insulation, and slope.

B. Product data: Each type of manufactured unit, accessory, and accessory material.

1.4 SEQUENCING

A. Coordinate installation of flashings with roof structure and membrane. Penetrations shall not damage weathertightness.

PART 2 - PRODUCTS

2.1 FLASHINGS

A. Basis-of-design product: Subject to compliance with requirements, provide the specified product, or comparable product by another manufacturer.

B. Flashing for plumbing vents through flat roof:

1. 4-lb (1.8 kg per 0.09 sq. m) seamless lead flashing assembly, 8-inch (205-mm) skirt, top counterflashing fitting, and waterproofing compound.
2. Provide with a vandal-proof hood.
3. Basis of design:

a. Vent flashing with vandal-proof hood: Elmdor/Stoneman 1100-7.

C. Flashing for plumbing vents on sloped roofs:

1. Base size 15 by 15 inch (380 by 380 mm); weight of lead, 4 lbs (1.8 kg per 0.09 sq. m); angle of roof as shown on the drawings. Flashing shall be formed to fit over top of pipe and in one continuous piece down to roof.
2. Basis of design: Oatey Flashings type “Hi Collar Lead Flashing”

D. Flashing for a single pipe through a flat roof:

1. 4-lb (1.8 kg per 0.09 sq. m) lead boot, 8-inch (205-mm) skirt; top counterflashing fitting and waterproofing compound.
2. Basis of design: Elmdor/Stoneman 1100-4.

2.2 ROOFTOP PIPE SUPPORT SYSTEM

A. UV-stabilized; polyethylene, polypropylene, and hot-dip galvanized strut-based support, 10-inch minimum strut length by 4.8 inches in height.

1. Basis of design: Caddy “Pyramid ST” Series PSF.

B. Provide manufacturer’s standard pipe clamps and accessories designed for strut system, as required for size, material, and configuration of air-conditioning condensate lines across roof.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Extend plumbing vents 8 inches (205 mm) above finished roof. Tightly seal clamp devices to vent. Space between vent hub and pipe shall be lightly sealed to allow piping movement.

B. Flashing and counterflashing shall be provided as specified in Division 07.

C. Where dissimilar metals would contact each other, coat them with a protective coating compatible with adjacent materials.

3.2 INSTALLING ROOFTOP PIPE SUPPORT SYSTEM

A. Where air-conditioning condensate piping runs from roof-mounted equipment to a roof drain, support on rooftop support system. Use clamps and fasteners compatible with piping.

END OF SECTION 22 05 06

SECTION 22 05 09 - PLUMBING EXPANSION SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Precharged bladder-type expansion tank for potable water system.

B. Precharged bladder-type potable water well tanks.

1.2 RELATED SECTIONS

A. Piping: Section 22 11 16.

B. Supports: Section 22 05 29.

1.3 SUBMITTALS

A. Product data: Each type of expansion system or tank, including each relief and air separation device and all accessories.

1. Certification that products comply with NSF/ANSI 61 and NSF/ANSI 372.

1.4 QUALITY ASSURANCE

A. Potable water system components intended to dispense water for human consumption, including pipe and joining materials, shall comply with NSF/ANSI 61, NSF/ANSI 372 with requirements for “lead-free” plumbing as defined by state laws and U.S. Safe Drinking Act.

B. Acceptance product marking: NSF®-61 and NSF®-372 (or NSF®-61-G) or other accepted certifier marks demonstrating third party certification with these requirements.

C. Product specifications herein may not necessarily meet all regulations for the limits on lead content. The Contractors and product suppliers shall be responsible to provide products that comply with NSF/ANSI 61 and NSF/ANSI 372 for domestic water systems.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis-of-design product: Subject to compliance with requirements, provide the specified and scheduled products, or comparable products by one of the following:

1. Expansion tanks:

    a. Amtrol, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell and Gossett Domestic Pump Div of ITT
    d. Taco
    e. Wessels
    f. Or approved equal.

2.2 EXPANSION TANK FOR POTABLE WATER

A. Pressurized bladder type tank, containing impermeable bladder which separates the air cushion from the system water. Operating temperature: 240 degrees F maximum. Precharge to manufacturer's standard pressure.

B. Shell: Welded steel, constructed, tested and stamped in accordance with ASME BPV for Unfired Pressure Vessels for a working pressure of 125 psi. Lined with protective coating.

C. Bladder: Butyl rubber, flexible but not stretchable under working conditions, removable for inspection.

D. FDA approval: Wetted components FDA-approved materials.

E. Size and capacity: Shown on the drawings.

F. Supports: For horizontal or vertical support on concrete equipment foundation, as diagramed on the drawings.

G. Basis of design: Taco PAX model number scheduled on the drawings.

2.3 AUTOMATIC AIR VENT

A. Float type vent, size and capacity recommended by manufacturer for tank and system.

2.4 WELL PRESSUIRZED TANK FOR POTABLE WATER

A. Pressurized bladder type tank, containing impermeable bladder which separates the air cushion from the system water. Operating temperature: 240 degrees F maximum. Precharge to manufacturer's standard pressure.

B. Shell: Welded steel, constructed, tested and stamped in accordance with ASME BPV for Unfired Pressure Vessels for a working pressure of 125 psi. Lined with protective coating.

C. Bladder: Heavy duty butyl rubber, flexible but not stretchable under working conditions, removable for inspection.

D. FDA approval: Wetted components FDA-approved materials.

E. Size and capacity: Shown on the drawings.

F. Supports: For horizontal or vertical support on concrete equipment foundation, as diagramed on the drawings.

G. Basis of design: Amtrol Well-X-Trol WX model number scheduled on the drawings.

PART 3 - EXECUTION

3.1 INSTALLING EXPANSION AND WELL PRESSUIRZED TANKS

A. Follow manufacturer's instructions and recommendations.

B. Install piping, air separation apparatus, and vents as diagramed on drawings.

C. Install supports as shown on drawings.

3.2 OPERATING INSTRUCTIONS

A. As specified in Section 22 05 00, provide operating instructions.

END OF SECTION 22 05 09

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 22 05 13 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Unless otherwise specified in a particular section or required for a particular application, motors shall conform to the following requirements, whether factory-installed or field-installed.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Motor capacitors: Division 26.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Pumps:

1. Domestic water pumps: Section 22 11 23.
2. Elevator sump pumps: Section 22 14 30.

1.4 REFERENCES

A. NEMA MG 1: Motors and Generators.

B. NEMA MG 10: Energy Management Guide for Selection and Use of Polyphase Motors.

C. NEMA MG 11: Energy Management Guide for Selection and Use of Single-Phase Motors.

D. UL 508: Industrial Control Equipment.

1.5 DEFINITIONS

A. Energy efficient motor: Motor meeting the nominal and minimum efficiency levels listed for its horsepower and speed in Table 12-10 of NEMA MG 1.

B. Nominal efficiency: Efficiency as defined in Table 12-8, Efficiency Levels, in NEMA MG 1, and identified on the motor nameplate.

1.6 SUBMITTALS

A. Product data:

1. Motors and drives not provided with equipment: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lugs, and coatings.
2. Motor capacitors.

B. Wiring diagrams required for the proper installation of plumbing equipment.

C. Submit product data which verifies compliance with ASHRAE 90.1 or provide certified performance ratings by a qualified independent testing agency.

D. Certifications:

1. Actual motor power factor for each motor, certified test results for each motor proposed for use on this project.
2. Field test showing corrected power factor, if required.

1.7 QUALITY ASSURANCE

A. UL label: As specified in Section 22 05 00, Common Work Results for Plumbing.

B. Actual motor power factor shall be tested and certified by an independent testing laboratory.

C. Where power factor is field tested as required in “Power Factor” in Part 2 below, specialist performing tests shall be acceptable to the local authorities having jurisdiction.

D. Plumbing equipment shall meet the energy performance requirements of ASHRAE 90.1.

1.8 REGULATORY REQUIREMENTS

A. Motors shall conform to the requirements of NEMA MG1 and applicable portions of the National Electric Code (NEC, NFPA 70).

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Motors:

1. A.O. Smith
2. Baldor Electric Co.
3. Marathon
4. Rockwell
5. Siemens
6. Toshiba International
7. Or approved equal.

B. Motor capacitors:

1. ABB Power Distribution
2. Commonwealth Sprague
3. General Electric
4. Or approved equal.

2.2 BASIC MOTOR REQUIREMENTS

A. Capacity: Each motor shall have sufficient capacity and torque to start, accelerate, and operate the machine it drives without exceeding the motor nameplate rating at the speed specified, or at any speed and load which may be obtained by the drive actually furnished.

B. Starting: Each automatically controlled motor shall be capable of starting as frequently as the control sequence may demand. Motors not automatically controlled shall be capable of making no fewer than 4 starts per hour.

C. Loads: Belt-connected motors shall be equipped with shafts and bearings designed to withstand both the normal connected loads of the drive furnished, and momentary loads imposed during acceleration.

D. Ratings: Motors shall be rated for continuous duty at 100 percent of rated capacity, and temperature rise shall be based on ambient temperature of 40 degrees C.

E. Phase: Unless otherwise indicated, motors one-half horsepower and larger shall be polyphase and motors smaller than one-half horsepower shall be single-phase motors.

F. Motor construction:

1. ODP (open drip-proof) NEMA design B construction:

   a. Motors for pumps, unless specified otherwise.
   b. Motors outdoors but inside of a weather-tight enclosure, unless specified otherwise.

2. TEFC severe duty:

   a. Motors mounted outdoors and not inside of a weather-tight enclosure.
   b. Where TEFC motors are specified.

G. Efficiency: The term “energy efficient” is defined in the article “Definitions” in Part 1 above.

1. Single-phase motors, alternating-current fractional horsepower, rated 1/20 to 1 horsepower, 250 volts or less: NEMA MG 11, types and efficiencies selected for their applications.
2. Polyphase motors, medium alternating-current, squirrel-cage, 1 to 500 horsepower, 600 volts or less: NEMA MG 10, energy-efficient types selected for their application. Nominal full-load efficiencies shall meet or exceed ratings of Table 12-10 of NEMA MG 1.

3. Motors for packaged hermetic and semi-hermetic refrigeration compressors need not comply with these efficiency requirements but they shall comply with the requirements indicated for power factor and power consumption.

2.3 SINGLE-PHASE MOTORS

A. Permanent split-capacitor or split-phase type.

B. Bearings: Sealed, pre-lubricated ball bearings.

C. Thermal protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal.

2.4 POLYPHASE MOTORS

A. NEMA MG1 Design B.

B. Stator: Copper windings.

C. Rotor: Squirrel cage.

D. Bearings: Doubly shielded, pre-lubricated ball bearings suitable for radial and thrust loading of connected equipment.

E. Temperature rise shall not exceed insulation rating.

F. Insulation: Class F.

G. Motors used with inrush controllers: Match wiring requirements for indicated controller with required motor leads brought to motor terminal box to suit control method.

H. Horsepower/frame relationship: NEMA Standard for T frame motors.

I. Motor frame and end shields: Cast iron.

J. Conduit box: Either steel or aluminum, diagonally split and rotatable in 90-degree increments, with grounding provision.

K. Finishes:

1. External hardware: Plated to resist corrosion.
2. External paint: Industrial enamel.

L. Nameplates: Stainless steel or aluminum and stamped in accordance with NEMA MG1. Nameplate information shall include the nominal efficiency value in accordance with NEMA MG1 and the manufacturer’s minimum guaranteed efficiency value.

2.5 ELECTRONICALLY COMMUTATED MOTOR (ECM)

A. Brushless direct current (DC) variable speed motor supplied with alternating current, with a permanent magnet with near zero rotor losses, permanently-lubricated ball bearings, electronic commutation, designed for synchronous rotation, and at least 70% efficient at all operating speeds.

B. As a minimum, the motor shall include the following features:

1. Integrated controller / invertor that operates the wound stator and senses rotor position to electronically commutate the stator.
2. Thermal overload protection.
3. Built-in soft start and soft speed change ramps.
4. Inductors to minimize harmonic distortion and line noise.
5. Designed to overcome reverse rotation without affecting life expectancy.
6. Include a pulse width modulating (PWM) controller for either manual or DDC controlled motor speed adjustment down to 25 percent of full speed. The manual PWM controller shall be field adjustable with a standard screwdriver. The remote PWM shall be capable of receiving a 0-10Vdc analog signal from a DDC controller provided by the controls contractor, as indicated or required by other sections of DIV 23 specifications.
7. Software for motor control as indicated or described in other DIV 22 specifications.

2.6 TEFC (TOTALLY ENCLOSED FAN-COOLED) MOTORS

A. Polyphase motors with the following additional requirements:

1. TEFC construction for severe environment.
2. Ventilating fans: Made of corrosion-resistant, non-sparking material.
3. Conduit box: Heavy-wall cast construction, gasketed with a lead gasket between box and motor frame.
4. Motor shaft shall be provided with an external slinger on the drive end.
5. Rotor and stator air-gap surfaces coated to prevent corrosion.
6. Finish: At least two coats of catalyzed epoxy enamel.

2.7 POWER FACTOR

A. Power factor for three-phase motors 10 HP and larger and packaged equipment systems totaling 10 HP and larger as noted below shall be not less than 90 percent at full rated load. Test, certify, and submit certified reports for each motor as required in “Submittals” and “Quality Assurance” in Part 1 above.

1. Should the Contractor propose to provide motors with less than 90 percent power factor, provide power-factor-correcting, automatically discharging type motor capacitors. The corrected power factor of the motor-capacitor combination shall be equal to or greater than 90 percent. Submit certified test results.

2. Motor capacitor: Designed for installation at the load side of motor starters; insulated, impregnated component unit completely enclosed in a grounded steel case with welded and ground seams. Where installed on outdoor equipment, case shall be weatherproof. Provide each unit with a flexible cable for connection to the starter or motor terminals. The capacitor shall be suitable for use in areas with ambient temperatures ranging from minus 10 degrees F to 115 degrees F.

B. Where motors totaling 10 HP and larger are part of packaged equipment system, the overall power factor for the entire system package shall be no less than 90 percent. Provide capacitors and appurtenances required to accomplish this power factor as part of the packaged equipment or furnish separately and wire as work of equipment installation. Capacitors shall be stepped, deenergized, or cycled when the unit is deenergized or the load is varied, to maintain 90 percent power factor.

1. Capacitors provided as part of packaged equipment: If the installation of the capacitors voids the UL label, unit shall be tested. Actual power factor shall be factory-tested and certified test results included in submittals.
2. Capacitors provided separately and wired as work of equipment installation: Unit shall then be field tested to verify actual power factor. Submit field test reports.
3. Tests shall be performed by an electrical testing specialist and in accordance with NFPA 70 (NEC) testing brochure.

C. Motors and packaged equipment systems equipped with variable frequency drives shall not receive power factor correcting capacitors.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount direct-connected motors securely and in accurate alignment. The drive shall be free from both angular and parallel misalignment when both motor and driven machine are operating at normal temperatures.

B. Provide each belt-connected motor with a securely mounted adjustable base to permit installation and adjustment of belts.

C. Mount capacitors shipped separately beside motor connection box as required. Connect in accordance with the requirements of Division 26, Electrical.

1. Test units at full rated load after the installation of the motor capacitors and submit reports.

3.2 OPERATING INSTRUCTIONS

A. As specified in Section 22 05 00, provide operating instructions.

END OF SECTION 22 05 13

SECTION 22 05 19 - METERS AND GAUGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Thermometers.

B. Pressure gauges.

1.2 RELATED SECTIONS

A. Pipe installation and testing: Section 22 05 00.

B. Water utility service entrance meters: Section 22 11 16.

C. Water meter for monitoring by HVAC control system: Division 23.

1.3 SUBMITTALS

A. Product data: For each type of meter, gauge, device, and fitting specified.

1. Scale range.
2. Ratings.
3. Calibrated performance curves.

B. Certification that products comply with NSF/ANSI 61.

C. Show flow measurement locations on valve charts specified in Section 22 05 23, for general-duty valves.

1.4 QUALITY ASSURANCE

A. Lead free requirements:

1. Potable water system components intended to dispense water for human consumption, including pipe and joining materials, shall comply with NSF/ANSI 61 and with requirements for “lead-free” plumbing as defined by state laws and U.S. Safe Drinking Act.
2. Acceptance product marking: NSF®-61.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Meters and gauges:

1. AMETEK; U.S. Gauge
2. Ashcroft; Dresser Instrument
3. Miljoco Corporation
4. Taco, Inc.
5. H.O. Trerice Co.
6. Weiss Instruments
7. Weksler; Dresser Instrument
8. Or approved equal.

2.2 THERMOMETERS

A. General:

1. Graduation: To the scale shown on the drawings, or of a scale so that the normal working temperature of the system is near the mid-point of the scale.
2. Case: Industrial, cast aluminum with baked enamel finish, dust and moisture tight.
3. Window: Acrylic or glass.
4. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.

B. Pipe-mounted liquid-in-glass thermometers: Brass well, separable sockets.

1. Display: 9 inches (230 mm), blue organic liquid in glass tube.
2. Accuracy: ±1 scale division.
3. Stem: Aluminum or stainless steel, 6-inch (150-mm) stem length and socket with 2.5-inch (64-mm) lagging extension neck for use in insulated piping.
4. Where thermometer wells only are required, provide separable socket with 2.5-inch (64-mm) lagging extension, fitted with attached chain and cap.
5. Basis of design: Trerice Adjustable Angle and Trerice Thermowells.

2.3 PRESSURE GAUGES

A. Dial-type analogue pressure gauges:

1. Case: Cast aluminum, glass filled nylon, or stainless steel.
2. Window: Glass.
3. Bourdon-tube: Lead-free bronze.
4. Movement: Brass.
5. Connection: Lead-free brass , NPT 1/4 (DN 8).

6. Display: Aluminum dial with white background, black graduations and numerals and adjustable pointer:

    a. Minimum 4.5 inch (113 mm) diameter when 8 feet (2.4 m) or less above finished floor.
    b. Minimum 6 inch (150 mm) diameter when more than 8 feet (2.4 m) above finished floor.

7. Accuracy: Accurate to within ±1 percent of range span.
8. Graduation: To the scale shown on drawings, or so pointer is nearly straight up at system normal working pressure.
9. Temperature rating: 150 degrees F (65 degrees C) fluid.
10. Gauges shall be straight pressure type (able to read only positive pressure), except gauges on suction side of pumps and inlet side of suction strainers shall be compound type (able to ready positive or negative pressure).
11. Basis of design:

    a. 4.5” (113 mm) gauges: Trerice 600 Series.
    b. 6” (150mm) gauges: Trerice 700 Series.

B. Gauge cock (pressure gauge isolation valve):

1. Ball valve:

    a. Configuration: Quarter turn ball valve with threaded ends.
    b. Brass with Teflon seat and plated brass ball.
    c. Temperature rating: 180 degrees F (82 degrees C) fluid.
    d. Basis of design: Trerice 866 series with PBF designation for lead-free brass.

2.4 PRESSURE GAUGE SNUBBERS

A. Pressure snubbers:

1. Pulsation dampening, brass body, 250 psig (1725 kPa) minimum, NPT end connections sized for adjacent gauge and gauge cock.
2. Basis of design: Trerice 872 Series pressure snubbers.

PART 3 - EXECUTION

3.1 INSTALLING THERMOMETERS AND WELLS

A. Provide pipe-mounted thermometers as indicated on the drawings.

B. Provide wells for pipe-mounted thermometers, and where indicated on the drawings.

C. Furnish and deliver to Owner at final inspection, one additional pipe line thermometer as above specified, with 6-inch (152-mm) stem length, for use in the thermometer wells. Range shall be 30 to 180 degrees F (0 to 83 degrees C).

3.2 INSTALLING PRESSURE GAUGES AND GAUGE COCKS

A. Provide pressure gauges as indicated on drawings.

B. Provide a gauge cock for each gauge.

C. Mount gauges vertically.

D. Connections to pipe lines shall be 0.5 inch (DN 15), with 0.5 inch (DN 15) by 0.25 inch (DN 8) reducer for valve, the assembly of sufficient length to clear insulation.

E. Where gauge cocks only are called for on drawings, provide the 0.5-inch (DN 15) connections to pipe line with reducer and the gauge cock.

F. Provide extra compound gauges and one extra straight gauges of appropriate scale to the Owner such that any failed gauge can be replaced.

G. Provide pressure snubbers for gauges near pumps or other pulsating locations.

END OF SECTION 22 05 19

SECTION 22 05 23 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Shutoff valves.

B. Check valves.

C. Balancing valves.

D. Backwater valves.

E. Hose connections.

F. Drain valves.

1.2 RELATED SECTIONS

A. Piping installation and testing: Section 22 05 00.

B. Piping systems:

1. Domestic water piping: Section 22 11 16.
2. Sanitary waste and vent piping: Section 22 13 16.
3. Storm drainage piping: Section 22 14 13.

C. Automatically operating valves: Section 22 11 19.

D. Automatic water temperature control valve for domestic hot water: Section 22 11 19.

E. Backflow preventers.

F. Access doors: Section Division 08.

1.3 REFERENCES

A. ASME B16.10: Face-to-Face and End-to-End Dimensions of Valves.

B. ASME B16.34: Valves - Flanged, Threaded, and Welding End.

1.4 SUBMITTALS

A. Product data: For each type of valve. Include body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions.

B. Certification that products comply with NSF/ANSI 61.

C. Maintenance data: For inclusion in operation and maintenance manual specified in Division 01 and Section 22 01 01. Include manufacturer's instructions for adjusting, servicing, disassembling, and repairing.

D. Valve charts: Furnish valve charts typed on 8.5 by 11-inch (216 by 279-mm) bond paper, showing locations of all manual and automatic control valves, and flow meters. Include:

1. Number
2. Location
3. Service
4. Function
5. Area served

E. Valve numbering system shall be approved by the Owner prior to final submittal. Place one copy of approved chart in a plastic envelope and mount on wall where directed. Provide another copy for each of the Operating and Maintenance Manuals.

1.5 QUALITY ASSURANCE

A. Lead free requirements:

1. Potable water system components intended to dispense water for human consumption, including pipe and joining materials, shall comply with NSF/ANSI 61 and with requirements for “lead-free” plumbing as defined by state laws and U.S. Safe Drinking Act.
2. Acceptance product marking: NSF®-61.

B. Ferrous valves shall conform to ASME B16.10 and B16.34 for dimension and design criteria.

C. Copper alloy valves (brass and bronze) shall have no more than 15 percent zinc in the alloy.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Shutoff valves:

1. Ball valves: Subject to compliance with requirements, provide the specified NIBCO valve, or comparable product by one of the following:

a. Apollo Valves
b. Milwaukee Valve Co.
c. NIBCO
d. Stockham Valve & Fittings
e. Victaulic Company of America
f. Walworth Co.
g. Watts Regulator Co.
h. Or approved equal.

B. Check valves:

1. Check valves: Subject to compliance with requirements, provide the specified NIBCO valve, or comparable product by one of the following:

a. Combination Pump and Valve Co.
b. Mueller Steam Specialty
c. NIBCO
d. Victaulic Company of America
e. Or approved equal.

2. Full-port check valves: Subject to compliance with requirements, provide the specified Zoeller valve, or comparable product by one of the following:

a. Liberty Pumps
b. Zoeller
c. Or approved equal.

C. Balancing valves: Subject to compliance with requirements, provide the specified Bell & Gossett valve, or comparable product by one of the following:

1. Watts Regulator Co.
2. Armstrong
3. Or approved equal.

D. Backwater valves:

1. Swing check type backwater valves: Subject to compliance with requirements, provide the specified NIBCO valve, or comparable product by one of the following:

a. Combination Pump and Valve Co.
b. Mueller Steam Specialty
c. NIBCO
d. Victaulic Company of America
e. Or approved equal.

E. Flapper type or ball check type backwater valves: Subject to compliance with requirements, provide the specified Zurn valves, or comparable products by one of the following:

1. Ames Company, Inc.

2. Jay R. Smith
3. Jenkins Bros., a corporation
4. Josam Manufacturing Co.
5. Zurn
6. Or approved equal.

F. Hose connections: Subject to compliance with requirements, provide the specified Zurn valves, or comparable products by one of the following:

1. Jay R. Smith
2. Crane Co.
3. Josam Manufacturing Co.
4. Woodford Manufacturing Co.
5. Zurn
6. Or approved equal.

G. Drain valves: Subject to compliance with requirements, provide the specified NIBCO valves, or comparable products by one of the following:

1. Apollo Valves
2. Milwaukee Valve Co.
3. NIBCO
4. Stockham Valve & Fittings
5. Victaulic Company of America
6. Walworth Co.
7. Watts Regulator Co.
8. Or approved equal.

2.2 SHUTOFF VALVES

A. Ball valves:

1. Valves NPS 0.25 (DN 8) through NPS 2 (DN 50:

   a. 600 psi CWP, two-piece silicon bronze alloy body, full port, blowout-proof stem, PTFE seats, stainless steel ball and stem, extension handle for use in insulated piping, threaded or soldered ends.
   b. Basis of design: NIBCO T-685-66-LF or S-685-66-LF.

2. Valves NPS 2.5 (DN 65) through NPS 4 (DN 100):

   a. 400 psi (27.6 Bar) non-shock cold working pressure, two-piece brass body, full port, blow-out-proof stem, PTFE seats, forged body and end cap, stainless steel ball and brass stem, extension handle for use in insulated piping, threaded or soldered ends.
   b. Basis of design: NIBCO T-FP-600A-LF or S-FP-600A-LF.

2.3 CHECK VALVES

A. Center-guided, spring-loaded silent-action type check valves:

1. Valves NPS 0.5 (DN 15) through NPS 2 (DN 50):

a. 250 psi CWP, silicone bronze body, PTFE disk, stainless steel stem and spring, threaded or soldered ends.
b. Basis of design: NIBCO T-480-Y-LF or S-480-Y-LF.

2. Valves NPS 2.5 (DN 65) through NPS 10 (DN 250):

a. 200 psi CWP, cast iron body, bronze renewable seat and disk, stainless steel stem and spring, flanged ends.
b. Basis of design: NIBCO F-910-B-LF.

B. Full port check valves:

1. Valves NPS 1.25 (DN 32) through NPS 3 (DN 75)

a. Rated for operation at 50 psi at 130 degrees F (54 degrees C)
b. Epoxy-coated cast iron body
c. Vertical or horizontal installation
d. Full port design, no restrictions
e. Neoprene polyester reinforced flapper with smooth edge, cast iron and noncorrosive metal backing plates, and stainless steel fastener
f. Stainless steel bolts

(1) Basis of design: Zoeller Unicheck.

2.4 BALANCING VALVES

A. Balancing valves:

1. NPS 3 (DN 80) and smaller: Calibrated balancing valve.

a. Materials: Low-lead brass body (<0.25 percent lead content), stainless steel ball with carbon filled TFE seat rings.
b. Pressure and temperature ports. Differential pressure readout ports across valve seat.
c. Ratings (NPT): Entire assembly 400 psi, 250 degrees F (2758 kPa, 121 degrees C).
d. Flow element: Variable orifice flow meter.
e. Adjustable pre-set balancing points with memory stop and isolation valve.
f. Drain port: 1/4-inch NPT.
g. Bi-directional design.
h. Bellows type meter gauge kit with case, provide one for use on the entire project.
i. Basis of design: Bell & Gossett Circuit Setter Plus.

2.5 BACKWATER VALVES

A. Backwater valves:

1. Horizontal backwater valve above grade:

a. NPS 1.5 (DN 40) and smaller: Swing check valve.

(1) 200 psi CWP, silicone bronze body, PTFE seat, renewable seat and disk, Y pattern, horizontal swing, threaded or soldered ends.

(2) Basis of design: NIBCO T-413-Y-LF or S-413-Y-LF.

b. NPS 2 (DN 50) and larger:

(1) Flapper type, O-ring, cast iron body, no-hub connections, gasketed and bolted cover
(2) Flapper: NPS 3 (DN 75) and larger; bronze. NPS 2 (DN 50); PVC.
(3) Basis of design: Zurn Z1090.

2. Horizontal backwater valve below slab-on-grade:

a. NPS 2 (DN 50) and larger:

(1) Flapper type, O-ring, cast-iron body, hub and spigot connections, bronze threaded cover.
(2) Flapper: NPS 3 (DN 75) and larger; bronze. NPS 2 (DN 50); PVC.
(3) Basis of design: Zurn Z1095.

3. Vertical backwater valve:

a. NPS 2 (DN 50) and larger:

(1) Ball check type, coated cast iron body, plastic ball float, bronze backwater bushing and replaceable neoprene seat.
(2) Basis of design: Zurn Z1099.

4. Service box for backwater valve below slab-on-grade: Fiberglass-reinforced polymer concrete, modular stacking units, manufacturer's standard gray, enclosures and cover rated to support no less than 8,000 lbs. over a 12 by 12-inch area.

a. Size: No less than 17 by 30 inches (432 by 762 mm), depths and number of stacked units required for valve location.
b. Cover: Locking, with two tamperproof stainless steel bolts, nonskid surface, impressed BWV logo, 1 by 4 inches (25 by 102 mm) pull slot.
c. Base: Open (no base).
d. Stone filter material: Uniform gradation, AASHTO M 43 size 67 or 7.
e. Basis of design: Hubbell Power Systems; Quazite Enclosures, PC style.

2.6 HOSE CONNECTIONS

A. Exterior wall hydrants:

1. Non-freeze type.
2. ASSE 1019 hydrant with integral anti-siphon backflow preventer.
3. Automatic drain.
4. Flush-mount, bronze casing, and interior parts; stainless steel face.
5. Provide operating rod of length to match wall thickness, provide wall clamp.
6. Pressure Rating: 125 psig (860 kPa).
7. Ceramic disc half turn valve.
8. Key-operated.
9. NPS 0.75 (DN 20) inlet.
10. NPS 0.75 (DN 20) ASME B1.20.7 garden-hose thread outlet.
11. Basis of design: Zurn Z-1321XL.

B. Hose bibs:

1. Provide with factory installed ASSE 1011 hose connection vacuum breaker.
2. Bronze body, stem, and bonnet, chrome-finished where exposed and rough brass where concealed. Provide metal handle and operating key. Remove handle for key operation where hose bib is accessible to the public. Leave metal handle in place where concealed.
3. Pressure Rating: 125 psig (860 kPa).
4. Compression type valve with replaceable washer.
5. Key or handle operated.
6. NPS 0.75 (DN 20) inlet.
7. NPS 0.75 (DN 20) ASME B1.20.7 garden-hose thread outlet.
8. Basis of design: Zurn Z-1341-CM.

2.7 DRAIN VALVES

A. Drain valves:

1. Provide with supplemental ASSE 1011 backflow preventer.
2. Full-port, two-piece ball valve, bronze body, bronze ball, replaceable PTFE seats and seals, vinyl-covered steel handle, threaded or soldered inlet, threaded cap with brass chain. Provide extension handles where used in insulated piping. Remove handle where valve is accessible to the public.
3. Pressure rating: 600-psig (4137-kPa).
4. NPS 0.75 (DN 20) inlet.
5. NPS 0.75 (DN 20) ASME B1.20.7 garden-hose thread outlet.
6. Basis of design: NIBCO T-585-80-LF-HC or T-585-80-LF-HC.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install valves to be readily accessible for operation and maintenance, and with ample clearance for turning handles or operators.

B. For valves in inaccessible locations, provide access doors as specified in a related section.

C. Identify valves as specified in Section 22 05 00, Common Work Results for Plumbing.

1. Provide tags for all valves except stop valves on individual fixtures or equipment where their function is obvious, or where the fixture or equipment is immediately adjacent. Numbers shall correspond to those shown on the Valve Chart. Attach tags to valve shaft.
2. Provide ceiling identification tags where valves are above an accessible suspended ceiling. Number shall correspond to tag number.

3.2 INSTALLING SHUTOFF VALVES

A. Install shutoff valves for water piping where indicated:

1. Sizes NPS 4 (DN 50) and smaller: Ball valves.

3.3 INSTALLING CHECK VALVES

A. Provide center-guided, spring-loaded silent-action type check valves in domestic water lines.

B. Provide full-port check valves in pumped sanitary, or pumped storm water lines.

3.4 INSTALLING BALANCING VALVES

A. Install balancing valves where indicated.

B. Locate valve to provide a minimum of 5 pipe diameters of straight inlet and 2 pipe diameters of straight outlet.

3.5 INSTALLING BACKWATER VALVES

A. Valve: Provide backwater valves in plumbing drainage piping where indicated.

B. Service box: Where valves are below slab- on-grade, install service box with bottom unit resting on stone filter material no less than two inches deep. Follow box manufacturer's instructions, including installation of deep unit at bottom of stacked units.

3.6 INSTALLING HOSE CONNECTIONS

A. Wall hydrants: Provide wall hydrants where indicated. In finished areas, locate units so that domestic water connection is concealed inside adjoining partition or furred space.

B. Hose bibs: Provide hose bibs where indicated. In finished areas, locate units so that domestic water connection is concealed inside adjoining partition or furred space.

C. Drain valves: Provide drain valve at every low point of a water system, and where indicated.

3.7 INSTALLING DRAIN VALVES

A. Provide drain valve at every low point of a water system, and where indicated.

END OF SECTION 22 05 23

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe hangers and supports.

B. Trapeze pipe hangers.

C. Metal framing systems.

D. Insulation protection.

E. Fasteners.

F. Equipment foundations and supports.

1.2 RELATED SECTIONS

A. Vibration control supports: Section 22 05 48.

B. Plumbing Piping Insulation: Section 22 07 19.

1.3 REFERENCES

A. American Society of Mechanical Engineers

1. ASME B31.9: Building Services Piping.

B. ASTM International

1. ASTM A 36: Standard Specification for Carbon Structural Steel
2. ASTM A 53: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
3. ASTM A 307: Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
4. ASTM A 563: Standard Specification for Carbon and Alloy Steel Nuts
5. ASTM A 1064: Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
6. ASTM C 533: Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
7. ASTM C 552: Standard Specification for Cellular Glass Thermal Insulation
8. ASTM F 594: Standard Specification for Stainless Steel Nuts

9. ASTM F 3125: Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated

C. American Welding Society

1. AWS-D.1.1: Structural Welding – Steel

D. Metal Framing Manufacturer's Association

1. MFMA-4: Metal Framing Standards Publication
2. MFMA-103: Guidelines for the Use of Metal Framing

E. Manufacturer's Standardization Society

1. MSS SP-58: Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

1.4 DEFINITIONS

A. Hot Systems: Maximum operating (service) temperatures 120 degrees F (49 degrees C) and above.

B. Ambient Systems: Maximum operating temperatures 60 to 119 degrees F (16 to 48 degrees C).

C. Cold Systems: Maximum operating temperatures 59 degrees F (15 degrees C) and below.

1.5 SUBMITTALS

A. Product data:

1. Provide manufacturer's literature showing compliance with specifications for each type of hanger, framing system, support, fastener and accessory materials.
2. Provide a schedule of piping types and sizes and associated pipe hanger types.
3. Provide a schedule of building attachment types and associated attachment hardware.
4. Provide a schedule of pipe types and sizes and proposed hanger spacing and support rod diameters.
5. Provide manufacturer's recommended pipe hanger spacing criteria for stainless steel piping.
6. For supports used as components of fire protections systems, include certification of listing and label as required in "Quality Assurance" below.

B. Welding certificates.

1.6 QUALITY ASSURANCE

A. Qualifications of welders: As specified in Section 22 05 00, Common Work Results for Plumbing.

B. Hangers and supports used as components of fire protection systems shall:

1. Comply with NFPA 13.
2. Be listed and labeled by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Pipe hangers:

1. Anvil International
2. Carpenter and Paterson, Inc.
3. Cooper Industries
4. National Pipe Hanger Corporation
5. PHD Manufacturing, Inc.
6. PHP Systems/Design
7. Or approved equal.

B. Metal framing systems:

1. Anvil International
2. Cooper Industries
3. Hydra-Zorb
4. PHD Manufacturing, Inc.
5. PHP Systems/Design
6. Unistrut
7. Or approved equal.

C. Pipe covering protection shields:

1. Anvil International
2. Carpenter and Patterson, Inc.
3. Cooper Industries
4. National Pipe Hanger Corporation
5. PHD Manufacturing, Inc.
6. Pipe Shields, Inc.
7. Rilco Manufacturing Co., Inc.
8. Or approved equal.

2.2 PIPE HANGERS AND SUPPORTS

A. General: Comply with requirements of MSS SP-58.

B. Hangers and clamps:

1. Crawl spaces, tunnels, and wet areas: Galvanized steel.
2. Typical interior applications: Galvanized steel or factory painted.
3. Exterior and corrosive applications: Stainless steel.
4. For use with uninsulated copper pipe: Copper plated.

C. Trapeze pipe hanger: MSS SP-58, Type 59, shop-fabricated or field-fabricated pipe support assembly made from structural carbon-steel shapes with pipe saddles and U-bolts to secure piping on top of hanger.

D. Supplemental materials:

1. Threaded rod: Continuously threaded.

    a. Zinc-plated or galvanized carbon steel for indoor applications.
    b. Stainless steel for outdoor and corrosive applications.

2. Nuts and washers: Provide the same material used for threaded rods (ASTM A 563 for steel, ASTM F 594 for stainless steel).
3. Structural carbon-steel shapes: ASTM A 36.
4. Steel pipe: ASTM A 53, Grade B, Type E (electric resistance welded), Schedule 40, black and galvanized steel.

E. Metal framing systems:

1. Description: Shop- or field-fabricated, pipe-support assembly made of channels, nuts, bolts, structural connections, accessories, fittings, and other manufactured components.
2. Standard: Comply with MFMA-4 for factory-fabricated components for field assembly.
3. Channels: Continuous slotted galvanized steel channel with inturned lips, width selected for applicable load criteria.
4. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
5. Metal framing system pipe clamps:

    a. Galvanized steel clamp pipe support with elastic stop nut, and hex head machine screw, and manufactured to connect to metal framing system channels.
    b. For insulated piping: Clamp shall have friction tape on inside of clamp surface, manufactured to connect to pipe clamp insulating insert over pipe.
    c. For uninsulated piping: Clamp shall have an integral molded thermoplastic elastomer clamping insert on inside of clamp surface, manufactured to connect to uninsulated pipe.

F. Insulation protection:

1. Pipe covering protection shield:

    a. Shield: Galvanized steel, meeting the requirements of MSS SP-58 Type 40. Provide with alignment ridges when used in conjunction with pipe hanger.

b. Structural insulation insert: Structural insulation insert to form the insulation for the lower half of, or the entire pipe circumference Provide ASTM C 533, Type I calcium silicate with 100-psig (688-kPa) minimum compressive strength; or ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength. Insert thickness shall match adjacent piping insulation thickness.

2. Combination insulating insert and insulation protection shield:

a. Insulating insert material for cold and ambient system piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength and vapor barrier. Insert thickness shall match adjacent piping insulation thickness.
b. Insulating insert material for hot system piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa) minimum compressive strength; or ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength. Insert thickness shall match adjacent piping insulation thickness.
c. Insulation protection shield: Galvanized steel.
d. Insulating insert and insulation protection shield shall cover entire circumference of pipe.
e. Insulating insert length: Extend 2 inches minimum (50 mm) beyond insulation protection shield.

3. Pipe covering protection saddle:

a. Saddle: Steel, meeting requirements of MSS SP-58 Type 39
b. Insulation insert: Insulating material located in the space between saddle and pipe.

4. Pipe clamp insulating insert:

a. Insulating insert material: Closed-cell, sponge or expanded rubber, ASTM C 534, Type I for tubing material, with integral supports constructed from non-compressive closed cell material, single piece construction with self-adhesive closure strips. Insert thickness shall match adjacent piping insulation thickness. If insulation thickness is not available, provide maximum available thickness and seal insulation vapor barrier at thickness transition.
b. Insulation protection jacket: Aluminum or stainless steel, bonded to insulation insert.
c. Insulating insert and jacket shall cover entire circumference of pipe.
d. Basis of design: Armacell “Armafix” insulating inserts.

2.3 FASTENERS

A. Mechanical expansion anchors:

1. Self-drilling type expansion shields or machine bolt drop-in anchors for drilled holes. Fasteners to floor slabs shall be vibration and shock resistant. Load applied to fasteners shall not exceed 25 percent of manufacturer’s stated load capacity in 3500 psi (24,000 kPa)

concrete. Provide zinc-coated anchors for indoor applications and stainless-steel anchors for outdoor applications.

2. Basis of design: ITT Phillips Anchors “Red Head.”

B. Fasteners to drywall or cavity wall construction:

1. Toggle bolts with hollow wall drive anchors or nylon anchors as required.
2. Basis of design: ITT Phillips Anchors “Red Head” toggle bolts.

C. Fasteners to wood construction: Lag bolts.

D. Bolts, nuts, and washers: ASTM A 307, or ASTM F 3125 where high strength is required.

E. Adhesive anchors, stainless-steel threaded anchors with epoxy adhesive in glass container.

2.4 CONCRETE AND GROUT

A. Concrete:

1. Concrete shall be no less than 3000-psi (25,000 kPa) strength.
2. Reinforcement: 6 by 6 inch (150 by 150 mm) welded steel wire fabric, ASTM A 1064.

B. Grout:

1. Premixed, non-shrink grout consisting of non-metallic aggregate, cement, and water-reducing and plasticizing agents; capable of developing minimum compressive strength of 7,000 psi (48,000 kPa) in 28 days.
2. Provide grout by one of the following manufacturers:

a. Sonneborn-Rexnord “Sonogrout”
b. L&M Construction Chemical Company “Crystex”
c. US Grout Corporation “Five-Star Grout”

PART 3 - EXECUTION

3.1 GENERAL

A. Provide hangers and supports in accordance with schedules at the end of this section, as modified by specifications for each location and type.

B. Comply with MSS SP-58. Provide hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

C. Provide hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

D. Where required, provide structural steel shapes or metal framing system channels and hardware to transfer load from a hanger location to multiple locations in the structure to get support from an appropriate location or to increase the strength of the connection to the structure.

E. Support horizontal piping from above with hangers and threaded rod where possible, unless otherwise indicated.

F. Secure vertical piping at stack bases.

G. Riser support:

1. Support pipe risers through floor slabs with riser clamps.
2. Where pipe sleeves or associated water dams are not capable of accepting the weight of the piping, provide supplemental supports to transfer the weight of the piping to the structure.
3. Provide additional supports as needed not to exceed scheduled maximum vertical support spacing.

H. Provide hanger sizes to allow for continuous insulation for insulated piping systems.

I. Fabricate wall-mounted and floor-mounted supports using metal framing systems or structural steel where required.

J. Support groups of small piping along a structural wall using a metal framing system secured to the wall.

K. Trim threaded rods with a maximum excess length of 1 inch (25 mm). Provide protective rubber red end caps on the ends of threaded rods exposed and within 8 feet (2.4 meters) of the floor, roof, or grade below.

L. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

M. Install lateral bracing with pipe hangers and supports to prevent swaying.

N. Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

O. Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

P. Coordinate with requirements for hangers that require vibration control. See Section 22 05 48.

Q. Trapeze pipe hangers: Provide where required for grouping of parallel runs of horizontal piping.

1. Weld steel according to AWS D-1.1.
2. Hang with threaded rods. Size threaded rods in accordance with MSS SP-58.
3. Design trapeze pipe hangers and supports based on supported load plus a 50 percent minimum safety factor.
4. Hanger spacing shall not exceed the requirements for the smallest pipe in the rack.

5. Hanger spacing shall not exceed 6 feet (1.8 m) where hung from wood.

R. Metal framing systems: Provide where required for grouping of parallel runs of piping, and support together on field-assembled strut systems. Comply with MFMA-103 for metal framing system selections and applications.

S. Where piping penetrates metal studs within metal stud partitions, provide polymer inserts manufactured for the purpose to isolate piping and insulation from the metal stud material.

T. Remove, add, and modify existing hangers and supports to coordinate with new work and support existing to remain elements.

3.2 BUILDING ATTACHMENTS

A. Attaching to structural walls:

1. Provide a minimum of two 0.375 inch (9.5 mm) minimum screw-type fasteners for attaching brackets and a minimum of three 0.5 inch (13 mm) minimum bolt-type fasteners for attaching structural supports.

B. Attaching to structural steel beams, channels, or angles:

1. Secure threaded rods to MSS SP-58 Type 28 beam clamps that are clamped to the bottom flange of steel beams for any pipe size.
2. Secure threaded rods to MSS SP-58 Type 23 beam clamps for beams with maximum flange thickness of 0.75 inch (19 mm) and for single pipes NPS 2 (DN 50) and smaller.

C. Attaching to bar joists:

1. Provide MSS SP-58 Type 19 top-beam C-clamps attached to top flange of the joists at panel points.
2. Piping perpendicular to joists:

a. Pipes NPS 2.5 (DN 65) and smaller: Support from at least every other joist to spread the load among joists. Where multiple pipes are grouped together, stagger hangers to distribute the load among available joists.
b. Pipes NPS 3 (DN 80) and larger: Support from every joist to spread the load among joists.
c. If additional support is required between joists, hang metal framing system channel or structural steel shape from joists using MSS SP-58 Type 19 C-clamps attached to the top flange of two joists, and hang piping from metal framing system channel or structural steel shape.

3. Piping parallel to joists:

a. Hang metal framing system channel or structural steel shape from joists using MSS SP-58 Type 19 C-clamps attached to the top flange of two joists. Hang piping from metal framing system channel or structural steel shape.

b. For pipes NPS 2.5 (DN 65) and smaller: A single pipe may be hung from a single joist.

D. Attaching to concrete slabs and composite slabs:

1. Obtain approval from the structural engineer and confirm allowable loads prior to supporting pipe from concrete slabs or composite slabs. Where approved, provide mechanical expansion anchors and steel bolts or rods.

E. Attaching to precast concrete hollow core plank:

1. Obtain approval from the structural engineer and confirm allowable loads prior to supporting pipe from precast concrete plank.
2. Floor construction with topping slab:

a. Threaded rods shall pass through the plank and be secured on topside with nut, locknut, and plate washer.
b. Plate washers: 4 by 8 inches by 0.125 inch thick (100 mm by 200 mm by 6 mm) thick for 0.375-inch and 0.5-inch (10-mm and 15-mm) rods; 6 by 12 inches by 0.187 inch thick (150 by 305 by 5 mm) for 0.625-inch (16-mm) and larger rods.
c. Top of hanger assembly shall be concealed below surface of topping slab.
d. Drill openings through precast planks for the passage of threaded rods with power-driven carbide-tip drills, in accordance with Architect's instructions. Do not cut reinforcing bar without specific approval of the Structural Engineer.

3. Existing floor construction:

a. Provide toggle bolts, or remove and repair topping slab and support pipe as indicated above.

4. Roof construction:

a. Provide toggle bolts.

5. Where several pipes are run in parallel, stagger individual hangers to avoid concentrating the load on a single plank.
6. Provide supplemental steel with connections to multiple planks where required to spread a load among multiple planks.

F. Attaching to steel decks: Not permitted.

G. Attaching to metal grating:

1. Piping perpendicular to structural members supporting grating:

a. Attach threaded rods to the structural members using MSS SP-58 Type 23 beam clamps.

b. If intermediate support is needed for proper hanger spacing, attach additional threaded rods to 2.5 by 2.5 by 0.25-inch (90 by 90 by 8-mm) angles, 12 inches (305 mm) long, welded to the underside of the grating.

2. Piping NPS 2 (DN 50) and smaller parallel with structural members supporting grating:

a. Attach threaded rods to 2.5 by 2.5 by 0.25-inch (90 by 90 by 8-mm) angles, 12 inches (305 mm) long, welded to the underside of the grating for piping between structural members.
b. Attach threaded rods to the structural members using MSS SP-58 Type 23 beam clamps for piping under structural members.

3. Piping NPS 2.5 (DN 65) and larger parallel with structural members supporting grating:

a. Support as specified above for bar joist construction.
b. Hang metal framing system channel or structural steel shape from structural members using MSS SP-58 Type 23 beam clamps. Hang piping from metal framing system channel or structural steel shape.

4. Threaded rods shall have locknuts.

H. Attaching to wood construction:

1. Obtain approval from the structural engineer and confirm allowable loads prior to supporting pipe from wood construction. Where approved, provide the following:

a. Beams: Lag bolts.
b. Trusses: Follow roof truss manufacturers' recommendations for attachment locations, loads, spacing, and methods of attachment.
c. Joists: Provide MSS SP-58 Type 34 side beam connectors.

3.3 INSTALLING STORM WATER PIPING

A. Provide hanger to support horizontal storm drainage piping within 12 inches of the first fitting downstream of connections to roof drains and overflow roof drains.

3.4 INSTALLING PIPING IN CRAWL SPACES

A. Hang single runs of piping NPS 2.5 (DN 65) and smaller from above.

B. Hang single runs of piping NPS 3 (DN 75) and greater, or groups of parallel piping, using a metal framing system. Attach tops of vertical members to the floor slab above. Attach bottoms of vertical members to concrete support piers. Attach horizontal members to vertical members, or to structural angles attached to load bearing walls with adhesive anchors. Suspend pipe hangers from the horizontal members.

C. Where existing piping in crawl space is replaced, the replacement piping may be suspended from existing threaded rod attachments.

D. Where required, attach MSS SP-58 Type 33 brackets to crawl space load bearing walls using adhesive anchors to support pipe hangers.

E. Provide protective coating as specified in the article “Cleaning and Painting” in Section 22 05 00.

3.5 INSTALLING CAST-IRON PIPING

A. Support piping within 18 inches (460 mm) of each horizontal joint in addition to satisfaction of maximum hanger spacing. Where there are multiple joints in a 4 foot (1.2 m) section, supports may be provided at every other joint.

B. Support piping at changes in direction.

C. Where pipe is supported by hangers more than 18 inches (460 mm) long, provide lateral support at a maximum interval of 40 feet (12.2 m) with sway bracing.

D. Secure closet bends, traps, and similar items against movement in any direction.

3.6 INSTALLING PLASTIC PIPING

A. Provide vinyl coated hangers and clamps.

3.7 INSTALLING EQUIPMENT FOUNDATIONS AND SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor. Provide lateral bracing, to prevent swaying.

B. Provide minimum four-inch (100-mm) -high concrete foundations (housekeeping pads) or as indicated on drawings, reinforced with welded-wire fabric, for floor-mounted equipment and where indicated. Anchor concrete foundations by dowels inserted into the floor slab.

C. Unless otherwise specified, provide concrete foundations, bolts, sleeves, and appurtenances as work of the section where the supported equipment is specified and in accordance with the requirements of Division 03.

D. Equipment shall be properly aligned and leveled, and grouted where necessary. Support piping independently of equipment and so as not to cause a strain or thrust.

E. Coordinate exact size, configuration and location of equipment, foundations, and supports using approved shop drawings of equipment.

3.8 PIPING HANGER AND SUPPORT SCHEDULES

A. Hanger and support types (insulated cold and ambient applications): Applications include, but are not limited to, domestic cold water and insulated sanitary and storm water systems.

HANGERS & SUPPORTS FOR INSULATED COLD AND AMBIENT APPLICATIONS		
MSS SP-58 Classification	Description	Piping Applications
Hung from Above		
Types 1 & 40	Clevis hanger & pipe covering protection shield.	NPS 0.5 (DN 15) through NPS 2 (DN 50)
Types 1 & 40 (with structural insulation insert)	Clevis hanger & pipe covering protection shield, with structural insulation insert.	NPS 2.5 (DN 65) and larger
Type 59 (with combination insulating insert and insulation protection shield)	Trapeze pipe hanger with pipe saddles & U-bolts (with combination insulating insert and insulation protection shield).	NPS 0.5 (DN 15) through NPS 4 (DN 100)
N/A	Metal framing system with metal framing system pipe clamps and pipe clamp insulating inserts.	NPS 0.5 (DN 15) through NPS 4 (DN 100)
Supported from Below		
Type 37 (with combination insulating insert and insulation protection shield)	Adjustable pipe stanchion saddle with U-bolt and floor flange anchored to floor (with combination insulating insert and insulation protection shield).	All sizes where supported from floor or a concrete support pier.
N/A	Metal framing system with metal framing system pipe clamps and pipe clamp insulating inserts.	NPS 0.5 (DN 15) through NPS 8 (DN 200)
Risers		
Type 8	Riser clamp.	All sizes

B. Hanger and support types (insulated hot applications): Applications include, but are not limited to domestic hot water and domestic hot water return systems.

HANGERS & SUPPORTS FOR INSULATED HOT APPLICATIONS		
MSS SP-58 Classification	Description	Piping Applications
Hung from Above		
Types 1 & 40	Clevis hanger & pipe covering protection shield.	NPS 0.5 (DN 15) through NPS 2 (DN 50)
Types 1 & 40 (with structural insulation insert)	Clevis hanger & pipe covering protection shield, with structural insulation insert.	NPS 2.5 (DN 65) to NPS 6 (DN 150)
Type 59 (with combination insulating insert and insulation protection shield)	Trapeze pipe hanger with pipe saddles & U-bolts (with combination insulating insert and insulation protection shield).	NPS 0.5 (DN 15) through NPS 4 (DN 100)
N/A	Metal framing system with metal framing system pipe clamps and pipe clamp insulating inserts.	NPS 0.5 (DN 15) through NPS 4 (DN 100)
Supported from Below		
Type 37 (with combination insulating insert and insulation protection shield)	Adjustable pipe stanchion saddle with U-bolt and floor flange anchored to floor (with combination insulating insert and insulation protection shield).	All sizes where supported from the floor or a concrete support pier. Use only where no significant horizontal pipe movement is anticipated.
Types 41 & 39	Adjustable roller support & pipe covering protection saddle (cast-iron roll and sockets, steel roll rod, supported from below with threaded rods).	All sizes where supported from racks, fixed structural supports, or brackets where vertical adjustment is required.
Types 44 & 39	Roller chair & pipe covering protection saddle (Cast-iron roll, steel roll rod, steel chair, bolts, and hex nuts).	All sizes where supported from racks, fixed structural supports, or brackets where vertical adjustment is not required.
N/A	Metal framing system with metal framing system pipe clamps and pipe clamp insulating inserts.	NPS 0.5 (DN 15) through NPS 6 (DN 150)
Risers		
Type 8	Riser clamp.	All sizes

C. Hanger and support types (uninsulated applications): Applications include, but are not limited to uninsulated storm water, sanitary, vent, compressed air, and laboratory gas systems.

HANGERS & SUPPORTS FOR UNINSULATED APPLICATIONS		
MSS SP-58 Classification	Description	Piping Applications
Hung from Above		
Type 1	Clevis hanger	All sizes
Type 10	Adjustable swivel ring	NPS 0.5 (DN 15) through NPS 4 (DN 100)
Type 59	Trapeze pipe hanger with pipe saddles & U-bolts.	NPS 0.5 (DN 15) through NPS 4 (DN 100)
N/A	Metal framing system with metal framing system pipe clamps for uninsulated piping.	NPS 0.5 (DN 15) through NPS 4 (DN 100)
Supported from Below		
Type 37	Adjustable pipe stanchion saddle with U-bolt, with floor flange and base anchored to floor.	All sizes where supported from the floor or a concrete support pier.
N/A	Metal framing system with metal framing system pipe clamps and pipe clamp insulating inserts.	NPS 0.5 (DN 15) through NPS 8 (DN 200)
Risers		
Type 8	Riser clamp.	All sizes

D. Minimum threaded rod sizes: Provide at least the following minimum rod diameters for single rods supporting a single pipe hanger.

Pipe Size	Minimum Rod Diameter
NPS 2 (DN 50) and below	0.375 inches (10 mm)
NPS 2.5 and NPS 3 (DN 65 and DN 75)	0.5 inches (15 mm)
NPS 4 and NPS 5 (DN 100 and DN 125)	0.625 inches (16 mm)
NPS 6 and NPS 8 (DN150 and DN 200)	0.75 inches (20 mm)
NPS 10 to NPS 12 (DN 250 to DN 300)	0.875 inches (22 mm)
NPS 14 to NPS 18 (DN 350 to DN 450)	1.0 inch (25 mm)
NPS 20 (DN 500) and above	1.25 inch (35 mm)

E. Maximum hanger and support spacing for pressurized piping:

1. Provide additional hangers or supports for concentrated loads such as flanges, valves, expansion compensators, fittings, and other specialties.
2. Horizontal spacing schedule:

<table>
<tr><th>Pipe Size</th><th>Copper Piping</th><th>Ductile Iron Piping</th><th>PVC (Schedule 80)</th></tr>
<tr><td>NPS 0.75 (DN 20) and below</td><td>5 feet (1.5 m)</td><td rowspan="3">7 feet (2.1 m)</td><td>2.5 feet (0.76 m)</td></tr>
<tr><td>NPS 1 (DN 25)</td><td>6 feet (1.8 m)</td><td rowspan="2">3 feet (1.0 m)</td></tr>
<tr><td>NPS 1.25 (DN 32)</td><td>7 feet (2.1 m)</td></tr>
<tr><td>NPS 1.5 (DN 40)</td><td rowspan="2">8 feet (2.4 m)</td><td>9 feet (2.7 m)</td><td rowspan="2">3.5 feet (1.1 m)</td></tr>
<tr><td>NPS 2 (DN 50)</td><td>10 feet (3 m)</td></tr>
<tr><td>NPS 2.5 (DN 65)</td><td>9 feet (2.7 m)</td><td>11 feet (3.4 m)</td><td rowspan="6">4 feet (1.2 m)</td></tr>
<tr><td>NPS 3 (DN 75)</td><td>10 feet (3 m)</td><td>12 feet (3.7 m)</td></tr>
<tr><td>NPS 4 (DN 100)</td><td rowspan="4">12 feet (3.7 m)</td><td>14 feet (4.3 m)</td></tr>
<tr><td>NPS 5 (DN 125)</td><td>16 feet (4.9 m)</td></tr>
<tr><td>NPS 6 (DN 150)</td><td>17 feet (5.2 m)</td></tr>
<tr><td>NPS 8 (DN 200)</td><td>19 feet (5.8 m)</td></tr>
</table>

3. Vertical spacing schedule:

Copper Piping	Ductile Iron Piping	PVC
10 feet (3 m)	15 feet (4.5 m)	10 feet (3 m) with guides at mid-span for piping NPS 2 (DN 50) and smaller

4. Provide hanger spacing to meet manufacturer’s recommendations and MSS SP-58 for stainless steel piping.

F. Maximum hanger and support spacing for metal and PVC gravity piping:

1. Provide additional hangers or supports for concentrated loads such as fittings, and other specialties.
2. Horizontal spacing schedule:

<table>
<tr><th>Pipe Size</th><th>Copper DWV Tubing</th><th>Cast-iron (Hub & Spigot)</th><th>Cast-iron (No-hub)</th><th>High-silicon Cast-iron</th><th>PVC</th></tr>
<tr><td>1.5 inches (40 mm)</td><td rowspan="2">8 feet (2.4 m)</td><td>N/A</td><td rowspan="11">5 feet (1.5 m)</td><td rowspan="4">5 feet (1.5 m)</td><td rowspan="2">3 feet (0.9 m)</td></tr>
<tr><td>2 inches (50 mm)</td><td rowspan="9">5 feet (1.5 m)</td></tr>
<tr><td>3 inches (75 mm)</td><td rowspan="6">10 feet (3 m)</td><td>42 inches (1.1 m)</td></tr>
<tr><td>4 inches (100 mm)</td><td rowspan="6">4 feet (1.2 m)</td></tr>
<tr><td>5 inches (125 mm)</td><td rowspan="5">N/A</td></tr>
<tr><td>6 inches (150 mm)</td></tr>
<tr><td>8 inches (200 mm)</td></tr>
<tr><td>10 inches (250 mm)</td><td rowspan="3">N/A</td></tr>
<tr><td>12 inches (300 mm)</td></tr>
<tr><td>15 inches (350 mm)</td></tr>
<tr><td colspan="6">Cast-iron horizontal support spacing may be increased up to but not in excess of 10 feet (3 m) where 10 foot (3 m) or greater lengths of pipe are used.</td></tr>
</table>

3. Vertical spacing schedule:

Copper DWV Tubing	Cast-iron (Hub & Spigot)	Cast-iron (No-hub)	High-silicon Cast-iron	PVC
10 feet (3 m)	15 feet (4.5 m)	15 feet (4.5 m)	14 feet (4.3 m)	10 feet (3 m) with guides at mid-span for piping NPS 2 (DN 50) and smaller

END OF SECTION 22 05 29

SECTION 22 05 48 - VIBRATION CONTROL SUPPORTS FOR PLUMBING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Vibration control supports for plumbing equipment.

1.2 RELATED SECTIONS

A. Hangers and supports: Section 22 05 29.

1.3 SUBMITTALS

A. Product data: For each type of vibration control support included in the work.

B. Shop drawings: Custom-fabricated supports.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis-of-design product: Subject to compliance with requirements, provide the specified Mason Industries product, or comparable product by one of the following:

1. Amber/Booth Company, Inc.
2. Kinetics Noise Control
3. Mason Industries
4. Vibro-Acoustics
5. Vibration Eliminator Company, Inc.
6. Vibration Mountings and Controls, Inc.
7. Or approved equal.

2.2 VIBRATION CONTROL SUPPORTS

A. Provide engineered supports for equipment and locations shown on drawings and specified in Part 3 below. The units shall prevent the transmission of vibration and mechanically transmitted sound to the building structure.

1. Select units in accordance with the weight distribution of the equipment, to produce reasonably uniform deflection. Deflections shall be as specified.

B. Specification E: Hangers, combination spring and minimum 0.3-inch (8-mm) deflection neoprene in series and with adjustment to transfer load to spring while holding supported object at fixed elevation. Include spring deflection indicator.

1. Neoprene element: Molded with a rod isolation bushing that passes through the hanger box.
2. Spring diameters and hanger box lower hole sizes: Large enough to permit the hanger rod to swing through a 30-degree arc before contacting the edges of the hole.
3. Springs shall have a minimum additional travel to solid equal to 50 percent of rated deflection.
4. Basis of design: Mason Industries Type PC30N.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Adjust vibration control supports as recommended by manufacturer to eliminate transmission of vibration to building structure or other systems.

B. Replace springs that become permanently deformed with new springs.

C. Provide 0.25-inch (6-mm) structural plate sized as required between isolator and equipment.

3.2 HUNG PUMP VIBRATION CONTROL

A. In-line circulator pumps: Vibration control is not required.

3.3 VIBRATION CONTROLS ON PIPING

A. Piping: Provide Specification E vibration control supports in first three hangers at both the suction and discharge of pumps-air compressors, and vacuum pumps. The static deflection shall be the same as specified for the mountings under the connected equipment.

1. If piping is connected to equipment mounted on slab on grade and hangs from structure under occupied spaces, the first three hangers shall have at least 0.75 inch (19 mm) deflection for pipe sizes up to and including NPS 3 (DN 80), 1.5 inch (38 mm) deflection for pipe sizes up to and including NPS 6 (DN 150) and 2.5 inch (64 mm) deflection thereafter.
2. Other hangers and mounts shall have a minimum spring deflection of 0.75 inch (19 mm).
3. Locate vibration control supports in hanger rods as close to the overhead supports as practical. On supports with double rods, use two vibration control supports.

END OF SECTION 22 05 48

SECTION 22 07 00 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Definitions and general requirements applicable to the insulation systems specified in "Related Sections."

1.2 RELATED SECTIONS

A. Plumbing piping insulation: Section 22 07 19.

B. Plumbing equipment insulation: Section 22 07 16.

1.3 REFERENCES

A. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials

B. NFPA 255: Standard Method of Test of Surface Burning Characteristics of Building Materials

C. UL 723: Standard for Test for Surface Burning Characteristics of Building Materials

1.4 DEFINITIONS

A. Concealed insulation shall include work:

1. Above ceilings.
2. In crawl spaces and tunnels.
3. Where furred in and in pipe chases.

B. Exposed insulation shall include work:

1. In all rooms and areas.
2. In mechanical equipment rooms, penthouses, or other similar utility spaces.
3. In storage rooms.

C. Unconditioned areas: Areas outside of the insulated envelope.

D. Finished spaces: Areas of the building accessible to the public and to building occupants other than service personnel.

1.5 QUALITY ASSURANCE

A. Perform work in strict accordance with the building, fire and safety codes of the state, county or city in which the work is performed.

B. Insulation, including fittings and butt strips, jackets, facings, and accessories such as adhesives, mastics, cements, tapes and cloth, shall have a fire and smoke hazard rating and label as tested by ASTM E84, NFPA 255, and UL 723, not exceeding Flame Spread 25, Fuel Contributed 50, Smoke Developed 50.

C. All insulation and accessories shall be free of asbestos.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver insulation and accessory products in manufacturers' wrapping or cartons, identified on the exterior and bearing labels showing conformance to flame and smoke rating requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Refer to sections listed in “Related Sections.”

PART 3 - EXECUTION (Not Used)

END OF SECTION 22 07 00

SECTION 22 07 16 - PLUMBING EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Plumbing equipment insulation for the equipment listed in the insulation thickness and material schedule at the end of this section.

1.2 RELATED SECTIONS

A. Definitions and general insulation requirements: Section 22 07 00.

1.3 REFERENCES

A. American Society of Testing and Materials

1. Standards for mineral fiber insulation materials

a. ASTM C 449: Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
b. ASTM C 612: Standard Specification for Mineral Fiber Block and Board Thermal Insulation
c. ASTM C 1136: Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

2. Standards for flexible elastomeric insulation materials

a. ASTM C 534: Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

1.4 SUBMITTALS

A. Material list: Each type of insulation and accessory, with manufacturer's name and material name and number. Identify locations for use, thickness of material, type of jacket, vapor barrier, and method of application.

B. Product data: Sufficient to show that the product meets the specified requirements for materials, composition, and performance.

C. Submit a single manufacturer for each product. Submittals that include multiple manufacturers for a single product are not acceptable.

D. Installer qualifications.

1.5 QUALITY CONTROL SUBMITTALS

A. Manufacturer's instructions: Recommended accessory materials and products; installation instructions.

1.6 QUALITY ASSURANCE

A. Installer qualifications: Installers shall be mechanics skilled in this trade, employed with a firm that has a minimum of five years of experience installing mechanical insulation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store rigid insulation products to protect them from breakage.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The listed manufacturers and particular products are intended to set a standard for materials, composition, and performance. Products of other manufacturers may be proposed as permitted by the provisions of Division 01 and the article "Product Options" in Section 22 01 01.

B. Flexible elastomeric insulation:

1. Aeroflex USA
2. Armacell LLC
3. K-Flex USA
4. Rubatex
5. Or approved equal.

C. Coatings, adhesives, and fabrics:

1. Childers
2. Foster
3. Manville Building Materials Group
4. Rock Wool Manufacturing Company
5. Trimac
6. Or approved equal.

2.2 FLEXIBLE ELASTOMERIC INSULATION MATERIALS

A. Flexible elastomeric sheet insulation: Closed-cell, sponge- or expanded-rubber materials, ASTM C 534, Type II, with vapor barrier facing.

B. Flexible elastomeric insulation adhesive:

1. Water resistant contact cement designed especially suited for bonding two impermeable surfaces and recommended for rubber foam, steel, and aluminum, and compatible with service temperatures.
2. Basis of design: Foster 85-75 “Drion”.

C. Flexible elastomeric insulation vapor barrier coating:

1. Water-based latex enamel coating for use over flexible elastomeric insulation, providing a moisture-resistant protective finish suitable for both indoor and outdoor applications.
2. Basis of design: Armacell “WB Armaflex” latex enamel.

D. Flexible Elastomeric Tape: Black, closed cell, self-adhering, elastomeric thermal insulation tape for insulating pipes and fittings, 0.125 inch (3 mm) thick, 2 inches (50 mm) wide, ASTM C 534, Type I — Grade 1.

2.3 FIELD-APPLIED GLASS CLOTH

A. Glass cloth: Woven Glass-Fiber Fabric: MIL-C-20079H. Type I, plain weave, 8 ounces per square yard (270 grams per square meter).

B. Glass Cloth Tape: Type II, Class 3, 4.5 ounces per square yard (150 grams per square meter).

C. Lagging finish coating:

1. Washable, abrasion-resistant, indoor insulation coating for canvas and glass lagging cloth.
2. Basis of design: Foster 30-36 “Sealfas”.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Provide insulation in accordance with the Insulation Thickness and Material Schedule at the end of this section, as modified by specifications for each location and type.

B. Apply insulation in a neat and workmanlike manner and in accordance with manufacturer’s printed instructions.

C. Insulate equipment as specified, except equipment with factory-applied insulation.

D. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment.

E. 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.

F. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

G. Install insulation with least number of joints practical.

H. Stagger joints.

I. Install insulation continuously around anchor attachments.

J. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

3.2 INSTALLING FLEXIBLE ELASTOMERIC INSULATION (COLD SURFACES)

A. Insulate equipment surface.

B. Insulate flanges, bolts, and accessories. Provide removable insulation sections to cover flanges, bolts, accessories, and parts of equipment which must be opened or removed periodically for maintenance, such as vessel covers, manholes, hand holes, cleanouts, and associated fasteners. Provide supports for removable sections as needed.

C. Do not insulate the following. Bevel and seal insulation edges:

1. Testing agency labels and stamps.
2. Manufacturer’s nameplates and data plates.

D. Secure insulation with a full coating of adhesive.

E. Stagger joints between layers.

F. Cut, score, or miter insulation to fit contours of equipment.

G. Seal breaks and punctures with tape.

H. Fill voids with small pieces of insulation applied with adhesive on all sides to maintain continuous vapor barrier.

I. Tape and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. Seal with vapor barrier coating.

J. 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.

K. Finish insulation with two coats of lagging finish coating with glass cloth and tape embedded between coats. Overlap glass cloth seams a minimum of 2 inches (50 mm).

3.3 SCHEDULES

A. Insulation thickness and material schedule:

INSULATION THICKNESS AND MATERIAL SCHEDULE			
Application	Fluid Temperature Range	Insulation Type	Minimum Insulation Thickness
Storage Tanks and Pressure Tanks for fluids below ambient temperature (1)	--	Flexible Elastomeric	Two Layers 0.75-inch (19 mm) Each Layer 1.5-inch (38 mm) Total
(1) - Applications with fluids below ambient temperature include but are not limited to domestic cold water, chilled domestic water, storm water, and air-conditioning condensate.			

END OF SECTION 22 07 16

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 22 07 19 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Plumbing piping insulation for the interior piping systems listed in the minimum insulation thickness schedule at the end of this section.

B. Plumbing piping insulation for the exterior piping systems.

C. Work of this section includes:

1. Insulation for new piping installed under this contract.
2. Patching existing insulation where removed to make connections to existing piping.
3. Patching existing insulation damaged during demolition and construction.

1.2 RELATED SECTIONS

A. Firestopping: Division 07.

B. Painting: Division 09.

C. Definitions and general insulation requirements: Section 22 07 00.

D. Pipe hangers and protection shields: Section 22 05 29.

E. Lavatory piping insulation: Section 22 42 00.

1.3 REFERENCES

A. American Society of Testing and Materials

1. Standards for mineral fiber insulation materials

a. ASTM C 449: Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
b. ASTM C 547: Mineral Fiber Pipe Insulation.
c. ASTM C 553: Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
d. ASTM C 1136: Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

2. Standards for flexible elastomeric insulation materials

    a. ASTM C 534: Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

3. Standards for all insulation materials

    a. ASTM C 450: Prefabrication and Field Fabrication of Thermal Insulating Fitting Covers for NPS Piping, Vessel Lagging, and Dished Head Segments.
    b. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials

4. Standards for field applied jackets and accessories

    a. ASTM C 1729: Standard Specification for Aluminum Jacketing for Insulation
    b. ASTM D 1784: Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
    c. ASTM B 209: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

1.4 SUBMITTALS

A. Material list: Each type of insulation and accessory, with manufacturer's name and material name and number. Identify locations for use, thickness of material, type of jacket, vapor barrier, and method of application.

B. Product data: Sufficient to show that the product meets the specified requirements for materials, composition, and performance.

C. Submit a single manufacturer for each product. Submittals that include multiple manufacturers for a single product are not acceptable.

D. Installer qualifications.

1.5 QUALITY CONTROL SUBMITTALS

A. Manufacturer's instructions: Recommended accessory materials and products; installation instructions.

1.6 QUALITY ASSURANCE

A. Installers shall be mechanics skilled in this trade, employed with a firm that has a minimum of five years of experience installing mechanical insulation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The listed manufacturers and particular products are intended to set a standard for materials, composition, and performance. Products of other manufacturers may be proposed as permitted by the provisions of Division 01 and the article "Product Options" in Section 22 01 01.

B. Mineral fiber insulation:

1. CertainTeed Corporation.
2. Johns Manville
3. Knauf Insulation
4. Manson Insulation
5. Owens-Corning
6. Or approved equal.

C. Flexible elastomeric insulation:

1. Aeroflex USA
2. Armacell LLC
3. K-Flex USA
4. Rubatex
5. Or approved equal.

D. Coatings, adhesives, and fabrics:

1. Childers
2. Foster
3. Manville Building Materials Group
4. Rock Wool Manufacturing Company
5. Trimac
6. Or approved equal.

2.2 MINERAL FIBER INSULATION MATERIALS

A. Mineral fiber preformed pipe insulation: Glass fibers bonded with a thermosetting resin, ASTM C 547 Type I, with factory-applied ASJ-SSL jacket. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

B. ASJ-SSL jacket:

1. All service jacket with self-sealing lap.
2. White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.
3. Complying with ASTM C 1136, Type I.

C. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, pressure sensitive, complying with ASTM C 1136; 3 inch (75 mm) width. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

D. Mineral fiber blanket insulation: Glass fibers bonded with a thermosetting resin, ASTM C 553, Type IV, without facing. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

E. Mineral fiber preformed fitting and valve covers: Glass fibers bonded with a thermosetting resin, made from the same material and density as adjacent pipe insulation, meeting ASTM C 450 requirements for dimensions used in forming insulation to cover valves, elbows, tees, flanges, strainers, and unions. Provide with preformed PVC field-applied jacket. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

F. Mineral fiber insulation adhesive:

1. Solvent free, low VOC, water-based adhesive designed for bonding mineral fiber insulation to steel or aluminum surfaces, and compatible with service temperatures. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
2. Basis of design: Foster 85-60 “Quick-Tack”.

G. Mineral fiber insulation vapor barrier mastic:

1. Vapor barrier coating for use over ASJ jackets to give a vapor barrier seal at joints, laps and punctures. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
2. Basis of design: Foster 30-65 “Vapor-Fas”.

H. Insulating cement: Mineral fiber cement with a hydraulic-setting binder, conforming to ASTM C 449. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

2.3 FLEXIBLE ELASTOMERIC INSULATION MATERIALS

A. Flexible elastomeric preformed pipe insulation: Closed-cell, sponge- or expanded-rubber, ASTM C 534, Type I for tubular materials. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

B. Flexible elastomeric preformed fitting and valve covers: Closed-cell, sponge- or expanded-rubber, made from the same material and density as adjacent pipe insulation, meeting ASTM C 450 requirements for dimensions used in forming insulation to cover valves, elbows, tees, flanges, strainers, and unions. Provide with preformed PVC field-applied jacket. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

C. Flexible elastomeric insulation adhesive:

1. Water resistant contact cement designed especially suited for bonding two impermeable surfaces and recommended for rubber foam, steel, or aluminum surfaces, and compatible

with service temperatures. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
2. Basis of design: Foster 85-75 “Drion”.

D. Flexible Elastomeric Tape:

1. Black, closed cell, self-adhering, elastomeric thermal insulation tape for insulating pipes and fittings, 0.125 inch (3 mm) thick, 2 inches (50 mm) wide.
2. ASTM C 534 Grade 1.
3. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

E. Flexible elastomeric insulation vapor barrier coating:

1. Water-based latex enamel coating for use over flexible elastomeric insulation, providing a moisture-resistant protective finish suitable for both indoor and outdoor applications. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
2. Basis of design: Armacell “WB Armaflex” latex enamel.

2.4 FIELD-APPLIED JACKETS

A. Aluminum jacket:

1. Jacket material: Smooth aluminum 0.016-inch (0.4 mm) thickness, lined with a bonded moisture barrier, factory cut and rolled to size, conforming to ASTM C 1729.
2. Fitting covers: Manufacturer’s factory-fabricated fitting covers made from the same material, finish, and thickness as the jacket, suitable to the size of fittings and thickness of insulation. Provide factory fabricated fitting covers for elbows, tees, flanges, unions, reducers, end caps, valves, and other fittings. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
3. Aluminum straps: Same alloy as jacket, conforming to ASTM B 209.

B. Polyvinyl chloride (PVC) jacket:

1. Jacket material: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; 20 mils (0.5 mm) thick; roll stock ready for shop or field cutting and forming. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
2. Color: White
3. Adhesive: As recommended by jacket material manufacturer. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
4. Fitting covers: Manufacturer’s factory-fabricated fitting covers made from the same material, finish, and thickness as the jacket, suitable to the size of fittings and thickness of insulation. Provide factory fabricated fitting covers for elbows, tees, flanges, unions, reducers, end caps, valves, and other fittings. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

5. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket and fitting covers with acrylic adhesive; suitable for indoor and outdoor applications, 2 inch (50 mm) width, 6 mil (0.15 mm) thickness. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

2.5 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Fabric-reinforcing mesh:

1. Woven Glass-Fiber Fabric: Approximately 2 ounces per square yard (68 grams per square meter) for covering pipe and pipe fittings.

2.6 FIELD-APPLIED GLASS CLOTH

A. Glass cloth: Woven Glass-Fiber Fabric: MIL-C-20079H. Type I, plain weave, 8 ounces per square yard (270 grams per square meter).

B. Glass cloth tape: Type II, Class 3, 4.5 ounces per square yard (150 grams per square meter).

C. Lagging finish coating:

1. Washable, abrasion-resistant, indoor insulation coating for glass lagging cloth. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
2. Basis of design: Foster 30-36 “Sealfas”.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Provide interior piping insulation in accordance with the Minimum Insulation Thickness Schedule for Interior Applications at the end of this section, as modified by specifications for each location and type.

B. Provide field applied jackets in accordance with the Field-Applied Jacket Schedule at the end of this section, as modified by specifications for each location and type.

C. Provide mineral fiber insulation unless otherwise indicated.

D. Apply insulation in a neat and workmanlike manner and in accordance with manufacturer’s printed instructions.

E. Maintain a continuous vapor barrier on systems that convey fluid at below-ambient temperatures, including the following applications:

1. Domestic cold water piping
2. Storm water piping

3. Roof drain bodies
4. Sanitary piping receiving air-conditioning condensate
5. Floor drain bodies receiving air-conditioning condensate
6. Air-conditioning condensate piping
7. Sump pump discharge piping

F. Where a continuous vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

G. Installation at pipe hangers:

1. Insulation shall be continuous through hangers for all piping systems.
2. Install pipe covering protection shields with thickness of structural insulation inserts equal, under load, to that of adjoining insulation.
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.
5. Shields and structural insulation inserts are specified in Section 22 05 29, Hangers and Supports for Plumbing Piping and Equipment.

H. Where insulated piping systems pass through sleeves or openings in partitions and floors, the insulation shall be continuous through the sleeves and openings. See Firestopping specifications for coordinating insulation and firestopping.

I. Do not insulate chrome-plated piping connections to plumbing fixtures, except wheelchair-accessible lavatories shall be insulated with special insulation and finish assemblies specified in Section 22 42 00.

J. 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.

K. 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.

L. Install insulation with longitudinal seams at top and bottom of horizontal runs.

M. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

N. Install insulation with least number of joints practical.

O. Finish installation with systems at operating conditions. Repair separations and cracking caused by thermal movement.

3.2 INSTALLING MINERAL FIBER INSULATION

A. Install insulation with factory-applied jackets as follows:

1. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive.
2. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap.
3. Cover circumferential joints and longitudinal seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
4. Where a continuous vapor barrier is indicated, apply vapor-barrier mastic on longitudinal seams and circumferential joints and at ends adjacent to pipe flanges and fittings.
5. Repair damaged insulation jackets by applying same jacket material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere and seal patches.

B. 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 using mineral fiber preformed fitting and valve covers whenever possible. Install preformed fittings with adhesive.
3. Where mineral fiber preformed fitting and valve covers are not available, insulate using mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining pieces 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. Coat with mastic. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
4. Valves: Insulate up to and including the bonnets, stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
5. Strainers: Insulate so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover.
6. Flanges and unions: Install preformed pipe insulation to outer diameter of flange or union. Make width of insulation section same as overall width of union or flange and bolts, plus twice the thickness of pipe insulation. Fill voids between inner circumference of flange or union insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
7. Install fitted PVC cover. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

C. Installation of floor drain bodies that receive air-conditioning condensate and roof drain bodies:

1. Provide mineral fiber blanket insulation, 1 inch thick minimum, adhered to drain body.
2. Coat with mastic.
3. Finish with two coats of lagging finish coating with glass cloth and tape embedded between coats.

3.3 INSTALLING FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and circumferential joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Installation on fittings and flanges:

1. Install insulation over fittings and flanges with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate using flexible elastomeric preformed fitting covers whenever possible. Install preformed fittings with adhesive. Tape and seal with vapor barrier coating.
3. Where flexible elastomeric preformed fitting covers are not available, insulate using mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining pieces and bonded with adhesive. Tape and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. Seal with vapor barrier coating.
4. Flanges: Install pre-formed pipe insulation to outer diameter of pipe flange. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation. 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. Secure insulation to flanges and tape and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. Seal with vapor barrier coating.
5. Install fitted PVC cover. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

3.4 INSTALLING FIELD-APPLIED JACKETS

A. Installing aluminum jacket:

1. Provide jacket tight to insulation.
2. Secure in place with aluminum straps at all circumferential joints and on minimum 12-inch (305-mm) centers.
3. Provide with 2-inch (50-mm) overlap at longitudinal seams and circumferential joints.
4. Interior Applications: Orient longitudinal seams to face a wall or ceiling.
5. Exterior Applications: Arrange overlap at longitudinal seams and joints to shed water. Seal seams and joints with weatherproof sealant recommended by insulation manufacturer.

B. Installing PVC jacket:

1. Provide jacket tight to insulation.
2. Provide with 1-inch (25-mm) overlap at longitudinal seams and circumferential joints.
3. For horizontal applications, install with longitudinal seams along top and bottom of pipes.
4. Seal with manufacturer’s recommended adhesive. Apply two continuous beads of adhesive to seams and joints, one bead under the jacket lap and another finish bead along each seam and joint edge.
5. Seams and joints shall completely prevent the entrance of water.

C. Installing canvas jacket: Adhere canvas jacket with lagging adhesive. Finish with lagging finish coating, ready for painting.

3.5 SCHEDULES

A. Minimum insulation thickness schedule for interior applications:

MINIMUM INSULATION THICKNESS SCHEDULE FOR INTERIOR APPLICATIONS (3)		
Application	Fluid Temperature Range	All Pipe Sizes
Domestic Hot Water & Domestic Hot Water Return Piping (2)	105F to 140F (40C to 60C)	1.5-inch (38 mm)
Domestic Cold or Tempered Water Piping (1)	--	1-inch (25 mm)
Horizontal Storm Water Piping	--	1-inch (25 mm)
Vertical Storm Water Piping Within 5 Feet (1.5 meters) of Floor Slab on Grade (1)	--	1-inch (25 mm)
All Storm Water Piping Receiving Air-Conditioning Condensate (1)	--	1-inch (25 mm)
Roof Drain Bodies	--	1-inch (25 mm)
Sanitary Piping Receiving Air-Conditioning Condensate (1)	--	1-inch (25 mm)
Floor Drain Bodies Receiving Air-Conditioning Condensate	--	1-inch (25 mm)
Air-conditioning Condensate Piping, Gravity and Pumped (1)	--	1-inch (25 mm)
Sump Pump Discharge Piping (1,4)	--	1-inch (25 mm)
Solar Piping	141F to 200F (60C to 93C)	2-inch (50 mm)

(1) - Contractor's Option within partitions only: 0.5-inch (13mm) flexible elastomeric insulation.
(2) - Contractor's Option within partitions only: 1-inch (25 mm) flexible elastomeric insulation for piping NPS 1.25 (DN 32) and smaller.
(3) - See additional specified thickness requirements for exterior applications.
(4) - Insulate where fluid conveyed is below ambient temperature, including but not limited to storm water, ground water, and air conditioning condensate.

B. Field-applied jacket schedule:

FIELD-APPLIED JACKET SCHEDULE		
Application	PVC Jacket	Aluminum Jacket
Exterior applications	X	X
Crawl spaces and tunnels	X	
Pipe insulation exposed in finished areas within 8 feet (2440 mm) of the finished floor		X
Pipe insulation exposed in finished areas more than 8 feet (2440 mm) above the finished floor	X	
Pipe insulation exposed in mechanical rooms, penthouses, and other service areas not accessible to the public.	X	

END OF SECTION 22 07 19

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 22 11 16 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Domestic cold water piping.

B. Domestic hot water piping.

C. Recirculated hot water piping.

D. Tempered water piping.

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Water meter for monitoring by HVAC control system: Division 23.

1.3 RELATED SECTIONS

A. Piping installation and testing: Section 22 05 00.

1.4 REFERENCES

A. American Society of Mechanical Engineers

1. ASME B 16.18: Cast Copper Alloy Solder Joint Pressure Fittings
2. ASME B 16.22: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
3. ASME B16.24: Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves: Classes 150, 300, 600, 900, 1500, and 2500

B. American Society of Mechanical Engineers/American National Standards Institute

1. ASME/ANSI B16.1: Cast iron pipe flanges and flanged fittings
2. ASME/ANSI B16.5: Pipe flanges and flanged fittings

C. American Society of Testing and Materials

1. ASTM A 182: Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
2. ASTM A 240: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
3. ASTM A 312: Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes

4. ASTM A 403: Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings
5. ASTM A 536: Standard Specification for Ductile Iron Castings
6. ASTM B 75: Standard Specification for Seamless Copper Tube
7. ASTM B 88: Standard Specification for Seamless Copper Water Tube
8. ASTM B 584: Standard Specification for Copper Alloy Sand Castings for General Applications
9. ASTM F 1545: Standard Specification for Plastic-Lined Ferrous Metal Pipe, Fittings, and Flanges

D. American Water Works Association

1. AWWA C-104: American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
2. AWWA C-110: American National Standard for Ductile-Iron and Gray-Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids
3. AWWA C-111: American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
4. AWWA C-151: American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water

E. National Sanitation Foundation/American National Standards Institute

1. NSF/ANSI 61: Drinking Water System Components – Health Effects

1.5 DEFINITIONS

A. Domestic water system: Potable water system for general human use, including hot and cold water supply and return.

1.6 SUBMITTALS

A. Product data: Each type of pipe and fitting included in the project.

B. Certification that products comply with NSF/ANSI 61.

C. Submit proposed method for providing electrical continuity at pipe joints in water service pipe.

D. Submit proposed means for anchoring pipes at water service entrance.

E. Certifications: Disinfection test report

F. Submit a single manufacturer for each product. Submittals that include multiple manufacturers for a single product are not acceptable.

1.7 QUALITY ASSURANCE

A. Lead free requirements:

1. Potable water system components intended to dispense water for human consumption, including pipe and joining materials, shall comply with NSF/ANSI 61 and with requirements for “lead-free” plumbing as defined by state laws and U.S. Safe Drinking Act.
2. Acceptance product marking: NSF®-61.

B. Pipe shall be certified by the manufacturer to meet referenced standards and shall bear a label directly on the pipe, indicating compliance.

PART 2 - PRODUCTS

2.1 ACCEPTABLE SUPPLIERS

A. Disinfection of domestic water system:

1. ARC Water Treatment Company, Inc.
2. Ecolab
3. Water Chemical Services, Inc.
4. Olin Water Services
5. Or approved equal.

2.2 ABOVE GROUND PIPE

A. Copper: ASTM B 88, Type L hard drawn.

2.3 ABOVE GROUND FITTINGS

A. General requirements for fittings:

1. Elbows in piping NPS 4 (DN 100) and larger shall be long radius type.

B. Cast or wrought fittings for copper pipe:

1. General: Solder joint, cast brass, ASME B16.18; or wrought copper, ASME B16.22.
2. Flanges: Bronze, solder type, ASME B16.24, Class 150.

C. Dielectric nipples:

1. Standard: IAPMO PS 66.
2. Electroplated steel nipple complying with ASTM F 1545.
3. Pressure Rating and Temperature: 300 psig (2,070 kPa) at 225 degrees F (107 degrees C).
4. End Connections: Male threaded or grooved.

5. Lining: Inert and noncorrosive, propylene.

2.4 UNDERGROUND PIPE AND FITTINGS

A. Ductile iron pipe and fittings:

1. Pipe:

a. AWWA C-151, Class 54.
b. AWWA C-104 cement lining.
c. AWWA C-111 mechanical or push-on joints.

2. Fittings: AWWA C-110, ductile iron, Class 350.

B. Copper Type K pipe and fittings:

1. Pipe: Copper tubing, ASTM B 88, Type K, hard drawn, plain end.
2. Fittings: Solder joint, cast brass, ASME B16.18, or wrought copper, ASME B16.22.

C. Abutments: Concrete, not less than three pipe diameters wide and two pipe diameters high.

PART 3 - EXECUTION

3.1 GENERAL

A. Install domestic water piping as shown on the drawings and in accordance with the provisions of Section 22 05 00, Common Work Results for Plumbing.

B. Install piping in accordance with the Schedule of Pipe Systems, Sizes, and Materials at the end of this section.

C. Provide drain valves at low points of domestic water system for drainage.

D. Install water meters in domestic water applications, and for monitoring by HVAC control system, furnished under Division 23.

1. Provide pipe flanges for meter. Provide pipe supports on either side of meter.
2. Provide isolation valves to facilitate replacement and service as shown on the drawings.
3. Provide a bypass valve where shown on the drawings.
4. Provide upstream and downstream straight run of piping in compliance with the manufacturer’s recommendations.

3.2 INSTALLING DIELECTRIC ISOLATION

A. Provide dielectric flanges with isolation sleeves for bolts and isolation washers on each side of flanged connection at flanged points of connection between ferrous piping and copper piping.

B. Provide dielectric nipples at connections between existing ferrous piping and copper piping.

3.3 INSTALLING UNDERGROUND PIPE AND FITTINGS

A. General installation:

1. Provide electrical continuity in water service pipe joints. Provide conductivity strips, wedges, or other approved methods where required.

2. Provide a shutoff valve at the point of water service entrance.

B. Ductile iron pipe installation:

1. Prevent injury to the pipe coating.
2. Install abutments at each change in pipe direction, resting on and transmitting thrust to undisturbed earth.
3. Anchor pipe at the point of building entrance with clamps or special fittings.

3.4 TESTING OF DOMESTIC WATER SYSTEM

A. When domestic water piping is completed, and before strainer baskets are installed, pressure test at the pressure shown in Piping Test Table in Section 22 05 00.

3.5 CLEANING OF DOMESTIC WATER SYSTEM

A. Flushing of building systems:

1. Flush domestic cold water, domestic hot water, recirculated hot water, and tempered water piping before using. Unless prescribed otherwise by the county or state health department, the method of flushing shall be as follows:
2. Do not allow flushing water for piping to travel through plumbing equipment. Isolate equipment by closing isolation valves and opening bypass valves or by leaving piping disconnected from equipment.
3. Flush new piping segments as the work progresses.
4. Provide temporary domestic water and drain piping as needed. Remove when flushing is complete.
5. Drain water from the segment low point to a safe location and replace water at the same rate.
6. Continue until drain water is free from sediment, scale, rust and other foreign substances.
7. Flush every new branch of piping, for a minimum of 15 minutes after running clean.
8. Install strainer baskets.
9. Disinfect piping as described below.

B. Disinfection of building systems:

1. Disinfect domestic cold water, domestic hot water, recirculated hot water, and tempered water piping before using. Unless prescribed otherwise by the county or state health department, the method of flushing shall be as follows:
2. Provide temporary domestic water and drain piping as needed. Remove when disinfection is complete.
3. Through a NPS 0.75 (DN 20) hose connection in the main downstream of the backflow preventer, pump in sodium hypochlorite to produce a free available chlorine residual of not less than 200 ppm. Provide plumbing connections and power for pumping chlorine into the system.
4. Fill all piping systems with chlorinated water.
5. Proceed downstream from the point of chlorine application, opening each water source for each faucet and outlet until chlorine is detected at a concentration of 200 ppm. Close each water source for each faucet and outlet when chlorine is evident at the required concentration.
6. Energize domestic water recirculation systems or provide another means of filling domestic hot water return piping with chlorinated water at a concentration of 200 ppm.
7. Retain this water in the system for at least three hours, but no more than 3.5 hours.
8. At the end of the retention period, verify that no less than 100 ppm of chlorine are present at the most remote end of the system.
9. Open all faucets and outlets and flush all piping until the chlorine residual in the water is less than 1 ppm.
10. Obtain a representative water sample from the system for analysis by a recognized bacteriological testing laboratory.
11. If the sample tested for coliform organisms is negative, the testing organization shall submit a letter and laboratory report to the Contractor, certifying successful completion of the disinfection. Submit the letter and report.
12. If any samples tested indicate the presence of coliform organisms, repeat the entire disinfection procedure.

3.6 SCHEDULE OF PIPE SYSTEMS, SIZES AND MATERIALS

A. Pipe schedules apply to domestic cold water, domestic hot water, domestic hot water return, and domestic temper water piping.

B. Above ground piping:

	Copper Type L cast or wrought fittings
NPS 2.5 (DN 65) and smaller	X
NPS 3 (DN 80) and NPS 4 (DN 100)	X
NPS 5 (DN 125) and larger	X

C. Above ground water service entrance or combination fire and water service entrance piping:

	Copper Type L cast or wrought fittings
NPS 2.5 (DN 65) and smaller	X
NPS 3 (DN 80) and larger	X

D. Below ground piping:

	Copper Type K cast or wrought fittings	Ductile iron push-on joints
NPS 2.5 (DN 65) and smaller	X	
NPS 3 (DN 80) and larger		X

END OF SECTION 22 11 16

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Backflow preventers.

B. Strainers.

C. Trap primers.

D. Water hammer arrestors (shock absorbers).

E. Thermostatic water temperature controllers.

F. Pressure relief valves.

1.2 RELATED SECTIONS

A. Piping:

1. Domestic water piping: Section 22 11 16.

B. Curbs and flashings: Section 22 05 06.

C. Insulation: Section 22 07 19.

1.3 REFERENCES

A. American National Standards Institute:

1. ANSI B1.20.1: Pipe Threads, General Purpose, Inch.
2. ANSI B 16.22: Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
3. ANSI Z21.22: Relief Valves for Hot Water Supply Systems.

B. American Society of Mechanical Engineers:

1. ASME A112.1.2: Air Gaps in Plumbing Systems (For Plumbing Fixtures and
2. Water-Connected Receptors).
3. ASME B16.18: Cast Copper Alloy Solder Joint Pressure Fittings.
4. ASME B16.22: Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

C. American Society of Sanitary Engineering:

1. ASSE 1001: Performance Requirements for Atmospheric Type Vacuum Breakers.

2. ASSE 1010: Performance Requirements for Water Hammer Arresters.
3. ASSE 1013: Performance Requirements for Reduced Pressure Principle Backflow Prevention Assemblies.
4. ASSE 1015: Performance Requirements for Double Check Backflow Prevention Assemblies.
5. ASSE 1017: Performance Requirements for Temperature Actuated Mixing Valves For Hot Water Distribution Systems.
6. ASSE 1018: Performance Requirements for Trap Seal Primer Valves - Potable Water Supplied.
7. ASSE 1044: Performance Requirements for Trap Seal Primer – Drainage Types and Electric Design Types.
8. ASSE 1070: Performance Requirements for Water Temperature Limiting Devices.

D. American Society for Testing and Materials:

1. ASTM B88: Standard Specification for Seamless Copper Water Tube.
2. ASTM B584: Standard Specification for Copper Alloy Sand Castings for General Applications.

E. PDI-WH 201: Water Hammer Arresters.

F. NSF/ANSI 61: Drinking Water System Components – Health Effects.

1.4 SUBMITTALS

A. Product data: Each specialty device or equipment, with installation instructions.

B. Certification that products comply with NSF/ANSI 61.

1.5 QUALITY ASSURANCE

A. Lead free requirements:

1. Potable water system components intended to dispense water for human consumption, including pipe and joining materials, shall comply with NSF/ANSI 61 and with requirements for “lead-free” plumbing as defined by state laws and U.S. Safe Drinking Act.
2. Acceptance product marking: NSF®-61.

B. Minimum working pressure: 125 psi (860 kPa) unless otherwise indicated.

PART 2 - PRODUCTS

2.1 BACKFLOW PREVENTERS

A. Acceptable Manufacturers

1. Ames
2. Febco
3. Watts Industries
4. Zurn-Wilkins
5. Or approved equal.

B. Double-check, backflow-prevention assemblies for domestic water service.

1. Standard: ASSE 1015.
2. Operation: Continuous-pressure applications unless otherwise indicated.
3. Pressure Loss: 5 psig (35 kPa) maximum, through middle one-third of flow range.
4. Body Material: Bronze for NPS 2 (DN 50) and smaller; stainless steel for NPS 2-1/2 (DN 65) and larger.
5. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
6. Configuration: Designed for horizontal, straight through flow.
7. Accessories: Ball valves with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; OS&Y gate valves with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.

2.2 STRAINERS

A. Acceptable Manufacturers

1. Keckley
2. Mueller Steam Specialty
3. Spirax Sarco Inc.
4. Tate Andale, Inc. “Guardian”
5. Watts Industries, Inc.
6. Or approved equal.

B. Minimum pressure rating: 125 psi (860 kPa)

C. Basket-type water strainers:

1. Epoxy-coated cast iron, flanged,
2. Type 304 stainless-steel screen with 1/8-inch (3-mm) perforations.
3. Basis of design: Mueller Steam Specialty No. 165. Basket:

D. Y-type strainers: Include with plugged blow-down connections and stainless steel strainers with maximum 0.045-inch (1.2-mm) perforations.

1. Pipe sizes NPS 2.0 (DN 50) and smaller: Brass body, threaded ends.

   a. Basis of design: Watts Series LF777SI.

2. Pipe sizes NPS 2.5 (DN 65) and larger: Stainless steel body, flanged ends.

a. Basis of design: Watts Series 77F-CSSI.

2.3 TRAP PRIMERS

A. Trap primers from water closet flush valves:

1. Acceptable Manufacturers:

a. Delaney
b. Sloan
c. Zurn Plumbing Products
d. Or approved equal.

2. Tailpiece assembly with chrome-plated fittings and chrome-plated flexible copper tubing and wall flange.

a. Basis of design: Sloan Valve Company Model VBF-72-A.

B. Pressure-differential activated trap primers:

1. Acceptable Manufacturers:

a. Precision Plumbing Products
b. Sioux Chief Manufacturing
c. Zurn Plumbing Products
d. Or approved equal.

2. ASSE 1018, trap primer valves to accommodate one to four floor primer outlets. Bronze body with stainless steel Primers shall release a metered amount of water when a 10 psi (70 kPa) pressure drop is sensed in the connected water line.

a. Distribution unit: Connects directly to the primer valve with up to four 5/8 inch OD compression outlet fittings for NPS 0.5 (DN 15) copper tubing.
b. Operating range: 20 - 80 psi (138 - 552 kPa).
c. Basis of design: Precision Plumbing Products P-1 and P-2 Series trap primer valves.

C. Flow activated trap primers:

1. Acceptable Manufacturers:

a. Mainline
b. Precision Plumbing Products
c. Or approved equal.

2. ASSE 1018, trap primer valves to accommodate one to four floor primer outlets. Bronze body with integral vacuum breaker. Primers shall release a metered amount of water when water flows the primer as a downstream fixture is used.

a. Distribution unit: Connects directly to the primer valve with up to four 5/8 inch OD compression outlet fittings for NPS 0.5 (DN 15) copper tubing.
b. Operating range: 20 - 80 psi (138 - 552 kPa).
c. In-line flow: 0.25 – 7 gpm (1 – 26.5 l/m).
d. Basis of design: Precision Plumbing Products Prime-Pro.

D. Automatic trap priming system:

1. Acceptable Manufacturers:

a. Hydronic Modules Corporation
b. Precision Plumbing Products
c. Sioux Chief Manufacturing
d. Zurn Plumbing Products
e. Or approved equal.

2. ASSE 1044, electronic trap priming system, factory assembled unit:

a. Pre-set 24-hour timer that actuates a solenoid valve 10 seconds every 24 hours providing 2.0 ounces discharge at 20 psi (138 kPa) inlet pressure.
b. NPS 0.75 (DN 20) copper inlet connection with bronze ball type shutoff valve.
c. NPS 0.75 (DN 20) supply manifold with ASSE 1001 atmospheric vacuum breaker, 5/8-inch compression outlet fittings for NPS 0.5 (DN 15) copper tubing. Provide one outlet for each primed floor drain. Manifold shall be calibrated for equal water distribution.
d. Provide a steel surface-mounted cabinet with access cover where concealed above ceilings or mounted in mechanical rooms.
e. Provide a recessed cabinet with stainless steel access cover, full-length piano hinge, and key-lock handle where mounted below ceilings in finished spaces.
f. Electrical: 120V/1/60 single-point power supply, circuit breaker, manual over ride switch and test button.
g. Basis of design: Precision Plumbing Products "Prime-Time Electronic Trap Priming System."

E. Trap primer piping:

1. Above grade piping exposed in bathrooms and finished areas: Chrome-plated copper tubing and fittings.
2. Above grade piping concealed or exposed in mechanical rooms or mechanical closets: Soft copper tube, ASTM B 88, Type L with ASME B16.18 cast copper or ASME B16.22 wrought copper fittings, solder joints.
3. Piping below slabs on earth: Soft copper tube, ASTM B 88, Type K with ASME B16.18 cast copper or ASME B16.22 wrought copper fittings, solder joints.

2.4 WATER HAMMER ARRESTORS

A. Acceptable Manufacturers:

1. MIFAB, Inc.
2. Josam Company
3. Jay R. Smith Manufacturing Company
4. Wade
5. Watts Drainage
6. Zurn Plumbing Products
7. Or approved equal.

B. ASSE 1010 or PDI-WH 201 certified:

1. Construction: Metal bellows or copper tube with piston.
2. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.5 THERMOSTATIC WATER TEMPERATURE CONTROLLERS

A. Acceptable manufacturers:

1. Bradley Corporation
2. Powers Regulator Company
3. Lawler Manufacturing Company, Inc.
4. Leonard Valve Company
5. Symmons Industries, Inc.
6. Or approved equal.

B. General:

1. Provide units of sizes, capacities, and piping arrangements as indicated on the drawings.
2. Construction: Copper or bronze body with corrosion-resistant interior components.
3. Minimum pressure rating: 125 psi (860 kPa).
4. Paraffin-based thermal actuation technology to sense and adjust outlet temperature with vandal-resistant locking mechanism to secure temperature setting.
5. Maximum water pressure drop at design flow rate: 10 psi (70 kPa).
6. Set units for the discharge temperatures specified below unless otherwise indicated on the drawings.

C. Master thermostatic water tempering valves:

1. ASSE 1017 listed.
2. Union and check stop at each inlet.
3. Discharge temperature adjustment range: 90 - 160 degrees F. Set at 120 degrees F.
4. Rigid bulb indicating thermometer at supply outlet; 3-inch dial graduated 30 degrees to 130 degrees F, stainless-steel, hermetically-sealed with external calibration screw.
5. Minimum controllable flow rate without recirculation: 3.0 gpm (11.4 l/m).
6. Rough bronze finish.
7. Basis of design: As scheduled on drawings

2.6 PRESSURE RELIEF VALVES

A. ASME rated, NB approved, automatic reseating type conforming to ANSI Z21.22.

1. Provide straight pressure type where installed in pipe lines and for protection of cold water vessels.
2. Provide combination pressure and temperature type where installed for hot water tanks and vessels.

PART 3 - EXECUTION

3.1 INSTALLING BACKFLOW PREVENTERS

A. Install backflow preventers in the building water supply, each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with requirements of authorities having jurisdiction.

B. Mount 48-inches (120 mm) above the floor unless otherwise noted on the drawings.

C. Strainers may be deleted with backflow preventers at the water service entrance if a strainer is included at the water entrance valving assembly.

D. Install drain piping for backflow preventers, full size of drain connection, with atmospheric-vent drain connection air-gap fitting, and terminate as indicated on the drawings.

E. Do not install bypass piping around backflow preventers.

3.2 INSTALLING STRAINERS

A. Install Y-pattern strainers on the supply side of each control valve, water pressure reducing valve, solenoid valve, pump, and where indicated on the drawings.

B. Install a basket type strainer at the water service entrance.

3.3 INSTALLING TRAP PRIMERS

A. Trap primers from water closet flush valves:

1. Provide trap primers from water closet flush valves for floor drains in toilet rooms.
2. Provide one primer for each floor drain via the tailpiece of the nearest water closet.
3. Trim tailpieces where required to provide adequate clearance between flush valves and ADA grab bars. Provide tailpiece trap priming connections a minimum of 6 inches (152 mm) above the flood rim of the water closet, unless otherwise approved by the authority having jurisdiction.
4. Provide chrome-plated copper tubing for exposed piping, full size of tailpiece connection. Provide a chrome-plated escutcheon at the wall penetration.

B. Pressure-differential activated trap primers:

1. Provide pressure-differential activated trap primers for floor drains outside of toilet rooms and where automatic trap priming systems are not indicated.
2. Install level and plumb to ensure equal flow distribution to all primer lines.
3. Connect primers to cold water lines NPS 1.5 (DN 40) and smaller.
4. Provide a domestic cold water connection with shutoff valve full size of the trap primer inlet connection.
5. Locate trap primers above the floor level of the drains they serve.
6. Locate trap primers in janitor's closets, storage rooms, or other spaces accessible to maintenance personnel. If these locations are not possible, mount in accessible locations concealed above ceilings.

C. Flow activated trap primers:

1. Provide flow activated trap primers for floor drains near fixtures that use domestic cold water and where automatic trap priming systems are not indicated.
2. Install level and plumb to ensure equal flow distribution to all primer lines.
3. Connect primers to cold water lines NPS 1 (DN 25) and smaller. Transition to trap primer connection size if required.
4. Do not install on combination hot and cold water lines.
5. Do not install on piping leading to a drinking fountain or water cooler.
6. Provide a domestic cold water connection with shutoff valve full size of the trap primer inlet connection. Provide cold water from outlet connection to fixture.
7. Locate trap primers above the floor level of the drains they serve.
8. Locate trap primers in janitor's closets, storage rooms, or other spaces accessible to maintenance personnel. If these locations are not possible, mount in accessible locations concealed above ceilings or, where indicated, provide chrome-plated primers below lavatories.

D. Automatic trap priming system:

1. Install automatic trap priming systems where indicated on the drawings.
2. Install level and plumb to ensure equal flow distribution to all primer lines.
3. Provide power connection.
4. Provide a domestic cold water connection with shutoff valve full size of the trap primer inlet connection.
5. Locate trap primers above the floor level of the drains they serve.
6. Locate trap primers in janitor's closets, storage rooms, or other spaces accessible to maintenance personnel. If these locations are not possible, mount in accessible locations concealed above ceilings.

E. Trap primer piping:

1. Provide trap primer piping full size of trap primer outlet connection or larger. Provide a union at the connection.
2. Provide trap primer piping concealed wherever possible.
3. Pitch piping continuously down toward drains at minimum 1.0 percent slope.
4. Connect to floor drain trap primer fittings. Transition to full size of floor drain connection.

5. Replace kinked piping.
6. Sleeve and seal piping at floor penetrations.

3.4 INSTALLING WATER HAMMER ARRESTORS

A. Size and locate water hammer arrestors as recommended by the Plumbing and Drainage Institute Standard PDI-WH 201 or ASSE 1010.

1. Install water hammer arrestors in each branch domestic water pipe (hot and cold) which feeds either a battery of fixtures or a single fixture.
2. Install water hammer arrestors upstream of quick-closure valves.
3. Install water hammer arrestor in accessible locations.

3.5 INSTALLING WATER TEMPERATURE CONTROLLERS

A. Install and connect controllers as shown on the drawings and in compliance with the manufacturer’s recommendations.

B. Adjust controllers to specified supply temperatures or as indicated on the drawings.

3.6 INSTALLING PRESSURE RELIEF VALVES

A. Install pressure relief valve in accordance with the equipment manufacturer's recommendations.

END OF SECTION 22 11 19

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 22 11 23 - DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. In-line circulator pumps.

1.2 RELATED SECTIONS

A. UL label, demonstration, training, and equipment installation: Section 22 05 00.

B. Motors: Section 22 05 13.

C. Equipment supports: Section 22 05 29.

D. Controls: Sections 23 09 01 through 23 09 23.

1.3 REFERENCES

A. ASME/ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

B. ASHRAE 90.1: Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings.

C. NSF/ANSI 61 - Drinking Water System Components – Health Effects.

D. Underwriters Laboratories

1. UL 508 - Standard for Industrial Control Equipment.
2. UL 778 - Standard for Motor-Operated Water Pumps.

1.4 SUBMITTALS

A. Product data: Include certified performance curves and rated capacities of selected models; shipping, installed, and operating weights; furnished specialties; and accessories for each type and size of pump specified. Indicate pumps' operating point on curves.

B. Certification that products comply with NSF/ANSI 61.

C. Certification that products comply with energy performance requirements of ASHRAE 90.1.

D. Shop drawings: Show layout and connections for pumps. Include setting drawings with templates, directions for installation of foundation and anchor bolts, and other anchorages.

1. Wiring diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.

E. Maintenance data: For each pump specified, to include in maintenance manuals specified in Division 01 and Section 22 01 01.

1.5 QUALITY ASSURANCE

A. UL label: As specified in Section 22 05 00, Common Work Results for Plumbing.

B. Lead free requirements:

1. Potable water system components intended to dispense water for human consumption, including pipe and joining materials, shall comply with NSF/ANSI 61 and with requirements for “lead-free” plumbing as defined by state laws and U.S. Safe Drinking Act.
2. Acceptance product marking: NSF®-61.

C. Comply with the energy performance requirements of ASHRAE 90.1.

D. Department of Energy (DOE) compliance: Pump manufactures shall comply with US Department of Energy (DOE) energy conservation standard that pertains to applicable pumps with 1 horsepower or greater. These pumps shall be evaluated using the Pump Energy Index (PEI) that determines the efficiency rating and DOE compliance. The lower the number the higher the efficiency.

1. Pumps shall have a PEI rating of 1 or less to comply with the standard.
2. The PEI compliant rating shall appear on the pumps permanent nameplate.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Specified units are the basis for design of the project. The following listed manufacturers also provide units of acceptable quality. If units by any of these manufacturers should be proposed, verify that they meet requirements specified in Division 01 and the article "Product Options" in Section 22 01 01, and submit shop drawings as specified in the “Submittals” article above.

B. In-line circulator pumps:

1. Armstrong Fluid Technology
2. Bell and Gossett, a xylem brand
3. Crane Pumps and Systems
4. Grundfos Pumps Corporation
5. Taco Comfort Solutions
6. Or approved equal.

2.2 GENERAL REQUIREMENTS

A. Provide type, size, configuration, capacity, and current characteristics indicated on the drawings.

B. Motors:

1. Provide motors that meet requirements in Section 22 05 13, Common Motor Requirements for HVAC Equipment.
2. Where electronically commutated motors are schedule, provide a controller with both of the following:

    a. Provide with a potentiometer for adjustment of constant speed operation, field-adjustable with a screwdriver to adjust the fan speed, and low voltage input terminals to receive a control signal from the building automation system to start and stop the fan motor.
    b. Provide with low voltage input terminals to receive a control signal from the building automation system to start and stop the fan motor and control the motor speed for variable speed operation.

3. Where electronically commutated motors are schedule, and where required on the drawings, provide packaged control capable capabilities to support the sequence of operation.
4. Single-phase motors that are not electronically commutated motors shall be permanent split-capacitor type.

C. Pumps shall comply with the DOE Energy Conservation Standard with a PEI rating of 1 or less.

2.3 IN-LINE CIRCULATOR PUMP

A. Provide a cartridge type circulator. “Low lead” bronze or stainless-steel body, stainless-steel cartridge with non-metallic impeller, ceramic shaft, carbon bearings and EPDM seals.

1. Basis of design: Taco Comfort Solutions Series 00.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install equipment as indicated on the drawings. Comply with requirements in Section 22 05 00.

3.2 INSTALLING IN-LINE CIRCULATOR PUMP

A. Support:

1. Support in line circulator pumps from piping.
2. Provide support for piping near the pump inlet and the pump outlet.

3. Provide hangers with sufficient capacity to support the piping and the pump.
4. Provide additional support for pump and motor where required by the manufacturer's recommendations.

B. Provide center-guided, spring-loaded silent-action check valves in discharge piping.

C. Provide valves for pump isolation on the suction and discharge side of each pump.

D. Provide gauge taps in the piping at the inlet and outlet of each pump.

3.3 OPERATING INSTRUCTIONS

A. As specified in Section 22 05 00, provide operating instructions.

END OF SECTION 22 11 23

SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Sanitary piping

B. Equipment drains

C. Radon vent piping

1.2 RELATED SECTIONS

A. Piping installation and testing: Section 22 05 00.

B. Sanitary waste piping specialties: Section 22 13 19.

1.3 REFERENCES

A. Cast iron piping standards

1. ASTM A 74: Standard Specification for Cast Iron Soil Pipe and Fittings
2. ASTM C 564: Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
3. ASTM C1540: Standard Specification for Heavy-Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings
4. CISPI 301: Standard Specification for hubless cast iron soil pipe and fittings for sanitary and storm drain, waste, and vent piping applications

B. Copper (DWV) piping standards

1. ANSI/ASME B16.29: Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fitting: DWV
2. ASME/ANSI B16.23: Cast Copper Alloy Solder Joint Drainage Fittings: DWV
3. ASTM B 306: Standard Specification for Copper Drainage Tube (DWV)

C. Copper Type L and M piping standards

1. ASME/ANSI B 16.18: Cast Copper Alloy Solder Joint Pressure Fittings
2. ASME/ANSI B 16.22: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
3. ASTM B 88: Standard Specification for Seamless Copper Water Tube

D. PVC (DWV) piping standards

1. ASTM D 1785: Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
2. ASTM D 2321: Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
3. ASTM D 2564: Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
4. ASTM D 2665: Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

E. PVC (Schedule 80) piping standards

1. ASTM D 1784: Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
2. ASTM D 1785: Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
3. ASTM D 2464: Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
4. ASTM D 2467: Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

1.4 SUBMITTALS

A. Product data: Each specified material and product.

B. Submit a single manufacturer for each product. Submittals that include multiple manufacturers for a single product are not acceptable.

1.5 QUALITY ASSURANCE

A. Cast iron pipe and fittings shall be marked with the collective trademarks of the Cast Iron Soil Pipe Institute (CISPI) and listed by NSF International.

B. Prior to any new piping installation, verify the inverts of piping to which new work is to be attached. Demonstrate to the satisfaction of the construction manager and/or Owner, that the connections to existing sanitary pipes meet the intent of the contract.

C. Pipe shall be certified by the manufacturer to meet referenced standards and shall bear a label, directly on the pipe, indicating compliance.

D. Clean, rod, and flush existing sanitary piping as necessary to maintain gravity flow.

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS

A. Install each type of pipe and fittings in locations required or permitted in Part 3, including the Pipe Installation Schedule at the end of the section.

B. Cast-iron hub and spigot pipe and fittings:

1. Pipe: ASTM A 74 service class
2. Neoprene gaskets joints:

a. Lifetime ASTM C 564 neoprene gasket joints
b. Basis of design: Fernco “Multi-Tite”, Tyler Pipe “Ty-seal”, or Mission Rubber “Mission-Tite.”

C. Cast-iron no-hub pipe and fittings:

1. Pipe and fittings: Cast Iron Soil Pipe Institute Standard 301.
2. Joints: Use one of the no-hub coupling options below

a. Option 1 (for use in any location):

(1) ASTM C 564 neoprene gaskets and two-piece cast-iron housing clamps and stainless-steel bolts and nuts.
(2) Basis of design: Products of MG Piping Products Company.

b. Option 2 (for use in any location):

(1) Corrugated 304 stainless-steel shields with four or six clamps and holding bolts conforming to ASTM C 1540 and rubber gasket sealing sleeves conforming to ASTM C 564
(2) Basis of design: Husky “Series 4000” coupling or Mission "Heavy Weight Series CHW" coupling.

3. Pipe and fitting restraints:

a. Provide for piping NPS 5 (DN 125) and larger
b. Factory fabricated pipe and fitting restraint assemblies rated to prevent pipe separation under fluid thrust forces up to 50 feet of head in conformance with CISPI 301.
c. Basis of design: Holdrite No. 117 No-Hub Pipe and Fitting Restraint.

B. Copper tube (DWV) pipe and fittings:

1. Pipe: copper tubing Type DWV, ASTM B 306
2. Fittings: Wrought copper drainage fittings and soldered joints conforming to ASME/ANSI B16.29 or cast-brass fittings conforming to ASME/ANSI B16.23.

C. Copper Type L and M pipe and fittings:

1. Pipe: ASTM B 88, Type L or M, hard drawn.
2. Fittings: Solder joint, cast brass, ASME B16.18; or wrought copper, ASME B16.22.

D. PVC (DWV) pipe and fittings:

1. Pipe: PVC, Schedule 40, ASTM D 1785.
2. Fittings: PVC, DWV, ASTM D 2665.
3. Solvent cement: PVC, ASTM D 2564.

E. PVC (Schedule 80) pipe and fittings:

1. Pipe: PVC, Schedule 80 pipe, manufactured from PVC compound with a cell class of 12454 per ASTM D 1784. Pipe shall be iron pipe size (IPS) conforming to ASTM D 1785.
2. Fittings: PVC, Schedule 80 fittings, manufactured from PVC compound with a cell class of 12454 per ASTM D 1784. Socket fittings shall comply with ASTM D 2467 and threaded fittings shall comply with ASTM D 2464.
3. Solvent cement: PVC, ASTM D 2564.

PART 3 - EXECUTION

3.1 PREPARATION

A. Connect piping as shown on the drawings. Check elevations of connection points before installing new work.

3.2 INSTALLATION, GENERAL

A. Use suitable tools and appliances for the safe and convenient handling and laying of pipe. Examine each section of pipe for defects. Do not lay any piece that is known to be defective. If any defective piece should be discovered after having been laid, remove and replace it at no change to the contract price.

B. Install piping in accordance with the Pipe Installation Schedule at the end of this section, as indicated on the drawings, and in accordance with Section 22 0500, Common Work Results for Plumbing. Materials and work shall conform to local plumbing codes and health department regulations.

C. Thoroughly clean all pipe and fittings before installing them, and keep them clean until the acceptance of the completed work. Cap or plug ends of lines to prevent debris from entering during construction.

3.3 INSTALLING CAST-IRON PIPING

A. 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." Install restraint assemblies at pipe couplings and fittings for piping NPS 5 (DN 125) and larger.

3.4 INSTALLING COPPER PIPING

A. Install aboveground copper tubing according to Copper Development Association, Inc. (CDA) "Copper Tube Handbook."

3.5 INSTALLING PVC (DWV) PIPING

A. Install aboveground PVC piping according to ASTM D 2665.

B. Install underground PVC piping according to ASTM D 2321.

C. Provide listed plastic pipe penetration protection at penetrations of fire-rated floors and assemblies.

D. PVC piping is not permitted in ceiling plenums or shafts used to convey HVAC system air.

3.6 INSTALLING SANITARY AND VENT PIPING

A. Make changes in direction of sanitary piping with approved sanitary fittings, Y branches, 1/8 or 1/16 bends.

B. In soil, waste, and vent stacks where branches occur that are smaller than stacks, provide properly sized reducing fittings.

C. Provide sanitary piping at a 2 percent minimum downward slope in the direction of flow unless otherwise indicated.

D. Provide vent piping at a 1 percent minimum downward slope toward vertical fixture vent or toward vent stack.

E. Provide sanitary vent termination height above the finished roof level at the minimum required per the applicable plumbing code, or as directed by the building inspector.

F. Provide sanitary vent terminations a minimum of 10 feet (3 meters) away from outside air intakes, or further where indicated on drawings.

3.7 INSTALLING PUMPED SANITARY PIPING

A. Above ground piping:

1. Brace piping at changes in direction.

B. Underground piping:

1. Install concrete abutments (thrust blocks) at all changes in direction. Provide abutments not less than 3 pipe diameters in width and 2 pipe diameters in height, resting on and transmitting thrust to undisturbed earth.
2. Anchor pipes at point of entrance into building or manhole with clamps or special fittings.

3.8 INSTALLING RADON VENT PIPING

A. Provide radon vent terminations a minimum of 25 feet (7.5 meters) away from outside air intakes, or further where indicated on drawings.

3.9 CONNECTING TO EXISTING PIPING

A. Clean the inside of existing piping at connections to new piping using a water blasting device.

B. Blasting device: Flexible high pressure hose with self-propelling nozzle which blasts to front, sides, and rear (propulsion).

C. Operation: Blasting device is operated with water at 15,000 psi (107 kPa). The piping system being cleaned is not pressurized.

D. Clean from the connection point to at least 5 feet (1.5 m) outside the exterior building wall.

3.10 SCHEDULES

A. Sanitary pipe installation schedule.

SANITARY PIPE INSTALLATION SCHEDULE Contractor has option where more than one x appears on a line						
MATERIAL TYPE						
Application	Cast-iron hub and spigot	Cast-iron no-hub	Copper tube (DWV)	Copper type L or M	PVC (DWV)	PVC (Schedule 80)
Sanitary, exterior or below slab on earth	X					
Sanitary, concealed within walls, partitions, or ceiling space		X	X			
Sanitary, interior exposed		X	X			
Sanitary, accessible pipe or crawl space		X				
Sanitary, over food preparation, storage, serving, or dining areas		X	X			
Pumped sanitary				X		
Pumped sanitary, exterior or below slab on earth						X
Miscellaneous drains from equipment		X	X			
Radon vent, below slab on earth	X				X	
Radon vent, above grade		X			X	
All information in this schedule is subject to local plumbing code and health department requirements.						

END OF SECTION 22 13 16

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Drains and cleanouts.

B. Flashing material.

C. Solids interceptors.

D. Sanitary vent cap filter.

1.2 RELATED SECTIONS

A. Piping: Section 22 13 16.

B. Curbs and flashings: Section 22 05 06.

C. Insulation: Section 22 07 19.

1.3 SUBMITTALS

A. Product data: Each specialty device or equipment, with installation instructions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. General: Model numbers are provided in the articles below to set a standard for materials, quality of construction, options and details, and performance. Provide named products, or equal products by the acceptable manufacturers listed.

B. Drains and cleanouts:

1. Josam Company
2. Jay R. Smith Manufacturing Company
3. MIFAB, Inc.
4. Wade
5. Watts Drainage
6. Zurn Plumbing Products
7. Or approved equal.

C. Solids interceptors:

1. Striem
2. MIFAB
3. Schier
4. Or approved equal.

2.2 FLOOR DRAINS AND FLOOR SINKS

A. Those installed in slabs on grade and above crawl space do not require flashing clamp devices. All others shall have flashing clamp devices.

1. Equal to the Zurn catalog numbers noted on drawings.

B. Floor drain P traps shall Be deep seal type and shall have primer plugs.

C. Floor sinks shall have acid-resistant porcelain enamel interior finish with internal aluminum dome strainers.

2.3 FLEXIBLE FLASHING

A. Polyvinyl chloride sheet, flexible, waterproof, unreinforced, 40 mil minimum thickness, intended for use as a drain flashing.

2.4 CLEANOUTS

A. Cleanouts: Those installed in slab on grade and in slab above crawl spaces do not require membrane flashing device. All others shall have flashing devices.

B. In sanitary lines:

1. Exposed piping:

a. Coated cast-iron cleanout tee with bronze cleanout plug.
b. Basis of design: Zurn Z-1445.

2. Concealed piping:

a. Coated cast-iron cleanout tee with bronze cleanout plug and polished bronze cover.
b. Basis of design: Zurn ZB-1446.

3. Concealed piping where more than 8 inches (205 mm) back from finished wall line: Install a sanitary 90 degrees long turn Y fitting with bronze cleanout plug extended out to finish 1 inch (25 mm) behind finished wall.

a. Provide with 9 by 9 inch cover plate (access panel) with vandalproof screws.

(1) Basis of design: Zurn Z-1460.

C. In underfloor sanitary lines: (See Floor Finish Schedule) All units complete with adjustable floor cleanout, coated cast-iron body, and bronze threaded plug.

1. In storage areas with plain or painted concrete floors: Polished bronze light-duty top.

a. Basis of design: Zurn ZB-1400.

2. In exposed areas with plain or painted concrete floors: Polished nickel bronze light-duty top.

a. Basis of design: Zurn ZN-1400.

3. In resilient tile floors: Polished nickel bronze light-duty square top recessed for 1/8-inch tile.

a. Basis of design: Zurn ZN-1400-TX.

4. In ceramic tile floors: Polished nickel bronze light-duty square top.

a. Basis of design: Zurn ZN-1400-T.

5. In carpeted floors: Carpet marker.

a. Basis of design: Zurn Z-1400-CM.

6. In terrazzo floors: Corrosion resistant ductile-iron top with severe and heavy-duty coating.

a. Basis of design: Zurn Z-1400-DC.

D. Outside cleanouts: Adjustable floor cleanout, coated cast-iron body and bronze threaded plug. Polished nickel bronze extra-heavy-duty veneer top with vandalproof screws.

1. Basis of design: Zurn ZN-1400-HD.

2.5 SOLIDS INTERCEPTOR

A. Under-sink solids interceptor.

1. PVC housing, polycarbonate perforated basket with o-ring.
2. 1-1/2” or 2” PVC socket inlet and outlet connections.
3. Top inlet and three outlet options.
4. Solids capacity: 0.17 gallons.
5. Perforated basket shall have the ability to be maintained via sie access and shall include clear face to allow visibility into unit.
6. Basis of design: Striem solids interceptor model “SIDEKICK”.

2.6 SANITARY VENT CAP FILTER

A. Vent filter with pelletized carbon media, for use on low flow, passive vent systems. Construction: PVC mushroom type rain cap with ABS DWV coupling for attaching to vent pipe and vapor phase virgin pelletized activated carbon in fiberglass mesh replaceable bag. Equal to OH Bio-Filter "OdorHog"

PART 3 - EXECUTION

3.1 INSTALLING FLOOR DRAINS AND FLOOR SINKS

A. Where floor drains are over occupied areas, flash them with flashing specified in this section, single piece for each drain, 30 by 30 inches (762 by 762 mm) with opening cut in center to suit clamping device of drain. Adhere flashing to substrate with adhesive and secure to clamping device of drain. Ascertain that weep holes from drainage pan are open.

B. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated. See architectural plans for additional information about slopes of floors.

C. Floor drains and floor sinks shall be provided with deep seal cast-iron P traps with primer connections, including those discharging directly into storm drains.

D. Floor drains and floor sinks shall be provided with trap primers.

E. Refer to Section 22 11 19, Domestic Water Piping Specialties, for trap primers.

F. Floor drains shall be covered until placed in service to prevent the entrance of any foreign matter.

3.2 INSTALLING CLEANOUTS

A. Install cleanouts at base of each vertical, soil, waste, and vent stack, in the vertical piping.

B. Cleanouts shall be the same size as the pipe into which they are installed, except no cleanout shall be larger than NPS 4 (DN 100).

C. Install cleanouts in horizontal piping where indicated on drawings. Where cleanouts occur directly below a floor, the cleanout shall terminate with top flush with floor. Provide for the floor finish to be installed on the cleanout cover, and separated from surrounding material. Install carpet markers after carpet installation is completed. Install ceramic tile and terrazzo per manufacturer's instructions.

D. Where cleanouts are over occupied areas, flash them with flashing specified in this section by the same method specified for floor drains.

E. Cleanouts on exterior lines: Extend up flush with finish grade and support in a concrete pad, 18 by 18 inches (460 by 460 mm), 8 inches (205 mm) thick, reinforced with 6 by 6-inch (50 by 50-mm) No. 6 wire mesh.

3.3 INSTALLING SOIDS INTERCEPTOR

A. Install so that strainer can be removed for cleaning.

B. Install floor recessed models per manufacturer's recommendations. Provide cover plate riser extensions as required to flush mount the cover with the floor.

3.4 SANITARY VENT CAP FILTER

A. For sanitary roof vent terminations in areas without equipment screens, install sanitary vent cap filters on all roof vent terminations that are located within 50 feet of air handling units or other outdoor air intakes or where indicated on drawings.

B. Provide filter on all sanitary vents that terminate at the roof within an equipment screened area where the equipment screens enclose air handling units or other outdoor air intakes.

END OF SECTION 22 13 19

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 22 14 13 - STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Air-conditioning condensate drain.

B. Storm water piping.

C. Foundation drain.

1.2 RELATED SECTIONS

A. Piping installation and testing: Section 22 05 00.

B. Storm water piping specialties: Section 22 14 23.

1.3 REFERENCES

A. Cast iron piping standards

1. ASTM A 74: Standard Specification for Cast Iron Soil Pipe and Fittings
2. ASTM C 564: Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
3. ASTM C1540: Standard Specification for Heavy-Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings
4. CISPI 301: Standard Specification for hubless cast iron soil pipe and fittings for sanitary and storm drain, waste, and vent piping applications

B. Copper (DWV) piping standards

1. ANSI/ASME B16.29: Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fitting: DWV
2. ASME/ANSI B16.23: Cast Copper Alloy Solder Joint Drainage Fittings: DWV
3. ASTM B 306: Standard Specification for Copper Drainage Tube (DWV)

C. Copper Type L and M piping standards

1. ASME/ANSI B 16.18: Cast Copper Alloy Solder Joint Pressure Fittings
2. ASME/ANSI B 16.22: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
3. ASTM B 88: Standard Specification for Seamless Copper Water Tube

D. PVC (DWV) piping standards

1. ASTM D 1785: Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
2. ASTM D 2321: Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
3. ASTM D 2564: Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
4. ASTM D 2665: Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

E. PVC (Schedule 80) piping standards

1. ASTM D 1784: Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
2. ASTM D 1785: Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
3. ASTM D 2464: Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
4. ASTM D 2467: Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

F. Perforated PVC piping standards

1. ASTM D 1785: Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
2. ASTM D 2466: Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40

G. Corrugated polyethylene piping standards

1. ASTM F 667: Standard Specification for 3 through 24 in. Corrugated Polyethylene Pipe and Fittings

1.4 SUBMITTALS

A. Product data: Each specified material and product.

B. Submit a single manufacturer for each product. Submittals that include multiple manufacturers for a single product are not acceptable.

1.5 QUALITY ASSURANCE

A. Cast iron pipe and fittings shall be marked with the collective trademarks of the Cast Iron Soil Pipe Institute (CISPI) and listed by NSF International.

B. Prior to any new piping installation, verify the inverts of all piping to which new work is to be attached. Demonstrate to the satisfaction of the construction manager and/or Owner, that the connections to existing storm water pipes meet the intent of the contract.

C. Pipe shall be certified by the manufacturer to meet referenced standards and shall bear a label, directly on the pipe, indicating compliance.

D. Clean, rod, and flush existing storm water piping as necessary to maintain gravity flow.

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS

A. Install each type of pipe and fittings in locations required or permitted in Part 3, including the Pipe Installation Schedule at the end of the section.

B. Cast-iron hub and spigot pipe and fittings:

1. Pipe: ASTM A 74 service class
2. Neoprene gaskets joints:

    a. Lifetime ASTM C 564 neoprene gasket joints
    b. Basis of design: Fernco “Multi-Tite”, Tyler Pipe “Ty-seal”, or Mission Rubber “Mission-Tite.”

C. Cast-iron no-hub pipe and fittings:

1. Pipe and fittings: Cast Iron Soil Pipe Institute Standard 301.
2. Joints: Use one of the no-hub coupling options below

    a. Option 1 (for use in any location):

        (1) ASTM C 564 neoprene gaskets and two-piece cast-iron housing clamps and stainless-steel bolts and nuts.
        (2) Basis of design: MG Piping Products Company.

    b. Option 2 (for use in any location):

        (1) Corrugated 304 stainless-steel shields with four or six clamps and holding bolts conforming to ASTM C 1540 and rubber gasket sealing sleeves conforming to ASTM C 564
        (2) Basis of design: Husky “Series 4000” coupling or Mission "Heavy Weight Series CHW" coupling.

3. Pipe and fitting restraints:

    a. Provide for piping NPS 5 (DN 125) and larger

b. Factory fabricated pipe and fitting restraint assemblies rated to prevent pipe separation under fluid thrust forces up to 50 feet of head in conformance with CISPI 301.
c. Basis of design: Holdrite No. 117 No-Hub Pipe and Fitting Restraint.

D. Copper tube (DWV) pipe and fittings:

1. Pipe: copper tubing Type DWV, ASTM B 306
2. Fittings:

a. Wrought copper drainage fittings and soldered joints conforming to ASME/ANSI B16.29
b. Cast-brass fittings conforming to ASME/ANSI B16.23.

E. Copper Type L and M pipe and fittings:

1. Pipe: ASTM B 88, Type L or M, hard drawn.
2. Fittings: Solder joint, cast brass, ASME B16.18; or wrought copper, ASME B16.22.

F. PVC (DWV) pipe and fittings:

1. Pipe: PVC, Schedule 40, ASTM D 1785.
2. Fittings: PVC, DWV, ASTM D 2665.
3. Solvent cement: PVC, ASTM D 2564.

G. PVC (Schedule 80) pipe and fittings:

1. Pipe: PVC, Schedule 80 pipe, manufactured from PVC compound with a cell class of 12454 per ASTM D 1784. Pipe shall be iron pipe size (IPS) conforming to ASTM D 1785.
2. Fittings: PVC, Schedule 80 fittings, manufactured from PVC compound with a cell class of 12454 per ASTM D 1784. Socket fittings shall comply with ASTM D 2467 and threaded fittings shall comply with ASTM D 2464.
3. Solvent cement: PVC, ASTM D 2564.

H. Perforated PVC pipe and fittings:

1. Pipe: PVC, Schedule 40, ASTM D 1785.

a. Perforations: Circular, not more than 0.3125 inch or less than 0.1375 inch in diameter, and arranged in rows parallel to the longitudinal axis of the pipe. Perforations approximately 3 inches, center-to-center, along rows. The rows approximately 1.5 inches apart and arranged in a staggered pattern so that all perforations lie at the midpoint between perforations in adjacent rows. The rows spaced over not more not than 90 degrees of circumference. The coupling end of the pipe not perforated for a length equal to the depth of the socket and perforations continued at uniform spacing over the entire length of the pipe.
b. Manufacturer's standard perforated PVC pipe which essentially meets these requirements may be substituted when approved.

2. Fittings: Schedule 40 PVC fittings: ASTM D 2466.

I. Perforated corrugated polyethylene:

1. Heavy-duty, highway-type conforming to AASSHTO M 252 and ASTM F 667, complete with snap couplings and fittings
2. Basis of design: Advanced Drainage Systems, Inc.

2.2 FOUNDATION DRAIN PIPING ACCESSORIES

A. Filter fabric:

1. Nonwoven polypropylene material recommended by the manufacturer for use in filtration or drainage
2. Permittivity, ASTM D 4491: 90-115 gallons per minute per sq. ft. (6-7 L/s per 0.9 sq. m).
3. Puncture resistance, ASTM D 4833: 65 lbs (290 N).
4. Mullen burst, ASTM D 3786: 230 psi (1586 kPa).
5. Trapezoid tear strength, ASTM D 4533: 45 lbs.
6. Grab/tensile elongation, ASTM D 4632: 110 lbs/50 percent.
7. Basis of design: Carthage Mills FX-40NS, Amoco 4506, or Mirafi 160N.

B. Pins for securing filter fabric: As recommended by the manufacturer, at least 15 inches (380 mm) long, 0.1875-inch (5-mm) diameter, with 1.5-inch-(38-mm) round washer attached to the top of the pin between staked ears.

C. Stone filter material: Uniform gradation, AASHTO M 43 size 67 or 7.

PART 3 - EXECUTION

3.1 PREPARATION

A. Connect piping as shown on the drawings. Check elevations of connection points before installing new work.

3.2 INSTALLATION, GENERAL

A. Use suitable tools and appliances for the safe and convenient handling and laying of pipe. Examine each section of pipe for defects. Do not lay any piece that is known to be defective. If any defective piece should be discovered after having been laid, remove and replace it at no change to the contract price.

B. Install piping in accordance with the Pipe Installation Schedule at the end of this section, as indicated on the drawings, and in accordance with Section 22 05 00, Common Work Results for Plumbing. Materials and work shall conform to local plumbing codes and health department regulations.

C. Thoroughly clean all pipe and fittings before installing them, and keep them clean until the acceptance of the completed work. Cap or plug ends of lines to prevent debris from entering during construction.

D. Make changes in direction of storm water piping with approved sanitary fittings, Y branches, 1/8 or 1/16 bends.

E. Install all storm water piping at a 2 percent minimum downward slope in the direction of flow unless otherwise indicated.

F. Seal air-conditioning condensate drain where it passes through outside wall and provide splash block if required.

3.3 INSTALLING CAST-IRON PIPING

A. 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." Install restraint assemblies at pipe couplings and fittings for piping NPS 5 (DN 125) and larger.

3.4 INSTALLING COPPER PIPING

A. Install aboveground copper tubing according to Copper Development Association, Inc. (CDA) "Copper Tube Handbook."

3.5 INSTALLING PVC (DWV) PIPING

A. Install aboveground PVC piping according to ASTM D 2665.

B. Install underground PVC piping according to ASTM D 2321.

C. Provide listed plastic pipe penetration protection at penetrations of fire-rated floors and assemblies.

D. PVC piping is not permitted in ceiling plenums or shafts used to convey HVAC system air.

3.6 INSTALLING STORM WATER PIPING

A. Install roof overflow piping extending 3.5 to 4 inches (75 to 100 mm) above roof. Flash as required for plumbing vents.

3.7 INSTALLING FOUNDATION DRAINS

A. Excavation for pipe laid against footings shall not be lower than the bottom of the footing.

B. Installing stone filter material and geotextile filter fabric:

1. Lay geotextile filer fabric, with material extending up as will be required to complete an envelope around stone filter material and piping.
2. Install no less than 6 inches of stone filter material under pipe, and lay pipe.
3. Fill with stone filter material no less than 6 inches (150 mm) on each side and 2 feet (610 mm) above piping, or to bottom of slab.
4. Fold geotextile filter fabric over pipe and stone filter material to form a continuous envelope, overlapping no less than 2 inches. Top of geotextile envelope shall be directly under slab or between stone filter material and earth fill.

C. Where foundation drains pass through walls or footings, provide sleeves.

D. Lay drain lines at elevations noted on drawings.

E. Lay piping without rises or traps. Lay piping flat, or with uniform fall towards the points of discharge.

F. Lay pipe with perforations downward.

G. Verify joints are tight prior to backfilling. During backfilling assure that joints are not disturbed.

3.8 INSTALLING PUMPED STORM WATER, AIR CONDITIONING CONDENSATE, ELEVATOR SUMP DISCHARGE, OR FOUNDATION DRAIN PIPING

A. Above ground piping:

1. Brace piping at changes in direction.

B. Underground piping:

1. Install concrete abutments (thrust blocks) at all changes in direction. Provide abutments not less than 3 pipe diameters in width and 2 pipe diameters in height, resting on and transmitting thrust to undisturbed earth.
2. Anchor pipes at point of entrance into building or manhole with clamps or special fittings.

3.9 CONNECTING TO EXISTING PIPING

A. Clean the inside of existing piping at connections to new piping using a water blasting device.

B. Blasting device: Flexible high pressure hose with self-propelling nozzle which blasts to front, sides, and rear (propulsion).

C. Operation: Blasting device is operated with water at 15,000 psi (107 kPa). The piping system being cleaned is not pressurized.

D. Clean from the connection point to at least 5 feet (1.5 m) outside the exterior building wall.

3.10 SCHEDULES

A. Storm water pipe installation schedule.

STORM WATER PIPE INSTALLATION SCHEDULE Contractor has option where more than one X appears on a line								
MATERIAL TYPE								
Application	Cast iron hub & spigot	Cast iron no-hub	Copper tube (DWV)	Copper Type L or M	PVC (DWV)	PVC (Schedule 80)	Perforated PVC	Perforated corrugated polyethylene
Storm water, exterior or below slab on earth	X							
Storm water, concealed within walls, partitions, or ceiling space		X	X					
Storm water, interior exposed		X						
Storm water, accessible pipe or crawl space		X						
Storm water, over food preparation, storage, serving, or dining areas		X	X					
Pumped storm water, air conditioning condensate, elevator sump discharge, or foundation drain				X				
Pumped storm water, air conditioning condensate, elevator sump discharge, or foundation drain, exterior or below slab on earth						X		
Backflow preventer discharge drain piping		X						
Air conditioning condensate, interior NPS 1 (DN 25) and smaller				X				
Air conditioning condensate, interior NPS 1.25 (DN 32) and larger		X	X					
Air conditioning condensate, exterior					X			
Foundation drains, buried 10 feet (3 meters) deep or less							X	X
Foundation drains, buried 10 feet (3 meters) deep or more							X	
All information in this schedule is subject to local plumbing code and health department requirements.								

END OF SECTION 22 14 13

SECTION 22 14 23 - STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Roof drains

B. Cleanouts.

C. Flashing material.

D. Roof overflow spouts.

E. Leader shoes.

1.2 RELATED SECTIONS

A. Storm water piping: Section 22 14 13.

B. Curbs and flashings: Section 22 05 06.

C. Insulation: Section 22 07 19.

1.3 SUBMITTALS

A. Product data: Each specialty device or equipment, with installation instructions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. General: Model numbers are provided in the articles below to set a standard for materials, quality of construction, options and details, and performance. Provide named products, or equal products by the acceptable manufacturers listed.

B. Drains and cleanouts:

1. Josam Company
2. Jay R. Smith Manufacturing Company
3. MIFAB, Inc.
4. Wade
5. Watts Drainage
6. Zurn Plumbing Products

7. Or approved equal.

2.2 ROOF DRAINS

A. Roof drain:

1. Body: Cast-iron.
2. Body Diameter: 14-inch to 16-inch (357-mm to 406-mm).
3. Dome strainers: Aluminum, removable, lockable in place and vandalproof.
4. Combination membrane flashing clamp and gravel stop.
5. Outlet Type: No-hub or threaded.
6. Accessories:

    a. Roof sump receiver.
    b. Provide extension suitable for the insulation thickness where required.
    c. Cast-iron underdeck clamp.
    d. Provide with internal water dam where used in an overflow application.
    e. Provide with stainless steel perforated gravel guard where required to prevent roof ballast from entering the drain.

7. Basis of design: Zurn Z100.

B. Lead for flashing roof drain: 4-lb (1.55-mm-thick) sheet.

2.3 CLEANOUTS

A. Cleanouts: Those installed in slab on grade and in slab above crawl spaces do not require membrane flashing device. All others shall have flashing devices.

B. In vertical storm lines:

1. Exposed piping:

    a. Coated cast-iron cleanout tee with bronze cleanout plug.
    b. Basis of design: Zurn Z-1445.

2. Concealed piping:

    a. Coated cast-iron cleanout tee with bronze cleanout plug and polished bronze cover.
    b. Basis of design: Zurn ZB-1446.

3. Concealed piping where more than 8 inches (205 mm) back from finished wall line: Install a sanitary 90 degrees long turn Y fitting with bronze cleanout plug extended out to finish 1 inch (25 mm) behind finished wall.

    a. Provide with 9 by 9 inch cover plate (access panel) with vandalproof screws.

(1) Basis of design: Zurn Z-1460.

C. In underfloor storm lines: (See Floor Finish Schedule) All units complete with adjustable floor cleanout, coated cast-iron body, and bronze threaded plug.

1. In storage areas with plain or painted concrete floors: Polished bronze light-duty top.

a. Basis of design: Zurn ZB-1400.

2. In exposed areas with plain or painted concrete floors: Polished nickel bronze light-duty top.

a. Basis of design: Zurn ZN-1400.

3. In resilient tile floors: Polished nickel bronze light-duty square top recessed for 1/8-inch tile.

a. Basis of design: Zurn ZN-1400-TX.

4. In ceramic tile floors: Polished nickel bronze light-duty square top.

a. Basis of design: Zurn ZN-1400-T.

5. In carpeted floors: Carpet marker.

a. Basis of design: Zurn Z-1400-CM.

6. In terrazzo floors: Corrosion resistant ductile-iron cover with severe and heavy-duty service.

a. Basis of design: Zurn Z-1400-DC.

D. Outside cleanouts: Adjustable floor cleanout, coated cast-iron body and bronze threaded plug. Polished nickel bronze extra-heavy-duty veneer top with vandalproof screws.

1. Basis of design: Zurn ZN-1400-HD.

2.4 FLEXIBLE FLASHING

A. Polyvinyl chloride sheet, flexible, waterproof, unreinforced, 40 mil minimum thickness, intended for use as a drain flashing.

2.5 ROOF OVERFLOW SPOUTS

A. Roof overflow spout:

1. Flanged spout designed to direct roof overflow away from building.
2. Materials: Polished nickel bronze body with removable stainless-steel screen.

3. Size: Noted on drawings.
4. Basis of design: Zurn Z-199.

2.6 LEADER SHOES

A. Leader shoe:

1. Cast-iron, conforming to downspouts shown on architectural and plumbing drawings, equal to J.R. Hoe and Sons Angular Downspout Boot. Inlet size to accommodate the downspout shown on architectural drawings. Outlet size to accommodate the below grade piping connection shown on the plumbing drawings. 28” length with side cleanout. Cleanout cover to include stainless steel tamperproof screws.

PART 3 - EXECUTION

3.1 INSTALLING ROOF DRAINS

A. The first fitting below the roof drain shall be a T with cleanout plug, except over food preparation and serving areas.

B. Set roof drains so membrane flashing clamp is depressed below normal roof membrane level. Flashing of the roof drains shall be as specified in Division 07.

C. Set roof drains to fit pitch of roof.

D. Sheet lead gaskets shall extend 12 inches (305 mm) beyond outer edge of roof drains and shall be secured with the membrane flashing clamp.

E. Membrane flashing clamp shall be embedded into the roofing and made watertight.

F. Ascertain that weep holes into drainage pans are open.

3.2 INSTALLING CLEANOUTS

A. Install cleanouts at base of each vertical storm water stack, in the vertical piping.

B. Cleanouts shall be the same size as the pipe into which they are installed, except no cleanout shall be larger than NPS 4 (DN 100).

C. Install cleanouts in horizontal piping where indicated on drawings. Where cleanouts occur directly below a floor, the cleanout shall terminate with top flush with floor. Provide for the floor finish to be installed on the cleanout cover, and separated from surrounding material. Install carpet markers after carpet installation is completed. Install ceramic tile and terrazzo per manufacturer’s instructions.

D. Where cleanouts are over occupied areas, flash them with flashing specified in this section, by the same method specified for floor drains.

E. Cleanouts on exterior lines: Extend up flush with finish grade and support in a concrete pad, 18 by 18 inches (460 by 460 mm), 8 inches (205 mm) thick, reinforced with 6 by 6-inch (50 by 50-mm) No. 6 wire mesh.

3.3 INSTALLING ROOF OVERFLOW SPOUTS

A. Install spout on each roof overflow drain outlet.

1. Locate as shown on drawings, no less than 12 inches (305 mm) above finished grade.
2. Coordinate installation with wall construction and wall finish application materials.

3.4 INSTALLING LEADER SHOES

A. Install leader shoes complete with cleanout, as indicated on drawings.

END OF SECTION 22 14 23

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 22 14 30 - ELEVATOR SUMP PUMPS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Elevator shaft submersible sump pump systems.

1.2 RELATED SECTIONS

A. UL label, demonstration, training, and equipment installation: Section 22 05 00.

B. Motors: Section 22 05 13.

C. Pumped storm water piping: Section 22 14 13.

D. Controls: Sections 23 09 01 through 23 09 23.

1.3 REFERENCED STANDARDS

A. Underwriters Laboratories

1. UL 508: Standard for Industrial Control Equipment
2. UL 778: Standard for Motor-Operated Water Pumps

1.4 SUBMITTALS

B. Product data: Include certified performance curves and rated capacities of selected models; shipping, installed, and operating weights; furnished specialties; and accessories for each type and size of pump specified. Indicate pumps' operating point on curves.

C. Shop drawings: Show layout and connections for pumps. Include setting drawings with templates, directions for installation of foundation and anchor bolts, and other anchorages.

1. Wiring diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.

D. Maintenance data: For each pump specified, to include in maintenance manuals specified in Division 01 and Section 22 01 01.

1.5 QUALITY ASSURANCE

A. UL label: As specified in Section 22 05 00, Common Work Results for Plumbing.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Specified units are the basis for design of the project. The following listed manufacturers also provide units of acceptable quality. If units by any of these manufacturers should be proposed, verify that they meet requirements specified in Division 01 and the article "Product Options" in Section 22 01 01, and submit shop drawings as specified in the "Submittals" article above.

B. Elevator shaft submersible sump pump systems:

1. Barnes, Crane Pumps and Systems
2. Stancor, Inc.
3. Zoeller Co.
4. Or approved equal.

2.2 GENERAL REQUIREMENTS

A. Provide type, size, configuration, capacity, and current characteristics indicated on the drawings.

B. Provide motors that meet requirements in Section 22 05 13, Common Motor Requirements for Plumbing Equipment.

2.3 SUMPS

A. Field-fabricated concrete sump pit: Concrete pit with cover as detailed on structural drawings.

2.4 ELEVATOR SHAFT SUBMERSIBLE SUMP PUMP SYSTEMS

A. Package: UL 778 pump and UL 508 controls, listed and tested as a package for automatic pumping of elevator shafts in accordance with ASME A17.1 and approved by the authority having jurisdiction.

B. Submersible sump pump:

1. Description: Factory-assembled and factory-tested fixed-position sump pump with exposed parts made of cast iron, stainless steel, bronze, rubber, PTFE, or high-impact molded plastic.
2. Pump shaft seal: Single mechanical seal.
3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sump pump.
4. Casing: Cast iron or stainless steel motor casing, cast iron volute, with legs that elevate pump to permit flow into impeller.
5. Support and discharge configuration: Support legs and threaded top discharge.

6. Impeller: Statically and dynamically balanced, bronze, stainless steel, cast iron, or thermoplastic, secured to shaft.
7. Shaft: Stainless steel.
8. Bearings: Factory-sealed, grease-lubricated ball bearings.
9. Seal: Carbon and ceramic mechanical seal.
10. Motor: Hermetically sealed, air-filled, capacitor-start type; with built-in overload protection and lightning protection, and lifting handle, cast-iron or stainless steel shell.
11. Power connection: Neoprene jacketed, waterproof plug-in power cable of length required and with grounding plug and cable-sealing assembly for connection between pump and point of disconnect in elevator shaft, length as required.
12. Basis-of-design product: Subject to compliance with requirements, provide the following basis of design product pumps, or comparable product manufactured by another listed manufacturer with the same or enhanced performance.

    a. Stancor SV-50: 50 GPM (190 liters per minute) at 22 feet (6.7 m) of head, 0.5 BHP.

C. Controls:

1. Control panel: Provide a U.L. listed control panel with the following minimum features:

    a. Enclosure: NEMA Type 4X.
    b. Enclosure front: Hinged access front.
    c. Power supply:

        (1) Single phase pumps 0.5 HP or smaller: Plug and cord connection.
        (2) Other pumps: Wired to local disconnect switch.

    d. Control power transformer.
    e. Circuit breaker disconnect.
    f. Terminal strip connections for building automation system:

        (1) High water alarm status.
        (2) Oil alarm status.
        (3) Pump status.

    g. Alarm light.
    h. Alarm horn or buzzer and alarm silence button.
    i. Pump run status sensing and indicator light.
    j. HOA switch.
    k. Pump starting:

        (1) Single phase pump control panels: Motor contactor.
        (2) Three phase pump control panels: Magnetic starter.

2. Fluid level controls: Provide corrosion resistant level sensors. Provide either solution below.

    a. Option 1:

(1) High fluid alarm switch
(2) Pump on float switch
(3) Sensor probe capable of sensing fluid level and the presence or absence of oil.
(4) If there is oil present, the pump will cycle with the water-oil interface near the elevation of the sensor probe.

b. Option 2:

(1) High fluid alarm switch to indicate high fluid level and differentiate between sensing water or oil at the high fluid level.
(2) Dual probe switch: The lower probe sets the off level for the pump when the liquid level drops below it. The upper probe turns the pump on if it senses water, but disables pump operation if it senses oil.
(3) If there is oil present, the pump will cycle with the water-oil interface near the elevation of the top probe of the dual probe switch.

c. Operation: Liquid level switches and oil sensor act in concert to automatically remove water from the sump pit while ensuring that no oil or similar substance is pumped.

(1) When switch indicates the Pump On level, and the oil sensor does not indicate the presence of oil, the switch shall initiate pumping until either the Pump Off level is reached or the sensor senses oil.
(2) When switch indicates the Pump On level, but the sensor indicates oil, the audible alarm shall sound and alarm condition shall be annunciated.
(3) When switch indicates the High Water alarm level, the audible alarm condition shall be annunciated.
(4) Alarm condition shall require manual silencing and reset.

3. Basis-of-design product: Subject to compliance with requirements, provide Stancor “Oil Minder” or comparable product manufactured by other listed manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install equipment as indicated on the drawings. Comply with requirements in Section 22 05 00.

3.2 INSTALLING ELEVATOR SHAFT SUBMERSIBLE SUMP PUMP SYSTEM

A. General:

1. Provide pumps within field fabricated concrete pit as detailed on structural drawings.

2. Provide a union, check valve, and shut-off valve in the pump discharge within the elevator shaft. Arrange to facilitate pump and check valve replacement by closing the shut-off valve and disconnecting the pump and discharge piping via the union.

B. Route discharge piping to one of the following locations as indicated on the drawings:

1. Open site drain with back water valve to building sanitary or storm water system.

C. Power and controls:

1. Provide the control panel in the elevator machine room, or another remote location as indicated on the drawings or as required by the elevator inspector.
2. Provide all control and power wiring and accessories for a complete and functional system.
3. Provide switches and sensors at required elevations, mounted to a mounting rod supported from the pit wall, or the pump discharge pipe, with fasteners provided by the control system manufacturer, and with wiring secured to the mounting rod or discharge pipe.
4. Provide wire from switches and sensors to a liquid tight NEMA 4X junction box within the elevator shaft, and then to the control panel through a schedule 40 PVC conduit.
5. Power to control panel:
6. Single phase pumps 0.5 HP or smaller: Plug and cord connection to 120-volt receptacle.
7. Other pumps: Wired to local disconnect switch.
8. Power from control panel to pump: Provide power wiring from the control panel, via a manufacturer provided cable, through a schedule 40 PVC conduit, to a NEMA 4X liquid tight junction box in the elevator shaft, and to the pump.
9. Provide interface between pump controls and building automation system.

3.3 OPERATING INSTRUCTIONS

A. As specified in Section 22 05 00, provide operating instructions.

END OF SECTION 22 14 30

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 22 33 00 - STORAGE ELECTRIC DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Commercial, storage electric domestic water heaters.

1.2 RELATED SECTIONS

A. UL label, demonstration, training, and equipment installation: Section 22 05 00.

B. Expansion tanks: Section 22 05 09.

C. Equipment supports: Section 22 05 29.

1.3 REFERENCES

A. ANSI Z21.22: Relief Valves for Hot Water Supply Systems.

B. ASHRAE 90.1: Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings.

C. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.

D. ASTM G123-00: Standard Test Method for Evaluating Stress-Corrosion Cracking of Stainless Alloys with Different Nickel Content in Boiling Acidified Sodium Chloride Solution.

E. ISO 3651-2: Determination Of Resistance to Intergranular Corrosion of Stainless Steels.

F. NSF/ANSI 61: Drinking Water System Components – Health Effects.

G. UL 174: UL Standard for Safety Household Electric Storage Tank Water Heaters.

H. UL 1453: UL Standard for Safety Electric Booster and Commercial Storage Tank Water Heaters.

1.4 SUBMITTALS

A. Product data: Each type and size water heater. Include nominal capacity and pressure rating; shipping, installed, and operating weights; and specialties and accessories furnished for this project. Indicate dimensions, wall thicknesses, required clearances, method of assembly, and piping connections.

B. Certification that the water heaters and fittings comply with NSF/ANSI 61.

C. Certification that products comply with energy performance requirements of ASHRAE 90.1.

D. Include operation and maintenance instructions and parts list for each type of water heater.

1.5 QUALITY ASSURANCE

A. UL label: As specified in Section 22 05 00, Common Work Results for Plumbing.

B. Lead free requirements:

1. Potable water system components intended to dispense water for human consumption, including pipe and joining materials, shall comply with NSF/ANSI 61 and with requirements for “lead-free” plumbing as defined by state laws and U.S. Safe Drinking Act.
2. Acceptance product marking: NSF®-61.

C. Comply with the energy performance requirements of ASHRAE 90.1.

D. ASME compliance: Fabricate and label water heater, hot-water storage tanks to comply with ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis-of-design product: Subject to compliance with requirements, provide the scheduled products, or comparable product by of the following:

B. Storage domestic electric water heaters:

1. A.O. Smith Corporation
2. Hubbell
3. PVI
4. State Industries, Inc.
5. Or approved equal.

2.2 STORAGE ELECTRIC DOMESTIC WATER HEATER

A. Provide type, size, configuration, capacity, and current characteristics indicated on the drawings.

B. Unit construction:
1. Maximum working pressure: 150 psi (1034 kPa).
2. Constructed and stamped in accordance with Section IV, Part HLW of the ASME and National Board Registered.
3. Ball-type drain valve.
4. Control compartments for service and maintenance through front.
5. Inlet carries entering cold water to bottom of tank.

C. Performance requirements:

1. Meet or exceed the energy performance requirements of ASHRAE 90.1.

D. Tank interior:

1. All internal surfaces exposed to water protected with glass heat-fused to the steel.
2. Provide anode rods for cathodic protection.

E. Insulation: Manufacturer's standard fiberglass or foam insulation.

F. Exterior jacket: Steel with manufacturer's standard baked enamel finish over bonderized undercoating.

G. ASME-rated temperature and pressure relief valve set at 125 psi (862 kPa) and 210 degrees F (98.9 degrees C) unless otherwise noted and capacity compatible with the water heater provided.

H. Heating element and controls:

1. Digital controls with fault diagnostics.
2. Combination thermostat and high-temperature-limit control.
3. Incoloy sheathed heating elements.
4. Solid state modulating step control.
5. Magnetic contactors, low-water cutoff, and fused control transformer.

I. Basis of design: A.O. Smith DVE.

2.3 WATER HEATER SPECIALTIES

A. Vacuum relief valve: Designed for vacuum relief in hot water tanks and heaters, ANSI Z21.22, brass body, high-heat-resisting disk.

1. Working pressure: At least 200 psi (1379 kPa).
2. Temperature rating: At least 250 degrees F (121.1 degrees C).
3. Operation: Closes under pressure and opens on a vacuum of not more than 0.5 inches of mercury (1.7 kPa).
4. Basis of design: Watts No. LFN36.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide a concrete equipment foundation (housekeeping pad) and install the equipment on that foundation. Comply with requirements in Section 22 05 29.

B. Plug all unused tappings.

C. Provide temperature and pressure relief valves. Extend relief valve outlet with water piping in continuous downward pitch and discharge to closest floor drain.

D. Provide vacuum relief valves.

E. Provide drain piping.

3.2 MANUFACTURER'S FIELD SERVICE

A. Provide manufacturer's startup and adjustment for water heaters.

3.3 OPERATING INSTRUCTIONS

A. As specified in Section 22 05 00, provide operating instructions.

END OF SECTION 22 33 00

SECTION 22 42 00.01 - PLUMBING FIXTURES – WATER CLOSETS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Water closets and related components.

1.2 RELATED SECTIONS

A. Piping:

1. Domestic water piping: Section 22 11 16.
2. Trap primers: Section 22 11 19.
3. Sanitary waste and vent piping: Section 22 13 16.

1.3 SUBMITTALS

A. Product data: For each water closet specified, including fixture, trim, fittings, accessories, appurtenances, supports, construction details, dimensions of components, and finishes.

B. Certification that products comply with NSF/ANSI 61.

C. Shop drawings:

1. A schedule of proposed water closets and trim, in the order listed in the specification.

1.4 QUALITY ASSURANCE

A. UL label: As specified in Section 22 05 00, Common Work Results for Plumbing.

B. Lead free requirements:

1. Potable water system components intended to dispense water for human consumption, including pipe and joining materials, shall comply with NSF/ANSI 61 and with requirements for “lead-free” plumbing as defined by state laws and U.S. Safe Drinking Act.

2. Acceptance product marking: NSF®-61.

C. Fixtures shall be of the best commercial grade of their respective kinds, free from flaws, cracks, craze or other imperfections, complete with fittings and connections. Residential grade fixtures shall not be acceptable. Fixtures manufactured by acceptable manufacturers are acceptable provided they meet specified requirements and are similar to the basis of design.

D. Fixtures and trim where required to be accessible to disabled people, identified in this section as "for disabled," shall comply with requirements of the Americans with Disabilities Act (ADA) Regulations, as applicable to each type of fixture or its use.

1. Trim must meet requirements for force of operation at water pressures up to 80 psi.
2. Models must be selected and installed so that flush controls will be on the fixture's open side.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis-of-design products: Subject to compliance with requirements, provide specified or scheduled products, or comparable product by one of the following.

1. Fixtures:

a. DuraSystem
b. Geberit
c. Kohler Co.
d. Toto
e. Or approved equal.

2. Supplies and miscellaneous trim:

a. Brass-Craft Manufacturing Co.
b. Elkay Manufacturing Co.
c. Engineered Brass Co.
d. McGuire Manufacturing Co.
e. T & S Brass and Bronze Works, Inc.
f. Or approved equal.

3. Toilet seats:

a. DuraSystem
b. Geberit
c. Kohler Co.
d. Toto
e. Or approved equal.

4. Flush tanks and carrier:

a. DuraSystem
b. Geberit
c. Kohler Co.
d. Toto
e. Or approved equal.

2.2 WALL-MOUNTED REAR OUTLET TANK-TYPE WATER CLOSETS

A. Common requirements:

1. Fixture:

a. One-piece, wall mounted, rear-outlet water closet for use with in-wall tank and carrier system.
b. Bowl type: Elongated
c. Seat: Provide by manufacturer, open front, elongated seat with ant-microbial surface. Equal to Kohler K-4650-A.
d. Passageway: 2.125 inches (54 mm).
e. Water connection: Rear connection
f. Mounting: Wall-mounted, using compatible in-wall tank and carrier system.
g. Weight capacity: Rated for a minimum 500 lbs.
h. Basis of design: Kohler “Veil” K-31539

2. Fixture and flush valve design consumption (provide one of the following):

a. Dual Flush: 0.8 / 1.6 gallons per flushing cycle
b. Single Flush: 1.28 gallons (4.8 L) per flushing cycle.

3. In-wall tank and carrier system

a. Floor mounted steel frame with adjustable supports for compatible wall hung toilet. Suitable for installation in 2”x6” stud wall.
b. Insulated tank.
c. Flush mounted, removable actuator plate.
d. Provide with manufacturer provided cast-iron waste pipe fitting.
e. Basis of design: Kohler K-6284.

B. F-1 wall-mounted rear outlet tank-type water closet:

1. Application:

a. General use.

2. Rim height: 15 inches (381 mm) rim to floor.

C. F-1A wall-mounted rear outlet tank-type water closet:

1. Application:

a. Adult, disabled.

2. Rim height: 18 inches (457 mm) rim to floor.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide and set water closets and compatible in-wall tank and carrier system to extent and number indicated on drawings. Water closets shall be left in first class condition, properly adjusted, cleaned and ready for operation.

B. Provide all parts, fittings, escutcheons, and appurtenances regularly required for each fixture.

C. Provide rough-in for water closets. Coordinate elevations of water closet flush valve rough-ins with rough-ins for grab bars, other wall-mounted items, and ADA clearance requirements for flush valve operators.

D. Where water closets are specified or noted to be accessible in accordance with ADA requirements, ensure that flush controls are installed on the fixture's open side.

E. Protect and cover water closets so they cannot be used until final work acceptance.

F. Install the complete water closet fixture and compatible in-wall tank and carrier system in accordance with the manufacturer's installation instructions.

3.2 SETTING OF FIXTURES

A. In locations where water closets are set against walls, seal crack between wall and the water closet with clear silicon sealant.

B. Wall-mounted water closets: Securely attach wall hung water closets to the wall using specified supports.

END OF SECTION 22 42 00.01

SECTION 22 42 00.03 - PLUMBING FIXTURES - LAVATORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Lavatories and trim, faucets, other fittings, and related components.

1.2 RELATED SECTIONS

A. Piping:

1. Domestic water piping: Section 22 11 16.
2. Sanitary waste and vent piping: Section 22 13 16.

1.3 SUBMITTALS

A. Product data: For each lavatory specified, including fixture, trim, fittings, accessories, appurtenances, supports, construction details, dimensions of components, and finishes.

B. Certification that products comply with NSF/ANSI 61.

C. Shop drawings:

1. A schedule of proposed fixtures and trim, in the order listed in the specification.

1.4 QUALITY ASSURANCE

A. UL label: As specified in Section 22 05 00, Common Work Results for Plumbing.

B. Lead free requirements:

1. Potable water system components, including pipe and joining materials, shall comply with NSF/ANSI 61 and with requirements for “lead-free” plumbing as defined by state laws and U.S. Safe Drinking Act.
2. Acceptance product marking: NSF®-61.

C. Fixtures shall be of the best commercial grade of their respective kinds, free from flaws, cracks, craze or other imperfections, complete with fittings and connections. Residential grade fixtures shall not be acceptable. Fixtures manufactured by acceptable manufacturers are acceptable provided they meet specified requirements and are similar to the basis of design.

D. Fixtures and trim where required to be accessible to disabled people, identified in this section as “for disabled,” shall comply with requirements of the Americans with Disabilities Act (ADA) Regulations, as applicable to each type of fixture or its use.

1. Trim must meet requirements for force of operation at water pressures up to 80 psi.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis-of-design products: Subject to compliance with requirements, provide specified or scheduled products, or comparable product by one of the following.

1. Fixtures:

   a. American Standard
   b. Commercial Enameling Co.
   c. Eljer
   d. Kohler Co.
   e. Sloan
   f. Zurn Plumbing Products
   g. Or approved equal.

2. Faucets:

   a. American Standard
   b. Chicago Faucet Co.
   c. Sloan.
   d. Speakman Co.
   e. T & S Brass and Bronze Works, Inc.
   f. Or approved equal.

3. Supplies, traps, and miscellaneous trim:

   a. Brass-Craft Manufacturing Co.
   b. Chicago Faucet Co.
   c. Elkay Manufacturing Co.
   d. Engineered Brass Co.
   e. McGuire Manufacturing Co.
   f. T & S Brass and Bronze Works, Inc.
   g. Or approved equal.

4. Fixture supports and carriers:

   a. Josam Mfg. Co.
   b. J.R. Smith
   c. Zurn Plumbing Products
   d. Or approved equal.

2.2 WALL-MOUNTED ENAMELED CAST IRON LAVATORIES (SINGLE HOLE FAUCET CENTERS)

A. Common requirements:

1. Fixture:

   a. Material: Cast iron with acid-resisting white enamel.
   b. Lavatory type: Rectangular, front overflow.
   c. Faucet holes: Single faucet hole.
   d. Mounting: Wall-mounted. Include cast-iron plate carrier connection fitting.
   e. Dimensions: 20 inches x 18 inches (508 mm x 457 mm).
   f. Basis of design: Kohler “Hudson” K-2867.

2. Supply nipples:

   a. Two brass nipples, triple-plated polished chrome of length and size as required.
   b. Basis of design: Brass-Craft.

3. Supply stops:

   a. Chrome-plated angle ball valve, 0.5-inch NPT (DN 15) inlet, 0.375-inch (DN 10) female threaded compression outlet, loose key handle, and slip wall flange.
   b. Basis of design: Chicago STB-21-00-AB.

4. Thermostatic mixing valve:

   a. Below counter ASSE 1070 thermostatic mixing valve.
   b. Brass body, adjustment cap with tamper resistant locking feature, integral inlet strainer screens, integral inlet check valves to protect against cross-flow.
   c. Discharge temperature setting range: 80 to 120 degrees F (27 to 49 degrees C).
   d. Flow rate range: 0.25 to 2.25 GPM (1.0 to 8.5 liters per minute).
   e. Inlet connections: Two 0.375-inch (DN 10) threaded compression connections, one for hot water and one for cold water.
   f. Outlet connections: One 0.375-inch (DN 10) threaded compression connections for tempered water.
   g. Basis of design: Powers LFG480.

5. Supply tubing: Provide 0.375-inch (DN 10) chrome-plated copper tubing and fittings between supply stops, thermostatic mixing valve and faucet.
6. P-trap and waste nipple:

   a. Chrome-plated, cast brass P-trap with ground joints, 1.25-inch inlet x 1.5-inch IPS outlet, swivel type, with cleanout.
   b. Chrome-plated cast brass 1.5-inch IPS waste nipple with cast brass chrome-plated set screw escutcheon.
   c. Basis of design: McGuire 8090 P-trap with McGuire waste nipple.

B. F-2 lavatory:

1. Application:

a. Adult, disabled.

2. Mounting height:

a. 34 inches (864 mm) rim to floor.

3. Faucet and drain:

a. Hard-wired sensor faucet and open grid drain.

2.3 MULTI-STATION WALL MOUNTED LAVATORY

A. Common requirements:

1. Fixture:

a. Material: Solid surface quartz, color selected by architect.
b. Lavatory type: Multi-user solid surface wall-hung wash fountain, front overflow.
c. Mounting: Wall-mounted. Include angled enclosure mounting option with hold open door. Include cast-iron plate carrier connection fitting.
d. Faucet holes (per faucet): Single faucet hole.
e. Enclosure mounting frame and access panel: Type 304 stainless steel.
f. Basis of design: Sloan Designer Series DSG

2. Supply nipples (provide one set per faucet):

a. Two brass nipples, triple-plated polished chrome of length and size as required.
b. Basis of design: Brass-Craft.

3. Supply stops (provide one set per faucet):

a. Chrome-plated angle ball valve, 0.5-inch NPT (DN 15) inlet, 0.375-inch (DN 10) female threaded compression outlet, loose key handle, and slip wall flange.
b. Basis of design: Chicago STB-21-00-AB.

4. Thermostatic mixing valve (provide one per faucet):

a. Below counter ASSE 1070 thermostatic mixing valve.
b. Brass body, adjustment cap with tamper resistant locking feature, integral inlet strainer screens, integral inlet check valves to protect against cross-flow.
c. Discharge temperature setting range: 80 to 120 degrees F (27 to 49 degrees C).
d. Flow rate range: 0.25 to 2.25 GPM (1.0 to 8.5 liters per minute).
e. Inlet connections: Two 0.375-inch (DN 10) threaded compression connections, one for hot water and one for cold water.

f. Outlet connections: One 0.375-inch (DN 10) threaded compression connections for tempered water.
g. Basis of design: Powers LFG480.

5. Supply tubing (provide one per faucet): Provide 0.375-inch (DN 10) chrome-plated copper tubing and fittings between supply stops, thermostatic mixing valve and faucet.
6. P-trap and waste nipple (2 required per wash station):

a. Chrome-plated, cast brass P-trap with ground joints, 1.25-inch inlet x 1.5-inch IPS outlet, swivel type, with cleanout.
b. Chrome-plated cast brass 1.5-inch IPS waste nipple with cast brass chrome-plated set screw escutcheon.
c. Basis of design: McGuire 8090 P-trap with McGuire waste nipple.

B. F-2A Four Station Lavatory:

1. Application

a. Adult, disabled.

2. Basis of design: Sloan DGS 8400
3. Mounting height: 34 inches (876 mm) rim to floor.
4. Faucet and drain (4 required):

a. Hard wired sensor faucet and open grid drain.

2.4 FAUCETS AND DRAINS

A. Common requirements:

1. Faucets shall be similar in appearance, function, and design to the basis of design model.
2. Faucets shall have a vandal-proof design.
3. Construction: Brass with polished chrome finish.
4. Mounting: Deck-mounted.
5. Provide faucets with a flow restrictor:
6. Flow restrictor: Provide either of the following:

a. Integral vandal-proof 0.35 GPM (1.3 liter per minute) non-aerating spray.
b. Retrofit flow restrictor:

(1) Vandal-proof 0.35 GPM (1.3 liter per minute) non-aerating spray, male thread.
(2) Basis of design: Chicago E39VPJKABCP.

B. Metering faucets:

1. Hard-wired sensor faucet (single faucet hole) and open grid drain:

a. Faucet centers: Mounted in single faucet hole.
b. Actuation: Daul-beam infrared sensors.
c. Spout: 5-inch (133-mm).
d. Consumption: 0.2 gallons per cycle maximum.
e. Power: Plug-in 12-volt AC transformer. Provide daisy chain electrical cable to combine multiple faucets on the same plug-in transformer.
f. Water connections: One connection for tempered water, 0.5-inch (DN 15) threaded connections for 0.375-inch (DN 10) riser.
g. Tailpiece:

(1) Cast brass open grid drain, 1.25-inch x 6-inch 17-gauge chrome-plated seamless brass tailpiece, chrome-plated brass lock nut, heavy rubber basin washer and fiber friction washer.
(2) Basis of design: McGuire 155-A.

h. Basis of design: Sloan EFX-200.

2.5 CARRIERS

A. Plate carrier:

1. Lavatories mounted on shafts or partitions where there is no floor on the opposite side:

a. Single lavatory: The plate carrier shall have a backup plate of 10-gauge steel, at least 6 inches (152 mm) high x 38 inches (965 mm) long.
b. Battery-mounted lavatories: The 10-gauge backup plate shall be continuous for full length of battery of fixtures, with the carrier plates properly spaced and welded to the backup plate.
c. Basis of design: Zurn Z1259 plate carriers.

2. Lavatories mounted on partitions where there is a floor on the opposite side:

a. Plate carrier with legs anchored to floor.
b. Basis of design: Zurn Z1224.

3. Multi-Station Lavatories:

a. Floor mounted carrier with legs anchored to floor with bearing plates, adjustable supporting rods, structural uprights, and welded feet.
b. Basis of design: Josam 17560-M1752 for 3-station units. Josam 17720-66-M1745 for 4-station units.

2.6 LAVATORY INSULATION KITS

A. Lavatory insulation kit:

1. Molded interlocking white trap and angle valve insulation assemblies with vinyl jacket.

2. Basis of design: Truebro “Lav-Guard 2” Series 100 E-Z.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide and set lavatories to extent and number indicated on drawings. Lavatories shall be left in first class condition, properly adjusted, cleaned and ready for operation.

B. Provide all parts, fittings, escutcheons, and appurtenances regularly required for each fixture.

C. Provide low-voltage devices and wiring for faucets which require them to operate.

D. Provide rough-in for lavatories. Coordinate elevations with other wall-mounted items.

E. Protect and cover lavatories so they cannot be used until final work acceptance.

F. Water supply:

1. Faucets with a separate hot water and cold water inlet:

a. Provide supply tubing and fittings between hot water supply stop and thermostatic mixing valve inlet.
b. Provide supply tubing and fittings between cold water supply stop and a 0.375-inch (DN 10) tee fitting. Provide supply tubing and fittings between tee and thermostatic mixing valve inlet and between tee and faucet cold water connection.
c. Provide supply tubing and fittings between thermostatic mixing valve tempered water discharge and faucet hot water connection.
d. Mount thermostatic mixing valve in a location that is accessible and as high as possible.

G. Provide wall-mounted lavatories with carriers.

H. Provide lavatories for the disabled with lavatory insulation kits. Where piping is concealed by a pedestal, the insulation kit may be omitted.

3.2 SETTING OF FIXTURES

A. In locations where fixtures are set against walls, seal crack between wall and fixture with silicon sealant.

B. Securely attach wall hung fixtures to wall using specified supports.

C. Provide reinforcement backer boards between studs for mounting of multi-station lavatories as indicated in the manufacturer’s recommended installation instructions. Anchor the enclosure mounting with hardware and fasteners recommended by the manufacturer.

D. After installation, paint undersides of cast-iron lavatories with two coats of white enamel.

END OF SECTION 22 42 00.03

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 22 42 00.04a - PLUMBING FIXTURES – MOP SINKS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Mop sinks, faucets, mop hangers, and related components.

1.2 RELATED SECTIONS

A. Piping:

1. Domestic water piping: Section 22 11 16.
2. Sanitary waste and vent piping: Section 22 13 16.

1.3 SUBMITTALS

A. Product data: For each mop sink specified, including fixture, trim, fittings, accessories, appurtenances, construction details, dimensions of components, and finishes.

B. Certification that products comply with NSF/ANSI 61.

C. Shop drawings: A schedule of proposed fixtures and trim, in the order listed in the specification.

1.4 QUALITY ASSURANCE

A. Lead free requirements:

1. Potable water system components, including pipe and joining materials, shall comply with NSF/ANSI 61 and with requirements for “lead-free” plumbing as defined by state laws and U.S. Safe Drinking Act.
2. Acceptance product marking: NSF®-61.

B. Fixtures shall be of the best commercial grade of their respective kinds, free from flaws, cracks, craze or other imperfections, complete with fittings and connections. Residential grade fixtures shall not be acceptable. Fixtures manufactured by acceptable manufacturers are acceptable provided they meet specified requirements and are similar to the basis of design.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis-of-design products: Subject to compliance with requirements, provide specified or scheduled products, or comparable product by one of the following.

1. Fixtures:

a. Acorn Engineering Co.
b. American Standard
c. Fiat Products
d. Zurn Plumbing Products
e. Or approved equal.

2. Faucets and mop hangers:

a. American Standard
b. Chicago Faucet Co.
c. Kohler
d. Moen
e. Speakman Co.
f. T & S Brass and Bronze Works, Inc.
g. Or approved equal.

2.2 MOP SINKS

A. F-3 mop sink (terrazzo):

1. Fixture:

a. Material: Terrazzo, black and white marble chips in gray Portland cement.
b. One-piece floor-mounted mop sink with drop front equipped with stainless-steel rim guard, and shoulders pitched 1:4 toward inside.
c. Dimensions: 36 inches x 36 inches (914 mm x 914 mm), 12 inches (305 mm) deep. Drop front: 6 inches (152 mm). Shoulders: No less than 2 inches (51 mm).
d. Basis of design: Fiat TSB-3002.

2. Accessories: Drain body with removable stainless-steel strainer plate, designed for an NPS 3 (DN 80) connection.
3. Faucet:

a. Water connections: 0.5-inch (DN 15) NPT with chrome-plated cast brass escutcheon.
b. Vacuum breaker spout with 3/4-inch (DN 20) male hose thread outlet, integral stops in shank, quarter turn lever handles, adjustable support arms, wall brace with adjustable rod, and pail hook.

c. Mounting height: 36 inches (914 mm) center line to finished floor.
d. Basis of design: Chicago 445-897SRXKCCP.

4. Mop hanger:

a. 24 inches (610 mm) long x 3 inches (76 mm) wide, 18-gauge, 302 stainless-steel mop hanger complete with slotted matching screws for mounting.
b. Basis of design: Fiat Products, Inc. 889-CC.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide and set mop sinks to extent and number indicated on drawings. Mop sinks shall be left in first class condition, properly adjusted, cleaned and ready for operation.

B. Provide all parts, fittings, escutcheons, and appurtenances regularly required for each fixture.

C. Provide rough-in for mop sinks.

D. Protect and cover mop sinks so they cannot be used until final work acceptance.

E. Install basins for mop sinks as recommended by manufacturer with space between basin and wall completely filled with a waterproof silicon sealant. Provide P trap.

END OF SECTION 22 42 00.04a

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 22 42 00.05a - PLUMBING FIXTURES – SINKS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Sinks and trim, faucets, other fittings, and related components.

1.2 RELATED SECTIONS

A. Piping:

1. Domestic water piping: Section 22 11 16.
2. Sanitary waste and vent piping: Section 22 13 16.

1.3 SUBMITTALS

A. Product data: For each sink specified, including fixture, trim, fittings, accessories, appurtenances, supports, construction details, dimensions of components, and finishes.

B. Certification that products comply with NSF/ANSI 61.

C. Shop drawings: A schedule of proposed fixtures and trim, in the order listed in the specification.

1.4 QUALITY ASSURANCE

A. UL label: As specified in Section 22 05 00, Common Work Results for Plumbing.

B. Lead free requirements:

1. Potable water system components, including pipe and joining materials, shall comply with NSF/ANSI 61 and with requirements for “lead-free” plumbing as defined by state laws and U.S. Safe Drinking Act.
2. Acceptance product marking: NSF®-61.

C. Fixtures shall be of the best commercial grade of their respective kinds, free from flaws, cracks, craze or other imperfections, complete with fittings and connections. Residential grade fixtures shall not be acceptable. Fixtures manufactured by acceptable manufacturers are acceptable provided they meet specified requirements and are similar to the basis of design.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis-of-design products: Subject to compliance with requirements, provide specified or scheduled products, or comparable product by one of the following.

1. Fixtures:

a. Acorn Engineering Co.
b. American Standard
c. Bradley Corporation
d. Commercial Enameling Co.
e. Eljer
f. Elkay Manufacturing Co.
g. Just Co.
h. Kohler Co.
i. Zurn Plumbing Products
j. Or approved equal.

2. Faucets:

a. American Standard
b. Chicago Faucet Co.
c. Speakman Co.
d. T & S Brass and Bronze Works, Inc.
e. Or approved equal.

3. Supplies, traps, and miscellaneous trim:

a. Acorn Engineering Co.
b. Brass-Craft Manufacturing Co.
c. Chicago Faucet Co.
d. Elkay Manufacturing Co.
e. Engineered Brass Co.
f. McGuire Manufacturing Co.
g. T & S Brass and Bronze Works, Inc.
h. Or approved equal.

2.2 KITCHENETTE SINKS

A. F-5 sink, kitchen:

1. Fixture:

a. Material: Type 304 stainless steel, 18-gauge, sound deadening coating on underside.

b. Sink type: Single-compartment, seamless radius-coved corners, 8-inch (102-mm) faucet centers.

(1) 3-hole ledge.

c. Dimensions: 17.5 inches x 15 inches (445 mm x 381 mm).
d. Bowl Dimensions: 12 inches x 12 inches x 6.375 inches deep
e. Mounting: In countertop specified in Division 12.
f. Basis of design: Elkay LRAD151765.

2. Faucet:

a. Chrome-plated cast brass, combination hot and cold water faucet, deck-mounted, 8-inch (203-mm) swing spout with non-aerating spray outlet, 8-inch (203-mm) faucet centers, 2-inch (51 mm) single-wing handles, quarter turn cartridge valves.
b. Water connections: 0.375-inch compression.
c. Water consumption: 1.5 GPM.
d. Basis of design: Chicago 1100-E35ABCP.

3. Supply nipples:

a. Two brass nipples, triple-plated polished chrome of length and size as required.
b. Basis of design: Brass-Craft.

4. Supply stops, thermostatic mixing valve, and supply tubing:

a. Supply stops:

(1) Chrome-plated angle ball valve, 0.5-inch NPT (DN 15) inlet, 0.375-inch (DN 10) female compression outlet, loose key handle, and slip wall flange.
(2) Basis of design: Chicago STB-21-00-AB.

b. Thermostatic mixing valve:

(1) Below counter ASSE 1070 thermostatic mixing valve.
(2) Brass body, adjustment cap with tamper resistant locking feature, integral inlet strainer screens, integral inlet check valves to protect against cross-flow.
(3) Discharge temperature setting range: 80 to 120 degrees F (27 to 49 degrees C).
(4) Flow rate range: 0.25 to 2.25 GPM (1.0 to 8.5 liters per minute).
(5) Inlet connections: Two 0.375-inch (DN 10) threaded compression connections, one for hot water and one for cold water.
(6) Outlet connections: One 0.375-inch (DN 10) threaded compression connections for tempered water.
(7) Basis of design: Powers LFG480.

c. Supply tubing: Provide 0.375-inch (DN 10) chrome-plated copper tubing and fittings between supply stops, thermostatic mixing valve and faucet.

5. Drain:

    a. Crumb cup strainer with 1.5-inch x 4-inch tailpiece.
    b. Basis of design: Elkay LK-35-B.

6. Slip tailpiece for dishwasher waste:

    a. Chrome-plated 1.5 inch (DN 40) brass tailpiece with dishwasher waste connection.

7. P trap and waste nipple:

    a. Chrome-plated brass body, 1.5-inch x 1.5-inch IPS outlet, swivel type, with cleanout.
    b. Chrome-plated cast brass 1.5-inch IPS waste nipple with cast brass chrome-plated set screw escutcheon.
    c. Basis of design: McGuire 8089 with McGuire waste nipple.

2.3 UTILITY SINKS

A. F-5A sink, utility with solids separator (Mud Room):

1. Fixture:

    a. Material: Type 300 series stainless steel, 18-gage
    b. Sink type: Single-compartment scullery sink with square corner welded construction. Full length 8-inch high integral backsplash. NSF certified. Faucet holes are 8 inch on centers in backslash.
    c. Supports: Four stainless steel 1-5/8-inch OD tubular legs with adjustable bullet shaped feet.
    d. Dimensions: Overall 21-inch (533 mm) by 21.5-inch (546 mm) inches by 34-inch (864 mm) tall, with one 18-inch by 18-inch by 12-inch (457mm x 457mm x 305mm) deep bowl and 8 inch backsplash.
    e. Basis of design: Elkay B1C18X18X

2. Faucet:

    a. Chrome-plated cast brass, combination hot and cold water faucet, wall-mounted, 8-inch (203-mm) swing spout with 0.75-inch hose thread male outlet with adaptor and atmospheric vacuum breaker, 8-inch (203-mm) faucet centers, 4-inch (102 mm) wristblade handles, quarter turn cartridge valves.
    b. Water connections: 0.375-inch compression.
    c. Water consumption: 2.2 GPM.
    d. Basis of design: Chicago 631-L8BVBE2-2CP

3. Drain:

    a. Elkay No. LK-18-B stainless-steel stamped drain fitting, 4.5-inch (114-mm) top with 3-inch (76-mm) grid, and 1.5-inch OD tailpiece.

4. P trap and waste nipple:

    a. Chrome-plated brass body, 1.5-inch x 1.5-inch IPS outlet, swivel type, with cleanout.
    b. Chrome-plated cast brass 1.5-inch IPS waste nipple with cast brass chrome-plated set screw escutcheon.
    c. Basis of design: McGuire 8089 with McGuire waste nipple.

5. Thermostatic mixing valve:

    a. Thermostatic mixing valve:

        (1) ASSE 1070 thermostatic mixing valve.
        (2) Brass body, adjustment cap with tamper resistant locking feature, integral inlet strainer screens, integral inlet check valves to protect against cross-flow.
        (3) Discharge temperature setting range: 80 to 120 degrees F (27 to 49 degrees C).
        (4) Flow rate range: 0.25 to 2.25 GPM (1.0 to 8.5 liters per minute).
        (5) Inlet connections: Two 0.375-inch (DN 10) threaded compression connections, one for hot water and one for cold water.
        (6) Outlet connections: One 0.375-inch (DN 10) threaded compression connections for tempered water.
        (7) Basis of design: Powers LFG480.

6. Solids Separator:

    a. Under-sink solids interceptor equal to Striem “SIDEKICK” as specified in 221319.

B. F-5B sink, utility with solids separator (Exhibit Storage Room):

1. Fixture:

    a. Material: Type 304 stainless steel, 14-gage
    b. Sink type: Single-compartment scullery sink with square corner welded construction. Full length 8-inch high integral backsplash. NSF certified. Faucet holes are 8 inch on centers in backslash.
    c. Supports: Four stainless steel 1-5/8-inch OD tubular legs with adjustable bullet shaped feet.
    d. Dimensions: Overall 33-inch (838 mm) by 27.5-inch (699 mm) inches by 36-inch (914 mm) tall, with one 30-inch by 24-inch by 14-inch (762mm x 610mm x 356mm) deep bowl and 8 inch backsplash.
    e. Basis of design: Elkay SS81302

2. Faucet:

    a. Chrome-plated cast brass, combination hot and cold water faucet, wall-mounted, 8-inch (203-mm) swing spout with 0.75-inch hose thread male outlet with adaptor and atmospheric vacuum breaker, 8-inch (203-mm) faucet centers, 4-inch (102 mm) wristblade handles, quarter turn cartridge valves.
    b. Water connections: 0.375-inch compression.
    c. Water consumption: 2.2 GPM.
    d. Basis of design: Chicago 631-L8BVBE2-2CP

3. Drain:

    a. Elkay No. LK-18-B stainless-steel stamped drain fitting, 4.5-inch (114-mm) top with 3-inch (76-mm) grid, and 1.5-inch OD tailpiece.

4. P trap and waste nipple:

    a. Chrome-plated brass body, 1.5-inch x 1.5-inch IPS outlet, swivel type, with cleanout.
    b. Chrome-plated cast brass 1.5-inch IPS waste nipple with cast brass chrome-plated set screw escutcheon.
    c. Basis of design: McGuire 8089 with McGuire waste nipple.

5. Thermostatic mixing valve:

    a. Thermostatic mixing valve:

        (1) ASSE 1070 thermostatic mixing valve.
        (2) Brass body, adjustment cap with tamper resistant locking feature, integral inlet strainer screens, integral inlet check valves to protect against cross-flow.
        (3) Discharge temperature setting range: 80 to 120 degrees F (27 to 49 degrees C).
        (4) Flow rate range: 0.25 to 2.25 GPM (1.0 to 8.5 liters per minute).
        (5) Inlet connections: Two 0.375-inch (DN 10) threaded compression connections, one for hot water and one for cold water.
        (6) Outlet connections: One 0.375-inch (DN 10) threaded compression connections for tempered water.
        (7) Basis of design: Powers LFG480.

6. Solids Separator:

    a. Under-sink solids interceptor equal to Striem “SIDEKICK” as specified in 221319.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Furnish, provide rough-in for, and set sinks to extent and number indicated on drawings. Sinks shall be left in first class condition, properly adjusted, cleaned and ready for operation.

B. Provide all parts, fittings, escutcheons, and appurtenances regularly required for each fixture.

C. Protect and cover fixtures so they cannot be used until final work acceptance.

D. Water supply for kitchen sinks with thermostatic mixing valves:

1. Provide supply tubing and fittings between hot water supply stop and thermostatic mixing valve inlet.
2. Provide supply tubing and fittings between cold water supply stop and a 0.375-inch (DN 10) tee fitting. Provide supply tubing and fittings between tee and thermostatic mixing valve inlet and between tee and faucet cold water connection.
3. Provide supply tubing and fittings between thermostatic mixing valve tempered water discharge and faucet hot water connection.
4. Mount thermostatic mixing valve in a location that is accessible and as high as possible.

E. Water supply for utility sinks with thermostatic mixing valves:

1. Provide shut-off valve on cold and hot water piping serving the fixture as indicated on drawings.
2. Provide piping and fittings between hot water supply stop and thermostatic mixing valve inlet.
3. Provide piping and fittings between cold water supply stop and a 0.375-inch (DN 10) tee fitting. Provide piping and fittings between tee and thermostatic mixing valve inlet and between tee and faucet cold water connection.
4. Provide piping and fittings between thermostatic mixing valve tempered water discharge and faucet hot water connection.
5. Mount thermostatic mixing valve where indicated on drawings in accessible location.

END OF SECTION 22 42 00.05a

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 22 42 00.06 - PLUMBING FIXTURES - DRINKING FOUNTAINS AND WATER COOLERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Drinking fountains and water coolers, trim, fittings, and related components.

1.2 RELATED SECTIONS

A. Piping:

1. Domestic water piping: Section 22 11 16.
2. Sanitary waste and vent piping: Section 22 13 16.

1.3 SUBMITTALS

A. Product data: For each drinking fountain and water cooler specified, including fixture, trim, fittings, accessories, appurtenances, supports, construction details, dimensions of components, and finishes.

B. Certification that products comply with NSF/ANSI 61.

C. Shop drawings: A schedule of proposed fixtures and trim, in the order listed in the specification.

1.4 QUALITY ASSURANCE

A. UL label: As specified in Section 22 05 00, Common Work Results for Plumbing.

B. Lead free requirements:

1. Potable water system components, including pipe and joining materials, shall comply with NSF/ANSI 61 and with requirements for “lead-free” plumbing as defined by state laws and U.S. Safe Drinking Act.
2. Acceptance product marking: NSF®-61.

C. Fixtures shall be of the best commercial grade of their respective kinds, free from flaws, cracks, craze or other imperfections, complete with fittings and connections. Residential grade fixtures shall not be acceptable. Fixtures manufactured by acceptable manufacturers are acceptable provided they meet specified requirements and are similar to the basis of design.

D. Fixtures and trim where required to be accessible to disabled people, identified in this section as “for disabled,” shall comply with requirements of the Americans with Disabilities Act (ADA) Regulations, as applicable to each type of fixture or its use.

1. Trim must meet requirements for force of operation at water pressures up to 80 psi.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis-of-design products: Subject to compliance with requirements, provide specified or scheduled products, or comparable product by one of the following.

1. Water coolers and fountains:

a. Eljer Mfg. Co.
b. Elkay Manufacturing Company
c. Halsey Taylor
d. Haws Corp.
e. Oasis Water Coolers
f. Sunroc Corporation
g. Or approved equal.

2. Supplies, traps, and miscellaneous trim:

a. Acorn Engineering Co.
b. Bradley Corporation
c. Brass-Craft Manufacturing Co.
d. Chicago Faucet Co.
e. Elkay Manufacturing Co.
f. Engineered Brass Co.
g. Guy Gray; IPS Corporation
h. Haws Corp.
i. McGuire Manufacturing Co.
j. T & S Brass and Bronze Works, Inc.
k. Or approved equal.

3. Fixture supports and carriers:

a. Josam Mfg. Co.
b. J.R. Smith
c. Zurn Plumbing Products
d. Or approved equal.

2.2 BARRIER FREE SURFACE-MOUNTED BI-LEVEL WATER COOLERS

A. Common requirements:

1. Fixture:

a. Water cooler type: Barrier free refrigerated-type bi-level water cooler.
b. Refrigeration circuit: R-134a, compressor with air-cooled condenser. Plug connection suitable for operation on 120-V, single-phase, 60-Hz current.
c. Capacity: To cool 8 gallons (30 L) per hour with inlet water 80 degrees F and room temperature 90 degrees F.
d. Lead: Waterways shall contain no lead. This requirement exceeds the requirement for the standard designation of "lead free."
e. Mounting: Surface-mounted on wall via galvanized steel bracket provided with unit.
f. Construction:

(1) Stainless steel satin finish basin tops.
(2) Galvanized steel frame.

g. Activation:

(1) Front and side mounted anti-microbial copper push pads.

h. Exterior panels:

(1) Stainless steel.

i. Bubbler:

(1) Flexible hooded bubbler with non-squirt feature.

j. Water connection: 0.375-inch (DN 10) with built-in 100 micron strainer.
k. Waste connection: 1.25-inch (DN 32) tailpiece.
l. P trap:

(1) 1.25-inch x 1.5-inch (DN 32 x DN 40) IPS outlet, cast-brass, ground joint, swivel type, with cleanout and complete with NPS 1-1/2 (DN 40) brass nipple with cast set screw escutcheon.
(2) Basis of design: McGuire 8090 with 2127 nipple.

m. Filter:

(1) Provide unit without filter.

2. Carrier:

a. Plate carrier with legs anchored to floor.
b. Basis of design: Zurn Z1225.

B. F- 4 barrier free surface mounted bi-level water cooler for disabled with bottle filler:

1. Provide with bottle filling station with brushed stainless-steel cabinet and electronic hands-free activation above lower basin.
2. Mounting height: For the basis of design, bubbler shall be 36 inches (914 mm) above finished floor and upper bubbler shall be 40 inches (1016 mm) above the finished floor.

3. Basis of design: Oasis PG8EBFSL.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Furnish, provide rough-in for, and set fixtures to extent and number indicated on drawings. The fixtures shall be left in first class condition, properly adjusted, cleaned and ready for satisfactory operation.

B. Provide all parts, fittings, escutcheons, and appurtenances regularly required for each fixture.

C. Securely attach wall hung fixtures to wall using specified supports.

D. Protect and cover fixtures so they cannot be used until final work acceptance.

E. Frost-proof drinking fountains: Provide water connection with shut-off valve and transition to fixture connection size. Provide connection from fixture's trap to sanitary system.

F. Water coolers: Provide water connection with shut-off valve concealed behind fixture access panel and transition to fixture connection size. Provide P-trap and connect to fixture tailpiece, concealed behind fixture access pane, and connect to sanitary system.

G. Provide mounting heights for fixtures "for disabled" that coordinate with the manufacturer's requirements for the fixture provided allowing for adequate leg room as well as a compliant bubbler height.

END OF SECTION 22 42 00.06

SECTION 23 01 00 - OPERATION AND MAINTENANCE OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Start-up and service for burners.

B. Start-up and service for refrigeration equipment.

C. Refrigeration equipment warranty.

1.2 RELATED SECTIONS

A. Operating manuals: Division 01 and Section 23 01 01.

B. General project warranty: General Conditions.

C. Refrigeration system start-up and service:

1. Condensing units: Section 23 63 13.
2. Air-handling units with coils: Section 23 73 22.
3. Variable-refrigerant-flow HVAC systems: Section 23 81 29.

1.3 SUBMITTALS

A. Samples:

1. Proposed service or test agreements of each type included in the project. Include a detailed list of work to be performed at each visit.

B. Service agency qualifications:

1. Refrigeration installation and service agency:

a. Name and address.
b. A list of ten projects, similar to this project in type, size, and components, which have been operating satisfactorily for at least two heating and cooling seasons.
c. A letter from each manufacturer of equipment requiring start-up or service, on the manufacturer's letterhead, indicating that the agency has been trained by the manufacturer and is acceptable to the manufacturer.
d. Attestation that that agency provides emergency service on call 24 hours a day.
e. Attestation that the agency maintains a stock of manufacturer's approved parts to service this equipment.
f. Attestation that the agency has service contracts available, meeting requirements specified for the equipment and systems of this project.

C. Field test reports:

1. Start-up reports for each burner:

a. Submit copies of burner start-up reports to the County Health Department, Division of Air Quality Control and the Owner.

2. Start-up reports for each piece of refrigeration equipment.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with the plumbing, electrical, building, fire and safety codes of the state, county or city in which the work is performed.

B. Burner operation shall meet the requirements for exhaust gases and temperature of the applicable authorities having jurisdiction.

1.5 QUALIFICATIONS OF EACH SERVICE AND MAINTENANCE AGENCY

A. Regularly engaged in performing installation, start-up, and service work for equipment and systems of the types included in this project.

B. Located in the Wilmington, DE, metropolitan area.

C. Staff factory-trained by the manufacturer of the equipment included in this project.

D. Provides emergency service on call 24 hours a day.

E. Maintains an adequate stock of manufacturer’s approved parts to service this equipment.

F. Has service contracts available, meeting requirements specified for the equipment and systems of this project.

1.6 REFRIGERATION EQUIPMENT START-UP, SERVICE, AND WARRANTY

A. Provide start-up, service, and emergency service for each refrigeration system installed as part of the work, by an agency qualified as described above.

B. Start-up:

1. Check all parts of the installation applicable to each refrigeration circuit. Verify that piping, wiring, controls, and appurtenances are in accordance with the recommendations of the equipment manufacturer.
2. Verify there is no physical damage to the equipment.
3. Verify that refrigerant charge is sufficient.
4. Leak test the refrigerant circuit with approved halide or electronic leak detector.
5. Check oil level where applicable and visually check for leaks.

6. Check and adjust operating temperature set points.
7. Check and adjust refrigerant circuit safety devices and set points.
8. Operate for run in period according to the manufacturer's written instructions.
9. Perform the following for chiller evaporators and water-cooled condensers:

    a. Verify that pumps are installed and functional.
    b. Verify vibration isolation and flexible pipe connections are installed.
    c. Verify appropriate pipes are connected to appropriate equipment connections.
    d. Verify appropriate access is provided for tube cleaning.
    e. Verify that thermometers and gauges are installed.
    f. Check bearing lubrication.
    g. Verify that refrigerant pressure relief is vented outside.
    h. Verify proper motor rotation.
    i. Verify temporary devices used for equipment transport are removed.
    j. Verify vibration isolator static deflection, including deflection during startup and shutdown.
    k. Verify and record performance of water flow and low temperature interlocks.
    l. Verify and record performance of safety and protection devices.
    m. Additional tests recommended by the manufacturer or required by specification sections.

10. Provide a start-up report including the following:

    a. Overall system condition.
    b. Verification that the system has been leak tested.
    c. Verification that the system has been checked for oil leaks.
    d. Record control set points.
    e. Record operating refrigerant pressures and temperatures.
    f. Record expansion valve super heat where applicable.
    g. Record temperatures of fluids entering and leaving evaporator and condenser.
    h. Record proper operation of safety and protection devices.
    i. Record starting and running amperage.
    j. Record power voltage and control voltage.

C. Service:

1. Period of service:

    a. Provide service during the correction period.

2. Frequency of service:

    a. Provide service near the beginning and the end of each cooling season.

3. Type of service: In addition to the repair service required during the correction period, provide maintenance service including the following for each piece of refrigeration equipment:

    a. All refrigeration equipment:

(1) Inspect complete refrigerant circuit for refrigerant leaks with approved halide or electronic leak detector. Correct as necessary.
(2) Replace defective parts and refrigerant at no addition to the contract sum.
(3) Tighten nuts, screws, and terminal wiring connections as required.
(4) Clean evaporators and condensers as needed.
(5) Lubricate moving parts as needed.
(6) Check for blockage of condensate elimination system and correct as required.
(7) Check and record unit starting and running amperage.
(8) Check and record power voltage and control voltage.
(9) Check and record operating temperatures and pressure. (Pressure not required on hermetic circuits.)
(10) Check and record thermostatic expansion valve super heat.
(11) Check temperature and pressure controls and adjust as required.
(12) Check limit switches and safety controls and adjust as required.
(13) Provide the Owner with a report describing the work performed and reporting measurements and results of tests.

D. Emergency service: Supply emergency service promptly upon call during correction period with no extra charge to Owner.

E. Warranty: In addition to the general project warranty, provide manufacturer's special warranties:

1. Provide a manufacturer's warranty to cover replacement of all refrigeration system parts and components for no less than the time of the general project correction period, starting from the date of substantial completion, executed to the Owner.
2. Provide compressors with an additional extended manufacturer's parts-only warranty for a total of five years, including the general correction period (unless a longer duration is specified elsewhere), executed to the Owner.
3. Provide refrigerant circuits of self-contained units with an additional extended parts-only warranty for a total of five years, including the general correction period, executed to the Owner.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 230100

SECTION 23 01 01 - HVAC GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. General provisions and requirements for all HVAC work.

1.2 RELATED SECTIONS

A. Requirements of this section generally supplement requirements of Division 01.\

B. Commissioning requirements: Divisions 01 and 23.

1.3 REFERENCES

A. NFPA 10: Portable Fire Extinguishers.

B. NFPA 241: Safeguarding Construction, Alteration, and Demolition Operations.

1.4 SYSTEM DESCRIPTION

A. The full set of Contract Documents applies to work of Division 23.

B. Visit the site and study all aspects of the project and working conditions, as required by General and Supplementary Conditions, Bidding and Contracting Requirements, Drawings, and Specifications. Verify field dimensions.

C. The work covered in technical sections includes the furnishing of all labor, equipment and materials, and the performance of all operations pertinent to the work described.

D. Except as required otherwise in Division 01, promptly obtain and pay for, including all necessary signatures and paperwork, all permits, fees and inspections required for work of this division by authorities having jurisdiction, including any utility connection or extension charge. No payment will be made until a copy of the permit is forwarded to the Owner.

E. HVAC work of this project includes, as a brief general description, the following:

1. A completely new HVAC system for the new nature center consisting of a variable refrigerant flow system and a dedicated outdoor air unit. The dedicated outdoor air unit consists of a split system air handling unit with companion heat pump condensing unit.
2. The project includes commissioning under the direction of a Commissioning Agent (CxA).

F. See Division 01 for requirements related to Owner's occupancy of the premises, limits on use of site, time restrictions on work, limits on utility outages or shutdowns, and phasing (sequencing) and scheduling.

1.5 PRODUCT OPTIONS

A. Except as modified by provisions of Bidding and Contracting Requirements and Division 01, the following options apply to Division 23 specifications.

1. Products specified by reference standards or by description only: Any product meeting those standards or description.
2. Products specified by naming one or more manufacturers, or model name or catalog reference number: Products specified establish a standard of quality, options to be included, and performance.

    a. Where other acceptable manufacturers are named, Contractor may provide products of those named manufacturers only, which meet the specifications.
    b. Where specification permits "equal" products, without naming other acceptable manufacturers, Contractor may use products of any manufacturer, which meet the specifications.

3. Products specified by naming one manufacturer and particular product, with no provision for other options: No options or substitutions allowed.

B. Where Contractor is permitted to use a product other than the specified item and model named as the basis of design, Contractor is responsible for all coordination and additional costs as specified in the article "Substitutions," below for substitutions.

1.6 SUBSTITUTIONS

A. Substitutions will be considered only as permitted or required by the Bidding and Contracting Requirements and Division 01. Except as modified by those requirements, the requirements below apply to Division 23 specifications.

B. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

C. Document each request with complete data substantiating compliance of proposed substitution with contract documents.

D. A request constitutes a representation that the Bidder or Contractor:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
2. Will provide the same warranty for the substitution as for the specified product.
3. Will coordinate installation and make changes to other work which may be required for the work to be complete with no additional cost to Owner.

4. Waives claims for additional costs or time extension which may subsequently become apparent.
5. Will reimburse Owner for review or redesign services associated with re-approval by authorities.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

F. Substitution submittal procedure is specified in Bidding and Contracting Requirements and Division 01.

1.7 MATERIALS AND EQUIPMENT

A. All materials and equipment shall be new and the best of their respective kinds, suitable for the conditions and duties imposed on them by the project, and of representative manufacture. The description, characteristics and requirements of the materials to be used shall be in accordance with the specifications.

B. All equipment, construction and installation must meet requirements of local, state and federal governing codes.

C. Singular number: In cases where material, a device, or part of the equipment is referred to in the singular number in the specifications, it is intended that such reference shall apply to as many items of material, devices, or parts of the equipment as are required to complete the installation as shown on the drawings or required for proper operation of the system.

D. Terms have the following meanings:

1. Furnish: Supply item
2. Install: Mount and connect item
3. Provide: Furnish and install.

E. All materials and equipment shall be installed and completed in a first class and workmanlike manner and in accordance with the best modern methods, practice and manufacturers' instructions. Any work which shall not present an orderly and neat or workmanlike appearance shall be removed and replaced with satisfactory work when so directed in writing by the Architect.

F. The specifications and drawings are intended to define the minimum requirements, as to quality of materials, construction, finish and overall workmanship.

G. General Conditions describe the correlation and intent of the Contract Documents. In case of discrepancies between the specifications and drawings, the specifications should be followed as to the general methods and principles and the drawings followed as to sizes, capacities and specifics for corresponding parts. If sizes are omitted, the Architect will determine sizes to be utilized.

H. In all cases of doubt, uncertainty, or conflict as to the true meaning of the specifications or drawings, it is the responsibility of the Contractor to notify the Architect of said uncertainty, doubt, or conflict and obtain a decision as to the intent before starting any work which may be affected by this decision.

1.8 COORDINATION

A. Should a situation develop during construction to prevent the proper installation of any equipment or item where shown on the drawings, call the situation to the attention of the Architect and await a written decision.

B. Plan and coordinate all work to proceed in an orderly and continuous manner without undue delay, and in conformance with project schedule. Submit samples, shop drawings, schedules, insurance policies and certificates, and the like in time to avoid delays in actual construction. Coordinate HVAC work so that work of each trade is completed before other construction begins which would obstruct it.

C. Coordinate trades to ensure that proper clearances between work of the various trades allow access to items which require operation and maintenance.

D. Coordinate location and elevation of all piping, ductwork, light fixtures, equipment, and appurtenances in such a manner that the finished installation is as indicated on drawings. In the event difficulties are encountered which prevent this, it is the Contractor's responsibility to bring this to the attention of the Architect prior to initiation of work. Correct improperly coordinated installation at no additional cost.

E. The Contractors' assistants shall include a competent foreman, who shall be on the premises at all times to check, lay out, coordinate and superintend the installation of work. The foreman shall establish all grades and lines relative to the work before starting, and be responsible for the accuracy thereof.

1.9 SUBMITTALS

A. Manufacturers' and subcontractors' lists:

1. As specified in Division 01, submit a complete list of proposed manufacturers for all equipment, materials and subcontractors used for the work of this division. Lists shall follow the sequence of the specifications. No considerations will be given for partial or incomplete lists. After review of lists, submit shop drawings and product data.

B. Shop drawings and product data:

1. Submit in accordance with the requirements of Division 01 or as established at the preconstruction conference, the required number of copies of shop drawings and product data for every item of equipment. Shop drawings or product data will not be considered until manufacturers' lists have been approved. Shop drawings and product data shall be submitted, as required by the General Conditions, with sufficient time for checking, return to Contractor, and resubmission as required before Contractor shall install any item.
2. Each item submitted shall be properly labeled, indicating the specific service for which the equipment or material is to be used, section and paragraph number of specification or drawing number to which it applies, Contractor's name and project name and number. Data submitted shall be specific and shall include product data and printed information in sufficient detail and scope to verify compliance with requirements of the contract documents. Clearly identify each item within the data. Data of a general nature will not be accepted. Each sheet must clearly show the project name and number.
3. The review of a shop drawing or product data shall not be considered as a guarantee of the measurements or building conditions or that the shop drawings or product data have been checked to see that item submitted properly fits the building conditions. This review shall not relieve the Contractor of the responsibility for furnishing material or performing work as required by the contract documents, for correctness of dimensions and quantities, or for proper coordination of details and interfaces among trades.
4. All exclusively electrical items furnished as items associated with mechanical items but not specifically described in the mechanical item submission, shall be submitted as a separate submittal but shall be clearly marked as associated with the mechanical item by identification specification paragraph.
5. Product data sheets shall be 8.5-inches by 11-inches cut sheets for operating and maintenance manual.

C. Submit at least three copies of the results of every test required under any section in this division.

D. Specialist shall submit a list of at least three projects similar to this project in type, size, and quality, which have been in place and operating satisfactorily for at least five years.

1. Include project name, address, name and phone number of owner's representative, and project type and size.

E. After the work is completed, submit all required certificates of approval from approved inspection agencies and authorities having jurisdiction over work of this division. Certificates of approval must be received by the Architect prior to final acceptance of the work.

1.10 SPECIALIST

A. The term "Specialist" as used in the specification shall mean an individual or firm of established reputation (or, if newly organized, whose personnel have previously established a reputation in the same field,) which is regularly engaged in, and which maintains a regular force of workers skilled in either (as applicable) manufacturing or fabricating items required by the contract, installing items required by the contract, or otherwise performing work required by the contract. Where the specification requires installation by a specialist, the term shall also be deemed to mean the manufacturer of the item, an individual or firm licensed by the manufacturer, or an individual or firm who will perform the work under the manufacturer's direct supervision.

1.11 CONTRACT CLOSEOUT SUBMITTALS

A. Project record documents:

1. Maintain on site one set of the following record documents; record actual revisions to the work of this division:

   a. Contract drawings.
   b. Specifications.
   c. Addenda.
   d. Change orders and other modifications to the Contract.
   e. Reviewed shop drawings, product data, and samples.

2. Maintain record documents separate from documents used for construction.
3. Record information concurrent with construction progress.
4. Specifications: Legibly mark and record in each section a description of actual products installed, including the following:

   a. Manufacturer's name and product model and number.
   b. Product options, substitutions, or alternates utilized.
   c. Changes made by addenda and modifications.

5. Record documents and shop drawings: Legibly mark each item to record actual construction, including:

   a. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   b. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the work.
   c. Field changes of dimension and detail.
   d. Details not on original Contract Drawings.

6. Submit documents as specified in Division 01.

B. Operation and maintenance data:

1. Submit sets prior to final inspection as specified in Division 01. Unless otherwise specified in Division 01, submit no fewer than three sets. In addition to requirements specified in Division 01, submit operating and maintenance manuals for the work of this division as specified below.
2. Lubrication charts: Prepare lubrication charts for each piece of mechanical equipment that requires grease or oil.

   a. Include the following:

      (1) Types of lubricants required.
      (2) Locations of lubrication points.
      (3) Frequency of lubrication.

b. Provide one extra set of lubrication charts mounted in plastic covers, besides those required in Operating and Maintenance Manuals.

3. Binders: Three-ring binders with vinyl-covered hard covers. Provide large enough binders, and sufficient quantity, that the required contents can be easily turned, removed, and reinserted.
4. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS," and title of project. Print on spine of binder "O & M INSTRUCTIONS." If more than one binder is required, print covers and spines with volume numbers. Include in the front of every binder an index to all binders.
5. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
6. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, typed on white paper.
7. Part 1: Directory, listing names, addresses, and telephone numbers of mechanical engineers; Contractor; mechanical subcontractors; and major mechanical equipment suppliers.
8. Part 2: Operation and maintenance instructions, arranged by specification section. For each category, identify names, addresses, and telephone numbers of subcontractors and suppliers. Identify the following:

    a. Significant design criteria, including pump and fan curves and similar performance charts.
    b. List of equipment, including operating weight of each piece.
    c. Parts list for each component, including recommended spare parts list.
    d. Operating instructions.
    e. Maintenance instructions for equipment and systems.
    f. Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.
    g. Valve charts, including locations of flow fittings.

9. Part 3: Project documents and certificates, including the following:

    a. Shop drawings and product data.
    b. Air and water balance reports.
    c. Photocopies of certificates.
    d. Photocopies of warranties and guarantees.
    e. Test reports: Copies of the results of all tests required under all sections of specifications.

10. Submit one copy of completed volumes in final form 15 days prior to final inspection. This copy will be returned after final inspection, with Engineer comments. Revise content of documents as required prior to final submittal.
11. Submit final volumes revised, within ten days after final inspection.

1.12 REGULATORY REQUIREMENTS

A. When these specifications call for materials or construction of a better quality or larger sizes than required by the following codes and standards, the provisions of the specifications shall take precedence.

B. Provide, without extra charge, any additional materials and labor which may be required for compliance with these codes and standards even though the work is not mentioned in these specifications or shown on the contract drawings.

C. Perform the work of this division in strict accordance with the following authorities. The latest revision of these codes accepted by the authority having jurisdiction as of the date of the contract documents shall apply.

1. The plumbing, mechanical, electrical, building, fire, and safety codes of the state and county or city in which the work is being performed.
2. The National Electric Code, NFPA 70 (NEC).
3. The National Fire Protection Association Code. (NFPA).
4. International Energy Conservation, Fire, Fuel Gas, Mechanical, and Plumbing Codes (ICC).

1.13 REFERENCE STANDARDS

A. Perform the work of this division using the standards of the following organizations, as referred to in technical sections, as a minimum requirement for construction and testing. Unless specified otherwise in Bidding and Contract Documents or Division 01, the latest revision current as of the date of the contract documents shall apply. Products shall be certified by manufacturers to meet the requirements of referenced standards.

1. Federal Specifications (FS)
2. Military Specification (MS)
3. Military Standards (Mil. Std.)
4. Air Conditioning, Heating, and Refrigeration Institute (AHRI)
5. Air Movement and Control Association (AMCA)
6. Associated Air Balance Council (AABC)
7. American Association State Highway and Transportation Officials (AASHTO)
8. American National Standards Institute (ANSI)
9. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
10. ASME International (ASME)
11. American Society for Testing and Materials (ASTM)
12. American Society of Sanitary Engineering (ASSE)
13. American Water Works Association (AWWA)
14. International Code Council (ICC)
15. Manufacturer’s Standardization Society of the Valve and Fittings Industry Inc. (MSS)
16. National Electrical Code, NFPA 70 (NEC)
17. National Electrical Manufacturer’s Association (NEMA)
18. National Fire Protection Association (NFPA)
19. National Fuel Gas Code, NFPA 54

20. National Sanitary Foundation (NSF)
21. National Standard Plumbing Code (NSPC)
22. The Occupational Safety and Health Act (OSHA)
23. Piping and Drainage Institute (PDI)
24. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)
25. Underwriters Laboratory Inc. (UL)
26. Delaware Occupational Safety and Health Act

1.14 TEMPORARY STORAGE

A. Maintain upon premises, where directed, a storage area, and be responsible for all contents within these areas. Provide all security measures necessary for this area.

B. Maintain the area and return it to its original condition at project completion.

1.15 PROTECTION

A. Control dust resulting from construction work to prevent its spread beyond the immediate work area, and to avoid creation of a nuisance.

1. Do not use water to control dust. Use drop cloths or other suitable barriers.
2. In areas where dirt or dust is produced as a result of the work, sweep daily, or more often as required.
3. Provide walk-off mats at entries and replace them at regular intervals.
4. Construct dust partitions, where indicated on the drawings or as required.
5. Protect areas occupied by Owner’s personnel or equipment.
6. Seal off all return air registers and other mechanical systems to prevent dust from entering.

B. Each trade and subcontractor is responsible for preventing damage and soiling of work performed by other trades or subcontractors. Each trade and subcontractor is responsible for providing temporary protection of its own work.

1. Protect work from spills, splatters, drippings, adhesives, bitumens, mortars, paints, plasters, and damage from welding or burning.
2. Protect finished work from damage, defacement, staining, or scratching.
3. Protect finishes from cleaning agents, or grinding and finishing equipment.
4. Protect adjacent and finished work from damage, using tape, masking, covers or coatings and protective enclosures.
5. Coordinate installations and temporarily remove items to avoid damage from finishing work.

C. Repair all damage or soiling to the complete satisfaction of the Architect; replace any materials or work damaged to such an extent that they cannot be restored to their original condition, all at no addition to the Contract Sum.

D. Protect work stored in place and supplies stored in the building.

1. Store materials and products, subject to damage from moisture, in dry locations. If necessary, protect in wraps or covers.
2. Store plastics, other materials, and products subject to damage from heat or cold at manufacturer's recommended temperatures.

E. Use of sidewalk or roadway areas outside of the property lines shall be with permission and approval of the local authorities having jurisdiction.

1.16 FIRE PROTECTION

A. As a minimum, provide hand-carried, portable, UL-rated extinguishers with each work crew working inside the building.

B. Select extinguishers in accordance with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

1.17 PROJECT CONDITIONS

A. Drawings showing utilities in concealed locations are based on the best information available but are not represented as being precisely correct. Work of the contract includes digging, cutting, drilling, using nondestructive methods, and other methods of locating concealed utilities in the field, as well as patching and repairing as specified in "Cutting and Patching" below.

B. If, in the course of the work, workers encounter a material they suspect to present some hazard:

1. Promptly notify the Owner and Architect in writing.
2. Do not perform any work which would disturb the suspected material until written instructions have been received.

1.18 WARRANTY

A. All work and equipment provided as work of this division shall be fully warranted under the general project warranty. In addition, provide added special warranties specified in individual sections.

B. During the correction period, the Contractor shall begin correcting any work found to be not in accordance with the requirements of the Contract Documents within 4-hours of receiving written notice from the Owner. Provide detailed schedule for completion of work within 24-hours of receiving written notice from the Owner and revise schedule based on any Owner comments generated. Except as otherwise required in General Conditions and Division 01, the correction period is one year after the date of substantial completion of the work. Work requiring correction shall promptly be repaired or completely replaced at no addition to the Contract Sum.

1. Service reports for warranty work shall be provided to the Owner

C. When use of the permanent equipment has been permitted for temporary heating or ventilation of the building, the warranty and correction periods shall nevertheless begin at the time of substantial completion, unless another date of acceptance has been agreed to by the Owner.

D. Special warranties are warranties required by individual specification sections, incidental product warranties, manufacturers' standard warranties, installer or subcontractor service agreements, and other individual warranties in addition to the general project warranty.

E. Provide copies of warranties as required for Operation and Maintenance Manual specified above, and by Division 01.

F. For items of work delayed beyond date of substantial completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

1.19 COMMISSIONING

A. This project includes commissioning under the direction of a Commissioning Agent (CxA). Contractors' and subcontractors' responsibilities are described in Divisions 01 and 23.

B. Cooperate with the CxA to accomplish the requirements of the Commissioning Plan during the construction and correction periods.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

B. Cut walls, floors, partitions, roofs, and other appurtenances for the passage or accommodation of pipes, ducts and appurtenances. Close superfluous openings and remove all debris caused by work of this division.

C. No cutting of any structure or finish shall be done until the condition requiring such cutting has been examined and approved by the Architect.

D. New or existing surfaces disturbed as a result of such cutting or otherwise damaged shall be restored to match original work and all materials used for any patching or mending shall conform to the class of materials originally installed.

E. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

3.2 TEMPORARY FACILITIES

A. Temporary water facilities, electricity, telephone, toilet facilities, and temporary heat, shall be provided as specified in Division 01.

3.3 PROGRESS MEETINGS

A. Progress meetings shall be held as specified in Division 01, and also when and if the Contractor or Architect finds them necessary or advantageous to progress of work.

B. Contractor, those subcontractors and those material suppliers concerned with current progress or with the scheduling of future progress, Architect and Owner shall each be represented at these meetings by persons familiar with the details of work and authorized to conclude matters relating to work progress.

3.4 COMMISSIONING

A. Comply with requirements of "Commissioning" in Part 1 above.

END OF SECTION 23 01 01

SECTION 23 05 00 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements applicable to more than one section of Division 23.

B. Piping installation materials.

C. Identification devices and materials.

D. Rust-inhibitive paint.

E. Backboards for piping specialties.

F. Treated wood lumber.

G. Equipment installation.

H. Cleaning and painting.

I. Operating instructions.

J. Piping tests.

1.2 RELATED SECTIONS

A. Project and special warranties: Division 01 and Section 23 01 01.

B. Operation and Maintenance Manuals: Division 01 and Section 23 01 01.

C. Commissioning requirements: Division 01 and Division 23.

D. Painting: Division 09.

E. Hangers and Supports for HVAC Piping and Equipment: Section 23 05 29.

1.3 REFERENCES

A. American Society of Mechanical Engineers

1. ASME Boiler and Pressure Vessel Code (BPVC).
2. ASME A 13.1: Scheme for the Identification of Piping Systems.
3. ASME B1.20.1: Pipe Threads, General Purpose, Inch.
4. ASME B 31.1: Power Piping.

5. ASME B 31.9: Building Services Piping.

B. American Society of Testing and Materials

1. ASTM A 234: Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
2. ASTM B 32: Standard Specification for Solder Metal
3. ASTM B 88: Standard Specification for Seamless Copper Water Tube
4. ASTM B 813: Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
5. ASTM D 635: Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
6. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials
7. ASTM E 548: Standard Guide for General Criteria Used for Evaluating Laboratory Competence

C. American Welding Society

1. AWS D1.1: Structural Welding - Steel
2. AWS A5.8: Specification for Filler Metals for Brazing and Braze Welding.
3. AWS D10.9: Specification for Qualification of Welding Procedures and Welders for Piping and Tubing
4. AWS D10.12: Guide for Welding Mild Steel Pipe.
5. AWS QC1: Specification for AWS Certification of Welding Inspectors

D. NFPA 70: National Electric Code

1.4 DEFINITIONS

A. Project correction period: A period after Substantial Completion of the work during which the Contractor shall correct every part of the work found to be not in accordance with the requirements of the contract documents, promptly after receipt of written notice.

B. Qualified testing agency: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

C. DN: Dimension Nominale, nominal pipe size in millimeters, in accordance with the metric system for construction, Systeme Internationale (SI).

D. NPS: Nominal pipe size in inches, in accordance with standard U.S. designations for manufactured pipe. Pipe sizes do not change when projects are designed and built in metric units; each size has a consistent name (nominal dimension) in each system.

1.5 DESIGN REQUIREMENTS

A. The drawings and system performances have been designed based on the use of the particular manufacturer's products specified and scheduled on the drawings.

B. Products of other manufacturers that are listed under the article "Acceptable Manufacturers," or permitted as "equal," are permitted provided:

1. Product shall meet the specifications.
2. Contractor shall make, without addition to the contract sum, all adjustments for deviations so that the final installation is complete and functions as the design basis product is intended.

C. Do not propose products with dimensions or other characteristics different from the design basis product that render their use impractical, or cause functional fit, access, or connection problems.

1.6 SUBMITTALS

A. Procedure application schedule:

1. Schedule of welding and brazing procedures proposed for each piping system in the project.

B. Valve charts:

1. Furnish valve charts typed on 8.5 by 11-inch (216 by 279-mm) bond paper, showing locations of all manual and automatic control valves, and flow meters. Include:

a. Number
b. Location
c. Service
d. Function
e. Area served

2. Valve numbering system shall be approved by the Owner prior to final submittal. Place one copy of approved chart in a plastic envelope and mount on wall where directed. Provide another copy for each of the Operating and Maintenance Manuals.

C. Certifications: Proof of operator and testing agency personnel qualifications as required for welding and brazing in the article "Quality Assurance" below.

D. Test reports: Field test results for each piping system as specified in Part 3 below.

1.7 QUALITY ASSURANCE

A. Provide materials and perform work in accordance with the plumbing, mechanical, electrical, building, fire, health and safety, and other applicable codes and regulations of the state, county or city in which the work is performed.

B. Welding procedures and operator qualifications for structural welding: AWS D1.1, Structural Welding Code Steel, electric arc process.

C. Welding, brazing, and soldering procedures and operator qualifications for building systems piping:

1. AWS D10.9, Qualification of Welding Procedures and Welders for Piping and Tubing.
2. ASME B31.9, Building Services Piping.
3. Copper Development Association "Copper Tube Handbook."

D. Qualifications of independent testing laboratory personnel:

1. Welding inspectors: AWS QC1, Certification of Welding Inspectors.

E. UL label:

1. Electrical control panels, equipment, materials and devices provided or installed as work of Division 23 shall be UL listed and shall bear a UL label.
2. Equipment, including custom assemblies, shall be listed and labeled as an assembly.
3. If a UL label is not available, the item shall be tested and labeled by a qualified nationally recognized testing agency, acceptable to authorities having jurisdiction, and in accordance with NFPA 70 (NEC).
4. Provide testing, if required, without addition to the contract sum.

F. VOC content: Field-applied adhesives and sealants, limits per South Coast Air Quality Management District (SCAQMD), Rule No. 1168.

G. Products shall contain no urea-formaldehyde content.

1.8 COMMISSIONING

A. This project includes commissioning under the direction of a Commissioning Agent. Contractors' and subcontractors' responsibilities are described in Division 01 and Division 23.

PART 2 - PRODUCTS

2.1 GENERAL

A. Piping techniques, testing, identification, painting, and operating instructions specified in this section apply to products specified in other sections of Division 23.

B. Equipment that uses or processes date and time data to perform its function shall be warranted by the manufacturer to properly function and correctly use or process all time-related data for all dates and times which occur during a reasonable life expectancy of the equipment.

2.2 PIPING INSTALLATION MATERIALS

A. Weldolets and thredolets: Fittings designed for installing branches on piping, with either welded or threaded connection to branch; conforming to ASTM A 234.

B. Soldering materials:

1. Solder: Free of lead, antimony, and zinc and meeting the requirements of ASTM B 32. No solder containing lead is permitted.

a. Tin 95.5 percent, copper 4 percent, and silver 0.5 percent.

(1) Equal to “Silvabrite 100” manufactured by Engelhard Corporation.

b. Tin, copper, bismuth, and silver.

(1) Equal to "Oatey Silver" manufactured by Oatey.

2. Flux:

a. Meeting the requirements of ASTM B 813 and NSF 61 certified.
b. Equal to Oatey H-20^{95}.

C. Brazing filler metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel. Alloy shall have a melting point greater than 1000 degrees F (540 degrees C).

D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

E. Threaded pipe joint materials:

1. Pipe joint compound:

a. Pipe joint compound recommended by the manufacturer for use at the temperature and pressure of the system.
b. For gas service: As specified in Section 23 11 26, Liquefied-Petroleum Gas Piping.

2. Pipe joint tape: Polytetrafluoroethylene (PTFE) pipe thread tape, "Teflon."

2.3 IDENTIFICATION DEVICES AND MATERIALS

A. Stenciling materials:

1. Stencils: Manufactured standard stencils prepared for required applications, conforming to ASME A 13.1 for color and size of legend letters, including arrows showing direction of flow.
2. Paint: Exterior type enamel, colors conforming to ASME A 13.1, or black.

B. Equipment identification tags:

1. Laminated plastic with adhesive back, white core and black outer layers, which, when engraved, will produce white letters and numerals on a black background.
2. Tags installed on curved surfaces shall be aluminum or brass.

C. Valve tags: Brass, 1.5 inch (40 mm) in diameter with black-filled numbers not less than 0.25 inch (6 mm) high, complete with brass attachment chains.

D. Ceiling identification tags: Laminated plastic with adhesive back, engraved black letters on white background, minimum 0.5 inch (15 mm) wide and length as required for 0.375 inch (10 mm) high letters for name of concealed device and number.

2.4 RUST-INHIBITIVE PAINT

A. Rust-inhibitive paint.

1. Alkyd based, white, black, or bronze tone for all piping except for gas piping which shall be yellow.
2. Applied in a wet film thickness of at least 2.9 mils (0.07 mm).
3. Equal to Benjamin Moore Super Spec HP D.T.M. Alkyd Low Lustre P23.

2.5 BACKBOARDS FOR PIPING SPECIALTIES

A. Backboards: Marine plywood: BS-1080, Veneer Grade A/B, moisture-resistant, spruce-pine-fir multiple ply, 5-ply minimum, pressure-treated construction, 0.563-inch (14-mm) thick minimum

B. Supports: Fiber reinforced plastic (FRP) composite structural shapes: ASTM D 635 and E 84, Pultruded FRP structural shapes, non-corrosive, flame retardant, thermosetting polyester resin, composite factory-fabricated shapes for assorted assemblies and field erection.

1. Ultimate tensile strength: 30,000 psi (207 MPa).
2. Modulus of elasticity: 2.8 x 106 psi (19,300 MPa).
3. Specific gravity: 1.6 to 1.75.
4. Density: 0.062 to 0.070 pounds/cubic inch (1.72 to 1.94 grams/cubic centimeter).
5. Flame spread: ASTM E 84 Class A, 25 maximum.
6. Color: Yellow.
7. Shapes and sizes as required to support the load, and in accordance with minimum sizes indicated on the drawings
8. Acceptable manufacturers:

a. Bedford Reinforce Plastics Company

b. Composites USA, Inc.
c. Liberty Pultrusions, Inc.
d. Strongwell Corporation
e. Structural Fiberglass, Inc.
f. Or approved equal.

C. Fasteners: Corrosion-resistant and suitable for secure anchorage into wall behind backboards.

2.6 TREATED WOOD LUMBER

A. Wood-preservative-treated lumber: Treated by pressure process, AWPA C2, with chemicals acceptable to authorities having jurisdiction, and marked with treatment quality mark of an inspection agency approved by ALSC Board of Review.

PART 3 - EXECUTION

3.1 GENERAL

A. Manufacturers' instructions: Except as modified by drawings or specifications, install products and equipment in accordance with manufacturers' instructions and recommendations applicable to the project conditions.

1. Immediately notify Architect if a difference or discrepancy is found between manufacturers' instructions and the drawings or specifications.

B. The contract drawings are diagrammatic and do not indicate all fittings or offsets in pipe and ductwork, all access panels, or all specialties required. Provide required fittings, offsets, access panels, and specialties to coordinate the work.

C. No pipe or duct shall be run below the head of a window or door.

D. Equipment, ducts, and pipes installed in areas without a suspended ceiling shall be as tight to structure as possible, but at least above a height of 6'-8", unless otherwise noted.

E. Items which require access for operation or maintenance shall be easily accessible. Do not cut or form hand holes for operation or maintenance of appliances through walls or ceilings.

F. Provide equipment and installations compliant with NFPA 70.

3.2 EQUIPMENT INSTALLATION

A. Prepare for installation:

1. Coordinate work to assure that any required recesses for equipment are correct.

2. Examine areas and conditions where equipment will be installed for rough in locations, compliance with installation requirements and tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.
3. Visually check equipment. Replace any damaged components prior to installation.
4. Remove temporary devices used for equipment transport.
5. Assemble equipment that is not assembled in the factory.

B. Install equipment:

1. Follow the manufacturer's rigging requirements for unloading and moving the equipment.
2. Set equipment plumb and level.
3. Install such that labels and safety instructions are clearly visible.
4. Drawings show the general arrangement of piping, ductwork, conduit and other elements. Coordinate elements to allow access doors to open fully, allow access to removable access panels or casing panels, maintain clearances in front of control panels and electrical components required by the NFPA 70, and maintain the manufacturer's recommended service clearances.
5. Install components inside of equipment enclosures such that they are serviceable when access panels are removed.
6. Extend grease fittings to accessible locations.
7. Install duct and piping hangers and supports so that duct and piping live and dead loads and stresses from movement will not be transmitted to connected equipment. Support equipment independently from piping and ductwork.
8. Provide connection flanges for ductwork to equipment in a manner that maintains the equipment's structural integrity.
9. Support:

    a. Floor-mounted equipment:

        (1) Securely fasten in place with connections to wall and floor.
        (2) Provide supplemental structure as required.
        (3) Provide a concrete equipment foundation where indicated. Comply with requirements of Section 23 05 29.

    b. Suspended equipment: Securely hang from structure above. Comply with requirements of Section 23 05 29. Provide 0.5 inch (12.5 mm) minimum diameter threaded rods.
    c. Wall-mounted equipment: Securely fasten to wall with metal fasteners, anchors, brackets, sleeves or other devices recommended by the equipment manufacturer. Provide blocking where required.
    d. Curb-mounted and rail-mounted equipment: Securely fasten to curb and provide flashing to make the installation weather tight. Comply with requirements of Section 23 05 06.
    e. Structural frame-mounted equipment: Securely fasten to structural frame.
    f. Equipment mounted at grade: Securely fasten to structural foundation. See drawings for details of construction of structural foundation.
    g. Coordinate supports so they do not interfere with access to other equipment that requires service.

h. Provide vibration isolation where required.

10. Snugly fit equipment to architectural finishes in finished spaces unless otherwise indicated.
11. Ensure that equipment, coils, and drain pans properly drain. Test drain pans.
12. Connect associated ducts, piping, power, controls, and other associated systems.
13. Conceal associated ducts, piping and electrical connections in finished spaces unless otherwise indicated.
14. In rooms without ceilings or other finishes to conceal ducts, piping, and electrical connections, arrange these elements to provide a neat and finished appearance.
15. Install dielectric pipe fittings at water coil connections where dissimilar metals are joined.
16. Coordinate with installation of building automation system controls.
17. Install equipment with a safety listing or certification as required to comply with their listing or certification requirements.

C. Install and wire items furnished with equipment:

1. Install control devices, accessories, and appurtenances furnished loose with equipment.
2. Wire devices furnished with equipment that are not factory-wired.

a. Perform the work as required in Section 23 09 01.
b. Comply with requirements in Section 23 09 02.
c. Comply with requirements in Division 26.
d. Comply with requirements in NFPA 70.
e. Comply with the manufacturer's installation requirements.

D. Prepare equipment for use:

1. Clean equipment and repair any damaged finishes. Remove paint splatters, dirt, and debris. Repair damaged finish to match original finish.
2. Adjust tension on belts.
3. Adjust discharge air devices.
4. Lubricate equipment.
5. Adjust equipment packaged controls to put the system into operation as intended.
6. Start up and operate equipment in accordance with manufacturer's instructions.
7. Verify smooth rotation and proper direction of rotation of motors.
8. Test controls, unit operation, and safety devices. Replace any failed components and retest.
9. Provide equipment identification.

3.3 PIPE INSTALLATION

A. Install piping in concealed locations, unless otherwise indicated or unless the piping is located in equipment rooms and service areas.

B. Install pipe exposed to view parallel to building lines and as close to walls, columns, and ceilings as may be practical, maintaining proper clearances for access at all parts requiring servicing. Diagonal runs are prohibited unless specifically indicated otherwise.

C. Install pipe a sufficient distance from other work to permit a clearance of not less than 0.5 inch (15 mm) between its finished covering and adjacent work.

D. Install piping free of sags and bends.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping and valves in locations to permit valve servicing.

G. Remove burrs resulting from cutting pipe or from any other operation.

H. Thoroughly clean pipe and fittings before they are installed, and keep them clean until the acceptance of the completed work. Cap or plug the ends of the lines to prevent earth and other debris from entering during construction.

I. Provide for expansion and contraction of piping and connections so that no breakage or excessive strain will occur. Provide anchors and guides of approved design where shown on drawings and where necessary to allow for proper expansion and contraction. At the time of installation, expansion loops shall be cold sprung to one-half of the calculated expansion.

J. Pipe connection flexibility:

1. Connect risers and branch connections to mains with at least five pipe fittings, including tee in main.
2. Connect risers and branch connections to equipment with at least four pipe fittings, including tee in riser.
3. Connect mains and branch connections to equipment with at least four pipe fittings, including tee in main.
4. Connections shall be arranged so that movement in piping due to expansion and contraction will not transmit excessive force to equipment.

K. Install unions or flanges in the piping at each item of equipment, control valve, and appliance, to provide easy removal of the equipment, valve, or appliance, and to provide for easy removal of coils.

L. Pitch hydronic piping so that air in the system can be properly vented. Provide shutoff valves where necessary to isolate parts of system for repairs without draining the entire system.

M. Interface with other products:

1. Where pipe is provided through walls, provide finished, permanent, waterproof installation complete with inserts, sleeves, supports or hangers, seals, and other appurtenances as required. Do not pierce, cut, or notch any footing or other structural member.
2. Waterproofing and dampproofing of the building shall be unharmed by the installation of the work. Where pipe has to pierce waterproofing or dampproofing, including outside walls, the penetration shall be made watertight. Waterproofing damaged or destroyed shall be repaired or replaced with new waterproofing.

N. Flanges shall be welded neck or slip-on pattern of class to suit the valves or equipment connections. Flanges shall have machine bolts with hex nuts and washers.

O. Threaded connections:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean.
3. Apply specified pipe joint compound or tape on male threads only.
4. Where piping is installed in crawl spaces and tunnels, cover exposed threads with rust-inhibitive paint. Apply after joints have been assembled and tested.

P. Welded Joints:

1. Construct joints according to AWS D10.12, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.

Q. Copper tubing installation:

1. Cut pipe with a tubing cutter or fine-tooth saw. Cuts made with a saw shall be true and square, and the end shall be filed smooth with a fine-tooth file. Remove all marks and burrs with sandpaper.
2. Solder joints for copper tubing: Clean ends of tubing and inside of fitting ends thoroughly with emery cloth before applying flux.
3. Provide dielectric fittings between copper and steel piping to prevent electrolysis.
4. Follow the techniques for soldering and brazing pipe, fittings, and valves as recommended by the manufacturer.
5. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

3.4 IDENTIFICATION

A. General: Do not apply identification until insulation and finish painting work is complete.

B. Equipment:

1. Stencil equipment with minimum two-inch (50-mm) -high letters or provide identification tags. Clearly indicate equipment designation and area served.
2. Firmly fasten each identification tag to its appropriate piece of equipment with drive screws, sheet metal screws, or rivets. Do not interfere with operation of, or damage the item being marked.

C. Piping:

1. Mark by stenciling.

2. Mark to identify service with arrows showing direction of flow. Apply markings near building walls where pipes enter or leave an accessible space and in intermediate locations so that markings are no more than 30 feet (9 m) apart. They shall be readily visible to a person standing on the floor.
3. Fully identify all piping installed as work of the project.
4. Mark pipe with letters of height and with colors as required by OSHA and conforming to ASME A 13.1.
5. Identify every thermometer, gauge, and control device.

D. Valves:

1. Provide valve tags for all valves except shutoff valves on individual pieces of equipment where the equipment is immediately adjacent and their function is obvious. Numbers shall correspond to those shown on the Valve Chart. Attach tags to valve shaft.
2. Provide ceiling identification tags where valves are above a ceiling. Number shall correspond to tag number.

E. Ductwork: Stencil ductwork after insulation is applied, if required, with minimum two-inch (50-mm)-high letters, clearly identifying service (supply, return, exhaust) and showing direction of flow with arrows. Mark ducts near building walls where they enter or leave a space, and at intervals of not more than 30 feet (9 m). Identification shall be visible to a person standing on the floor.

F. Ceiling identification tags: Provide on access doors or, in suspended ceilings, on the ceiling support grid near the item identified.

1. Valves: Identify with the same number shown on the valve tag.
2. Terminal units above ceilings: Identify with unit description and number.

3.5 CLEANING AND PAINTING

A. Cleaning: Clean all piping and equipment. Where items are to be painted, clean ready for painting.

B. Painting: Coordinate painting with requirements of Division 09. Paint the items identified below to be painted. Use paint materials and systems specified in Division 09.

C. Items to be painted:

1. Items identified below to have protective coating.
2. Items furnished with manufacturer’s prime coat.
3. Mechanical rooms (including but not limited to boiler, chiller, and air-handling unit rooms):

   a. Insulation and uninsulated steel: Piping, pumps, tanks, and vessels.
   b. Hangers and supports.

4. Piping and ductwork exposed in finished spaces, insulated and uninsulated.

5. Inside ducts behind registers, grilles, and diffusers.

D. Items not to be painted: Copper, stainless steel, and equipment furnished with manufacturer's finish.

E. Protective coating: Uninsulated gas piping and fittings installed outdoors shall be painted with one priming coat and one finish coast of rust-inhibitive paint.

F. Paint systems in mechanical rooms:

1. Galvanized steel: One coat of primer recommended for galvanized surfaces and one coat of glossy alkyd enamel.
2. Ferrous metal: One coat of primer recommended for ferrous metal and one coat of glossy alkyd enamel.
3. Items protected with rust-inhibitive primer: Finish coat of compatible glossy enamel.

G. Paint systems for exposed piping and ductwork: Primer compatible with the substrate, whether steel, galvanized steel, insulation jacket, or other material; one coat or two, if required to cover, of paint to match adjacent surfaces in color and texture.

H. Painting inside ducts behind registers, grilles, and diffusers: Matte black, compatible with substrate and suitable for the temperatures at which the duct will operate, extending from the duct opening to a depth such that no unpainted surface will be visible to a person standing on the floor or adjacent balconies.

3.6 BACKBOARDS FOR PIPING SPECIALTIES

A. Provide wall-mounted backboards, sizes and locations as indicated on the drawings, for mounting piping specialties. Assembly shall consist of plywood board, FRP supports, and fasteners.

3.7 TREATED WOOD LUMBER

A. Provide wood-preservative-treated lumber where wood members are required as detailed on the drawings and in the following applications:

1. Cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, or waterproofing.
2. Sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
3. Framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.

3.8 OPERATING INSTRUCTIONS (DEMONSTRATION)

A. Furnish factory-trained/equipment vendor-employed or factory-trained/factory-employed service technicians with the skills and labor to start-up and operate all mechanical systems and equipment. Provide the following services.

1. Start up and operate all systems and equipment for one 8-hour day.
2. Training:

a. Provide at least 40 hours of training time, consisting of ten periods of four consecutive hours, during a period of not less than 90 days.
b. Maintenance training:

(1) Train the Owner's designated personnel in the manufacturer's recommended preventive maintenance procedures for each unique type of equipment that requires periodic maintenance.
(2) Training shall include, but not be limited to filter changes, belt changes, lubrication, and adjustment.
(3) Engage the Owner's designated personnel in hands-on training activities that demonstrate required maintenance and service.

c. Operation training:

(1) Train the Owner's personnel in the operation of equipment and systems.
(2) Training shall include, but not be limited to demonstration of packaged controls, modes of operation, and observation of equipment operating parameters and self-diagnostic capabilities.
(3) Provide troubleshooting opportunities during each training session.

d. Make the Operating and Maintenance Manual available at the time of the instructions, for use by instructors and Owner personnel.
e. Record training:

(1) Furnish a qualified videographer to record training and demonstration activities.
(2) Record each training and demonstration activity separately.
(3) Record instruction, demonstrations, diagrams, and visual aids as necessary.
(4) Record each session in 720p DVD video and audio format at a minimum.
(5) Provide audio pickup sufficient for future use as a teaching and demonstration tool. Use microphones where necessary. Repeat all training where audio is unintelligible.
(6) Audibly describe training and demonstration activities during recordings. Indicate floor, room number, and vantage point as part of the narration.
(7) Provide two sets of DVDs within seven days of each training activity.

3. Direct digital building automation system control training shall be in addition to the equipment training required within this section. Refer to specification section 23 09 23 for direct digital building automation system control operating training requirements.
4. Schedule start-up and operation as well as training at times agreed upon by the Owner and the Architect.

a. Submit training itinerary to the Owner and Construction Manager a minimum of two-weeks prior to the anticipated date of performing the first scheduled activity.
b. Provide a proposed schedule similar in format to the sample included below to coordinate the training effort.
c. Revise the schedule based on comments received from the Owner and resubmit a final copy for record.

Item	Demonstrating Organization	Date	Start Time	End Time
Start-up and Operation Day				
Equipment Type #1 Training				
Equipment Type #2 Training				
Equipment Type #3 Training				
Etc.				

3.9 PIPING TESTS

A. Refrigerant pipe testing: Test as specified in Section 23 23 00.

B. Hydrostatic testing:

1. Notify Owner in writing at least 24 hours prior to the test. **[**
2. Test before pipes are concealed or insulated.
3. Piping may be tested in sections as the work progresses.
4. Provide fluid, pumps, valves, and gages required for testing.
5. Where water is used as the test fluid, provide ambient temperature water and provide means to avoid freezing. Drain and dispose of test fluid when testing is concluded.
6. Isolate equipment and expansion tanks during test.
7. Isolate or remove any components with a pressure rating below the required test pressure.
8. Brace and support piping during the test, so that no movement, displacement, or damage results from the application of the test pressure.
9. Provide a pressure relief valve, set at a pressure no more than one-third higher than test pressure, to protect against damage caused by expanding liquid or other source of overpressure during test.
10. Replace piping or fittings found defective with new material.
11. Documentation of tests: Prepare a test report for each portion of piping tested, identified by service, material, location, and pipe size. Include these items**:**

    a. Date of test.
    b. Starting and completion times.
    c. Initial test pressure.
    d. Final test pressure.
    e. Problems or leaks detected.
    f. Corrective actions taken.
    g. Record of successful completion of testing.
    h. Name, title, and signature of person conducting test.

12. Piping Systems Test Schedule:

System	Test Pressure psig (kPa)	Duration	Allowable Drop	Medium
Fuel gas	100 (690)	4 Hours	None	*Air

* If pressure drops, locate leaks with soap and water solution

END OF SECTION 23 05 00

SECTION 23 05 02 - SLEEVES AND PLATES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Sleeves.

B. Sealing materials.

C. Escutcheon plates.

D. Mechanical penetration seals.

1.2 SUBMITTALS

A. Product data: For each type of product, include a description, characteristics, materials, composition, finishes, and performance. Include the following:

1. Sleeves.
2. Sealing materials.
3. Escutcheon plates.
4. Mechanical penetration seals.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Sleeves without water stops:

1. Steel sleeves: Schedule 40 black steel pipe, ASTM A 53.
2. Copper sleeves: Type L, ASTM B 88 hard drawn.
3. Plastic sleeves: Schedule 40 PVC, ASTM D 1785.

B. Sleeves with water stops:

1. Cast-iron sleeves with water stops: Extra heavy, equal to product of U.S. Pipe Co. with water stop and ends as shown on the drawings.

2.2 SEALING MATERIALS

A. Waterproof sealant:

1. Bare and insulated pipes carrying fluids 150 degrees F (65 degrees C) and below:

a. High-performance, moisture cured, 1-component, polyurethane-based, non-sag, elastomeric sealant. Use a primer for applications required by the manufacturer.
b. Basis of design: Sika Corporation “Sikaflex - la.”

2. Bare and insulated piping carrying fluids 151 degrees F (66 degrees C) and above:

a. One-part RTV silicone, neutral-cured, architectural grade sealant. Use a primer for applications required by the manufacturer.
b. Basis of design: Dow Corning Corporation “790 Silicone.”

B. Grout: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout, 5000 psi (34.5 MPa), 28-day compressive strength.

2.3 ESCUTCHEON PLATES

A. Floor, wall, and ceiling escutcheon plates for existing piping:

1. Stamped or cast brass with set screw, split and tabbed.
2. Finish: Chrome.

B. Floor, wall, and ceiling escutcheon plates for new piping:

1. Stamped or cast brass with set screw.
2. Finish: Chrome.

2.4 MECHANICAL PENETRATION SEALS

A. Mechanical penetration seals:

1. Seals shall be modular mechanical type, consisting of interlocking synthetic links shaped to continuously fill the annular space between the pipe and wall opening. Bolt and nut fasteners for the seals shall be stainless steel for units used in penetrations below grade.
2. Basis of design: PSI “Link-Seal Modular Seals” or Calpico Sealing Link “LINX”.

2.5 ABOVE-GRADE PIPE PENETRATION COVERS

A. Above-grade pipe penetration covers:

1. Penetration cover that seals and protects piping penetrations from weather damage, air leakage, pipe vibration, and pests.
2. Weather resistant ASA polymer penetration cover.
3. TPE polymer pipe sleeve with stainless steel clamp for airtight seal around pipe(s).
4. PVC foam wall gasket for airtight seal to wall.
5. Carbon steel mounting anchors.
6. Basis of design: Airex “Titan Outlet.”

PART 3 - EXECUTION

3.1 INSTALLING SLEEVES

A. Provide sleeves for bare piping, or piping with insulation continuous through sleeve, passing through walls, partitions, beams, or slabs. Sleeves for insulated piping shall be large enough to pass piping and insulation.

B. Sleeve materials:

1. Penetrations in non-fire-rated interior construction:

a. Provide steel sleeves for penetrations of steel, cast iron, and insulated piping.
b. Provide copper sleeves for penetrations of uninsulated copper tubing and piping.
c. Provide plastic or steel sleeves for penetrations of plastic piping.
d. Plastic piping and sleeves are not permitted in ceiling spaces used as HVAC system plenums, or in shafts used for building HVAC air distribution.
e. Plastic sleeves are not permitted for penetrations of masonry construction.
f. A core drill may be provided in cast concrete walls in lieu of a sleeve.

2. Penetrations in fire-rated construction:

a. Provide sleeves that are acceptable components of through-penetration firestop assemblies specified in Division 07.
b. Where acceptable for floor penetration listing, provide sleeve projections above floor slabs in compliance with requirements of this section.
c. Where pre-manufactured cast in place or drop in fire rated sleeves are used in floors, provide the manufacturer’s water dam accessories to achieve compliance.

3. Penetrations in exterior walls and foundations, masonry or concrete:

a. Provide cast iron sleeves with water stops in new cast concrete walls.
b. A core drill may be provided in cast concrete walls in lieu of a sleeve.
c. Provide steel sleeves in masonry walls.

4. Penetrations of steel beams:

a. Where steel pipe penetrates a steel beam that is not part of a fire- or smoke-rated assembly, no sleeve is required.
b. Do not cut, drill, or burn structural steel for installation of piping without specific instructions from the Architect.

C. Sleeve projection:

1. Sleeves through walls and partitions: Flush with finished surfaces.
2. Sleeves through floors:

a. Typical floors: Extend 0.375 inch (10 mm) above finished floor.

b. Kitchens and food service areas: Extend 0.375 inches (10 mm) above finished floor.
c. Mechanical or equipment room floors: Extend one inch (25 mm) above finished floor.
d. Finish neat and level.
e. Provide anchor clips to prevent sleeves from being loosened and knocked down.

3.2 INSTALLING SEALING MATERIALS

A. Penetrations in non-fire-rated interior construction:

1. Seal exterior of sleeve to wall or floor being penetrated:

a. Provide grout where sleeves penetrate concrete or masonry.
b. Provide waterproof sealant or wall construction materials where sleeves penetrate gypsum board walls.

2. Sealant between sleeve interior and pipe or pipe insulation:

a. Typical applications: Seal spaces between sleeves and pipe, or between sleeves and pipe insulation, with mineral wool.
b. Kitchens and food service areas: Seal space between sleeves and pipe, or between sleeves and pipe insulation, with waterproof sealant and finish even with sleeve.

B. Penetrations in fire-rated construction: Seal as required by the through-penetration firestop assembly specified in Division 07.

3.3 INSTALLING ESCUTCHEON PLATES

A. Provide plates of size and depth required to conceal sleeves where exposed piping passes through interior walls, partitions, floors, and ceilings. Secure plates in place with set screws.

B. Do not install floor or wall plates on pipes in the kitchen and food service areas.

3.4 INSTALLING MECHANICAL PENETRATION SEALS

A. Penetrations in exterior masonry or concrete walls and foundations:

1. Above grade: Mechanical penetration seal, at outside face of wall.

3.5 INSTALLING ABOVE-GRADE PIPE PENETRATION COVERS

A. Penetrations in exterior above-grade masonry or concrete walls and foundations:

1. Anchor cover to wall to protect insulated pipe through sleeve.

2. Secure clamp to seal sleeve to pipe insulation jacket.

END OF SECTION 23 05 02

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 23 05 06 - CURBS, RAILS, AND FLASHINGS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Curbs.

B. Rails.

C. Accessory materials.

1.2 RELATED SECTIONS

A. Rough carpentry: Division 06.

B. Rooftop pipe support systems: Division 22.

C. Ductwork: Section 23 31 13.

D. Condensing units:

1. Air-cooled Refrigerant Condensing units: Section 23 63 13.
2. Variable-Refrigerant-Flow HVAC Systems: Section 23 81 29

1.3 SUBMITTALS

A. Product data: For each type of product, include a description, characteristics, materials, composition, finishes, and performance. Include the following:

1. Flashings.
2. Curbs, rails.
3. Accessory materials.

B. Shop drawings: Include the following for each type of product:

1. Dimensioned plans, elevations, and sections of complete assembled units.
2. Weights, loads, and support and attachment details.
3. Details of and any required field assembly.
4. Include dimensions and weights of supported equipment and illustration of coordination.

1.4 QUALITY ASSURANCE

A. Curbs and rails may be the product of the manufacturer of the equipment they support, or of a roof curb and support manufacturer, provided they are equal to the products of the named manufacturers and meet this specification.

1.5 COORDINATION

A. Coordinate the installation of roof curbs, rails, and roof penetrations with other work. Perform the work in a way that maintains facility weathertightness and preserves the roof warranty.

B. Coordinate the installation of roof curbs, rails with support structure below for required location and support capacity.

C. Coordinate the installation of roof curbs and rails with supported equipment and distribution systems.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis-of-design product: Subject to compliance with requirements, provide the scheduled product, or comparable product by one of the following:

B. Curbs and flashing systems for groups of pipes:

1. Curbs Plus, Inc.
2. Pate Co.
3. Roof Products & Systems (RPS) Corp.
4. ThyCurb Division, ThyBar Corp.
5. Or approved equal.

C. Curbs and rails:

1. Curbs Plus, Inc.
2. Pate Co.
3. Roof Products & Systems (RPS) Corp.
4. ThyCurb Division, ThyBar Corp.
5. Or approved equal.

2.2 SINGLE PIPE FLASHING

A. Flashing for a single pipe through a flat roof:

1. 4-lb (1.8 kg per 0.09 sq. m) lead boot, 8-inch (205-mm) skirt; top counterflashing fitting and waterproofing compound.
2. Basis of design: Elmdor/Stoneman Engineering and Manufacturing Co. 1100-4.

2.3 CURBS

A. Curbs:

1. Fabricate curbs in accordance with certified equipment drawings supplied by the equipment manufacturer, and with details on the drawings. Select style and configuration as required for securing to exterior concrete pad.
2. Height:
    a. At least 18 inches (455 mm) above top of insulation, except where additional height is required by the application or is required by the drawings.
3. Construction: 18 gauge minimum galvanized steel, monolithic with all welded components, fully mitered corners, factory-attached treated wood nailer, and steel counterflashing.
4. Insulation: Fiberglass board, 3 lb/sf (48 kg/m^3) density, 1.5 inches (38 mm) thick.
5. Protective liner: On curbs serving duct systems made of aluminum, black steel, or stainless steel, or paint spray booth exhaust, provide a protective liner of the same metal as the duct.

B. Platform Curbs for condensing units 5 tons and smaller:

1. Fabricate curbs in accordance with certified equipment drawings supplied by the equipment manufacturer, and with details on the drawings. Select style and configuration as required by roof membrane, insulation, and slope.
2. Height: At least 18 inches (455 mm) above top of insulation, except where additional height is required by the application or is required by the drawings.
3. Construction: 18 gauge minimum galvanized steel, monolithic with all welded components, fully mitered corners, factory-attached treated wood nailer, and steel counterflashing.
4. Insulation: Fiberglass board, 3 lb/sf (48 kg/m3) density, 1.5 inches (38 mm) thick.
5. Curb top: Provide treated plywood of adequate thickness, and with intermediate structural supports, as required to support the weight of the associated equipment without visible deflection of the solid top, and covered with no less than an 18 gauge galvanized steel counterflashing cap.
6. Pipe and conduit flashings: EPDM, ribbed aluminum base, mounting holes for screws, designed for field mounting on curb top, number and size to suit pipe and conduit required.
7. Basis of design:
    a. Curb: Pate pedestal curb with solid top.
    b. Flashings: Pate “Dektite” flashing system.

2.4 RAILS

A. Equipment support rail:

1. Fabricate each rail in accordance with certified equipment drawings supplied by the equipment manufacturer, and with details on the drawings. Select style and configuration as required by roof membrane, insulation, and slope.
2. Height: At least 18 inches (455 mm) above top of insulation, except where additional height is required by the application or is required by the drawings.
3. Construction: 18 gauge minimum galvanized steel, monolithic with all welded components, fully mitered corners, factory-attached treated wood nailer, and steel counterflashing.
4. Basis of design: RPS ER.

2.5 ACCESSORY MATERIALS

A. Wood-preservative-treated lumber: As specified in Division 06 and in Section 23 05 00.

1. Application: Treat items indicated on the drawings, and the following:

a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, or waterproofing.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Provide flashing and counterflashing as specified in Division 07.

B. Securely attach curbs and rails to structure with a 6-inch (150-mm) wide treated wood frame, with countersunk flat-head 0.375-inch (10-mm) diameter cadmium-plated through bolts with washer and double nuts on underside of structural framing around roof opening. Secure curb and rails to treated wood frame with No. 10 cadmium-plated wood screws. Place bolts and screws on maximum 12-inch (305-mm) centers, with no fewer than two for each side of rail or curb.

C. Where dissimilar metals would contact each other, coat them with a protective coating compatible with adjacent materials.

END OF SECTION 23 05 06

SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Unless otherwise specified in a particular section or required for a particular application, motors shall conform to the following requirements, whether factory-installed or field-installed.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Motor capacitors: Division 26.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Condensing units: Section 23 63 13.

B. Air-handling units:

1. Air-handling units with coils: Section 23 73 22.

C. Variable-Refrigerant-Flow HVAC Systems: Section 23 81 29.

D. Terminal units:

1. Electric resistance terminal units: Section 23 82 38.

E. Variable frequency drives: Division 26.

1.4 REFERENCES

A. NEMA MG 1: Motors and Generators.

B. NEMA MG 10: Energy Management Guide for Selection and Use of Polyphase Motors.

C. NEMA MG 11: Energy Management Guide for Selection and Use of Single-Phase Motors.

D. UL 508: Industrial Control Equipment.

1.5 DEFINITIONS

A. Energy efficient motor: Motor meeting the nominal and minimum efficiency levels listed for its horsepower and speed in Table 12-10 of NEMA MG 1.

B. Nominal efficiency: Efficiency as defined in Table 12-8, Efficiency Levels, in NEMA MG 1, and identified on the motor nameplate.

1.6 SUBMITTALS

A. Product data:

1. Motors and drives not provided with equipment:

   a. Include nameplate data and ratings; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lugs, and coatings.
   b. Electrical characteristics.
   c. Include verification of compliance with ASHRAE 90.1.

2. Motor capacitors.
3. Wiring diagrams required for the proper installation of mechanical equipment.

B. Certifications:

1. Actual motor power factor for each motor, certified test results for each motor proposed for use on this project.
2. Field test showing corrected power factor, if required.
3. Motors controlled by variable frequency controllers: Certification that motor meets specified requirements.

1.7 QUALITY ASSURANCE

A. UL label: As specified in Section 23 05 00, Common Work Results for HVAC.

B. Actual motor power factor shall be tested and certified by an independent testing laboratory.

C. Where power factor is field tested as required in “Power Factor” in Part 2 below, specialist performing tests shall be acceptable to the local authorities having jurisdiction.

D. HVAC equipment shall meet the energy performance requirements of ASHRAE 90.1.

1.8 REGULATORY REQUIREMENTS

A. Motors shall conform to the requirements of NEMA MG1 and applicable portions of the National Electric Code (NEC, NFPA 70).

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Motors:

1. A.O. Smith
2. Baldor Electric Co.
3. Marathon
4. Rockwell
5. Siemens
6. Toshiba International
7. Or approved equal.

B. Motor capacitors:

1. ABB Power Distribution
2. Commonwealth Sprague
3. General Electric
4. Or approved equal.

2.2 BASIC MOTOR REQUIREMENTS

A. Capacity: Each motor shall have sufficient capacity and torque to start, accelerate, and operate the machine it drives without exceeding the motor nameplate rating at the speed specified, or at any speed and load which may be obtained by the drive actually furnished.

B. Starting: Each automatically controlled motor shall be capable of starting as frequently as the control sequence may demand. Motors not automatically controlled shall be capable of making no fewer than 4 starts per hour.

C. Loads: Belt-connected motors shall be equipped with shafts and bearings designed to withstand both the normal connected loads of the drive furnished, and momentary loads imposed during acceleration.

D. Ratings: Motors shall be rated for continuous duty at 100 percent of rated capacity, and temperature rise shall be based on ambient temperature of 40 degrees C.

E. Phase: Unless otherwise indicated, motors one-half horsepower and larger shall be polyphase and motors smaller than one-half horsepower shall be single-phase motors.

F. Motor construction:

1. ODP (open drip-proof) NEMA design B construction:

a. Motors for fans, air-handling units, and pumps, unless specified otherwise.
b. Motors outdoors but inside of a weather-tight enclosure, unless specified otherwise.

2. TEFC severe duty:

    a. Motors for cooling towers.
    b. Motors for condensing units.
    c. Motors mounted outdoors and not inside of a weather-tight enclosure.
    d. Other locations where TEFC motors are specified.

3. TEAO severe duty: TEAO motors may be used in lieu of TEFC motors where the motor is directly connected to a shaft that drives a fan that will inherently cool the motor based on the design of the machine.

G. Efficiency: The term “energy efficient” is defined in the article “Definitions” in Part 1 above.

1. Single-phase motors, alternating-current fractional horsepower, rated 1/20 to 1 horsepower, 250 volts or less: NEMA MG 11, types and efficiencies selected for their applications.
2. Polyphase motors, medium alternating-current, squirrel-cage, 1 to 500 horsepower, 600 volts or less: NEMA MG 10, energy-efficient types selected for their application. Nominal full-load efficiencies shall meet or exceed ratings of Table 12-10 of NEMA MG 1.
3. Motors for packaged hermetic and semi-hermetic refrigeration compressors need not comply with these efficiency requirements but they shall comply with the requirements indicated for power factor and power consumption.

2.3 SINGLE-PHASE MOTORS

A. Permanent split-capacitor or split-phase type.

B. Bearings: Sealed, permanently-lubricated ball bearings.

C. Thermal protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal.

2.4 POLYPHASE MOTORS

A. NEMA MG1 Design B.

B. Stator: Copper windings.

C. Rotor: Squirrel cage.

D. Bearings: Unless otherwise indicated in individual sections:

1. Motors 5 HP and above: Doubly shielded, pre-lubricated and re-lubricatable ball bearings suitable for radial and thrust loading of connected equipment.
2. Motors less than 5 HP: Sealed, permanently-lubricated ball bearings.

E. Thermal protection:

1. Motors controlled by a variable frequency drive dedicated to the motor:

   a. Protected by electronics in the drive.
   b. For motors 25 HP and above, also provide a temperature sensor embedded in the stator windings and wired to an input on the variable frequency drive.

2. Motors controlled by a variable frequency drive serving more than one motors: Protected by a manual motor protector in line with the power to the individual motor.
3. Motors controlled by starters: Protected by thermal overload protection in the motor starter.

F. Temperature rise shall not exceed insulation rating.

G. Insulation: Class F.

H. Motors used with inrush controllers: Match wiring requirements for indicated controller with required motor leads brought to motor terminal box to suit control method.

I. Horsepower/frame relationship: NEMA Standard for T frame motors.

J. Motor frame and end shields: Cast iron.

K. Conduit box: Either steel or aluminum, diagonally split and rotatable in 90-degree increments, with grounding provision.

L. Finishes:

1. External hardware: Plated to resist corrosion.
2. External paint: Industrial enamel.

M. Nameplates: Stainless steel or aluminum and stamped in accordance with NEMA MG1. Nameplate information shall include the nominal efficiency value in accordance with NEMA MG1 and the manufacturer's minimum guaranteed efficiency value.

2.5 ELECTRONICALLY COMMUTATED MOTOR (ECM)

A. Brushless direct current (DC) variable speed motor supplied with alternating current, with a permanent magnet with near zero rotor losses, electronic commutation, designed for synchronous rotation, and at least 70 percent efficient at all operating speeds.

B. Bearings: Sealed, permanently-lubricated ball bearings.

C. Thermal protection: Internal thermal overload protection.

D. As a minimum, the motor shall include the following features:

1. Integrated controller / invertor that operates the wound stator and senses rotor position to electronically commutate the stator.
2. Built-in soft start and soft speed change ramps.
3. Inductors to minimize harmonic distortion and line noise.
4. Designed to overcome reverse rotation without affecting life expectancy.
5. Motor speed shall be controllable down to 20 percent of full speed. Speed shall be controlled by either a potentiometer with manual adjustment on the motor or by a 0-10Vdc analog signal from a remote source, as required by other sections of Division 23 specifications.
6. Software for motor control shall be as indicated or described in other Division 23 specifications.

2.6 TEAO (TOTALLY ENCLOSED AIR-OVER) MOTORS

A. Motors with the following additional requirements:

1. TEAO construction for severe environment.
2. Conduit box: Heavy-wall cast construction, gasketed with a lead gasket between box and motor frame.
3. Motor shaft shall be provided with an external slinger on the drive end.
4. Rotor and stator air-gap surfaces coated to prevent corrosion.
5. Finish: At least two coats of catalyzed epoxy enamel.

2.7 TEFC (TOTALLY ENCLOSED FAN-COOLED) MOTORS

A. Motors with the following additional requirements:

1. TEFC construction for severe environment.
2. Ventilating fans: Made of corrosion-resistant, non-sparking material.
3. Conduit box: Heavy-wall cast construction, gasketed with a lead gasket between box and motor frame.
4. Motor shaft shall be provided with an external slinger on the drive end.
5. Rotor and stator air-gap surfaces coated to prevent corrosion.
6. Finish: At least two coats of catalyzed epoxy enamel.

2.8 MOTORS CONTROLLED BY VARIABLE FREQUENCY DRIVES

A. Specifically constructed and warranted by the manufacturer to meet the voltage requirements of NEMA MG 1, Part 31.4.4.2.

B. Temperature rise: Match rating for Class B insulation.

C. Insulation: Class B or F (TEFC), or Class F (ODP).

D. Bearing protection:

1. Conductive shaft grounding ring, to transmit induced current from shaft to motor frame without harming bearings.
2. Basis of design: Aegis SGR by Electro Static Technology.

2.9 POWER FACTOR

A. Power factor for three-phase motors 10 HP and larger and packaged equipment systems totaling 10 HP and larger as noted below shall be not less than 90 percent at full rated load. Test, certify, and submit certified reports for each motor as required in "Submittals" and "Quality Assurance" in Part 1 above.

1. Should the Contractor propose to provide motors with less than 90 percent power factor, provide power-factor-correcting, automatically discharging type motor capacitors. The corrected power factor of the motor-capacitor combination shall be equal to or greater than 90 percent. Submit certified test results.
2. Motor capacitor: Designed for installation at the load side of motor starters; insulated, impregnated component unit completely enclosed in a grounded steel case with welded and ground seams. Where installed on outdoor equipment, case shall be weatherproof. Provide each unit with a flexible cable for connection to the starter or motor terminals. The capacitor shall be suitable for use in areas with ambient temperatures ranging from minus 10 degrees F to 115 degrees F.

B. Where motors totaling 10 HP and larger are part of packaged equipment system, such as packaged air-conditioning unit or air-conditioning condensing unit, the overall power factor for the entire system package shall be no less than 90 percent. Provide capacitors and appurtenances required to accomplish this power factor as part of the packaged equipment, or furnish separately and wire as work of equipment installation. Capacitors shall be stepped, deenergized, or cycled when the unit is deenergized or the load is varied, to maintain 90 percent power factor.

1. Capacitors provided as part of packaged equipment: If the installation of the capacitors voids the UL label, unit shall be tested. Actual power factor shall be factory-tested and certified test results included in submittals.
2. Capacitors provided separately and wired as work of equipment installation: Unit shall then be field tested to verify actual power factor. Submit field test reports.
3. Tests shall be performed by an electrical testing specialist and in accordance with NFPA 70 (NEC) testing brochure.

C. Motors and packaged equipment systems equipped with variable frequency drives shall not receive power factor correcting capacitors.

2.10 MOTOR DRIVES

A. Motors for belt-driven units shall have adjustable variable pitch cast-iron sheaves to allow a 10 percent increase or reduction in speed for units less than 30 HP and fixed sheaves for units 30 HP and larger.

B. Provide belts with a minimum service factor of 1.5 based on the motor BHP.

C. Provide OSHA compliant belt guards and protection from rotating shafts.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount direct-connected motors securely and in accurate alignment. The drive shall be free from both angular and parallel misalignment when both motor and driven machine are operating at normal temperatures.

B. Provide each belt-connected motor with a securely mounted adjustable base to permit installation and adjustment of belts.

3.2 POWER FACTOR

A. Mount capacitors shipped separately beside motor connection box as required. Connect in accordance with the requirements of Division 26, Electrical.

1. Test units at full rated load after the installation of the motor capacitors, and submit reports.

3.3 ADJUSTING

A. Provide additional drive and belt changes where required to meet requirements of testing and balancing specified in Section 23 05 93, Testing, Adjusting and Balancing.

3.4 OPERATING INSTRUCTIONS

A. As specified in Section 23 05 00, provide operating instructions.

END OF SECTION 23 05 13

SECTION 23 05 19 - METERS AND GAUGES FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pressure gauges.

B. Pressure gauge snubbers.

1.2 RELATED SECTIONS

A. Valve tags and charts: Section 23 05 00.

B. Gas shut-off valves: Section 23 11 23.

1.3 SUBMITTALS

A. Product data: For each type of product, include a description, characteristics, materials, composition, finishes, and performance. Include the following:

1. Pressure gauges.
2. Pressure gauge snubbers.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Pressure gauges:

1. AMETEK; U.S. Gauge
2. Ashcroft; Dresser Instrument
3. Miljoco Corporation
4. Taco, Inc.
5. H.O. Trerice Co.
6. Weiss Instruments
7. Weksler; Dresser Instrument
8. Or approved equal.

2.2 FUEL GAS PRESSURE GAUGES

A. Fuel gas pressure gauges:

1. Case: Drawn steel or brass.
2. Window: Glass.
3. Pressure-element assembly: Grade A phosphor-bronze Bourdon-tube.
4. Display: White coated aluminum, with black graduations and markings, minimum of 2.5-inch (64-mm) diameter.
5. Accuracy: ±1.6 percent of range.

6. Graduation: To the scale shown on drawings, or so pointer is nearly straight up at system normal working pressure, designed for pressure 10 psi (69 kPa) and less with 1/10 of 1 psi increments.
7. Connection: Brass, NPT 1/4 (DN 8).
8. Basis of design: Trerice No. 760B.

B. Gauge cock (pressure gauge isolation valve): Provide a manual gas shut-off ball valve as specified in Section 23 11 23.

2.3 PRESSURE GAUGE SNUBBERS

A. Pressure snubbers:

1. Pulsation dampening, brass body, 250 psig (1725 kPa) minimum, NPT end connections sized for adjacent gauge and gauge cock.
2. Basis of design: Trerice 872 Series pressure snubbers.

PART 3 - EXECUTION

3.1 INSTALLING FUEL GAS PRESSURE GAUGES AND GAUGE COCKS

A. Provide pressure gauges as indicated on drawings.

B. Provide a gauge cock for each gauge.

C. Mount gauges vertically.

D. Connections to pipe lines shall be 0.5 inch (DN 15), with 0.5 inch (DN 15) by 0.25 inch (DN 8) reducer for valve, the assembly of sufficient length to clear insulation.

E. Where gauge cocks only are called for on drawings, provide the 0.5-inch (DN 15) connections to pipe line with reducer and the gauge cock.

F. Provide pressure snubbers for gauges near pumps or other pulsating locations.

END OF SECTION 23 05 19

SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Hangers and clamps.

B. Trapeze pipe hangers.

C. Supplemental materials.

D. Metal framing systems.

E. Insulation protection.

F. Fasteners.

1.2 RELATED SECTIONS

A. Vibration control supports: Section 23 05 48.

B. HVAC Piping Insulation: Section 23 07 19

C. Duct supports: Section 23 31 13.

1.3 REFERENCES

A. American Society of Mechanical Engineers

1. ASME B31.1: Power Piping.
2. ASME B31.9: Building Services Piping.

B. ASTM International

1. ASTM A 36: Standard Specification for Carbon Structural Steel
2. ASTM A 53: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
3. ASTM A 307: Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
4. ASTM A 563: Standard Specification for Carbon and Alloy Steel Nuts ASTM A 1064: Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
5. ASTM C 533: Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
6. ASTM C 552: Standard Specification for Cellular Glass Thermal Insulation

7. ASTM F 594: Standard Specification for Stainless Steel Nuts
8. ASTM F 3125: Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated

C. American Welding Society

1. AWS-D.1.1: Structural Welding – Steel

D. Metal Framing Manufacturer's Association

1. MFMA-4: Metal Framing Standards Publication
2. MFMA-103: Guidelines for the Use of Metal Framing

E. Manufacturer's Standardization Society

1. MSS SP-58: Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

1.4 DEFINITIONS

A. High Temperature Hot Systems: Operating temperatures 200 degrees F (93 degrees C) and above.

B. Hot Systems: Operating temperatures 120 degrees F (49 degrees C) to 200 degrees F (93 degrees C).

C. Ambient Systems: Operating temperatures 60 to 119 degrees F (16 to 48 degrees C).

D. Cold Systems: Minimum operating temperatures 59 degrees F (15 degrees C) and below.

1.5 SUBMITTALS

A. Product data: For each type of product, include a description, characteristics, materials, composition, finishes, and performance. Include the following:

1. Hangers and clamps.
2. Trapeze pipe hangers.
3. Supplemental materials.
4. Metal framing systems.
5. Insulation protection.
6. Fasteners.

B. Product application schedule: Include the following:

1. Provide a schedule of piping types and sizes and associated pipe hanger types.
2. Provide a schedule of building attachment types and associated attachment hardware.
3. Provide a schedule of pipe types and sizes and proposed hanger spacing and support rod diameters.

4. Provide manufacturer's recommended pipe hanger spacing criteria for plastic piping.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Qualifications of welders: As specified in Section 23 05 00, Common Work Results for HVAC.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Pipe hangers:

1. Anvil International
2. Carpenter and Paterson, Inc.
3. Cooper Industries
4. National Pipe Hanger Corporation
5. PHD Manufacturing, Inc.
6. PHP Systems/Design
7. Or approved equal.

B. Metal framing systems:

1. Anvil International
2. Cooper Industries
3. Hydra-Zorb
4. PHD Manufacturing, Inc.
5. PHP Systems/Design
6. Unistrut
7. Or approved equal.

C. Pipe covering protection shields:

1. Anvil International
2. Carpenter and Patterson, Inc.
3. Cooper Industries
4. National Pipe Hanger Corporation
5. PHD Manufacturing, Inc.
6. Pipe Shields, Inc.
7. Rilco Manufacturing Co., Inc.
8. Or approved equal.

2.2 PIPE HANGERS AND SUPPORTS

A. General: Comply with requirements of MSS SP-58.

B. Hangers and clamps:

1. Crawl spaces, tunnels, and wet areas: Galvanized steel.
2. Typical interior applications: Galvanized steel or factory painted.
3. Exterior and corrosive applications: Stainless steel.
4. For use with uninsulated copper pipe: Copper plated.

C. Trapeze pipe hanger: MSS SP-58, Type 59, shop-fabricated or field-fabricated pipe support assembly made from structural carbon-steel shapes with pipe saddles and U-bolts to secure piping on top of hanger.

D. Supplemental materials:

1. Threaded rod: Continuously threaded.

a. Zinc-plated or galvanized carbon steel for indoor applications.
b. Stainless steel for outdoor and corrosive applications.

2. Nuts and washers: Provide the same material used for threaded rods (ASTM A 563 for steel, ASTM F 594 for stainless steel).
3. Structural carbon-steel shapes: ASTM A 36.
4. Steel pipe: ASTM A 53, Grade B, Type E (electric resistance welded), Schedule 40, black and galvanized steel.

E. Metal framing systems:

1. Description: Shop- or field-fabricated, pipe-support assembly made of channels, nuts, bolts, structural connections, accessories, fittings, and other manufactured components, including brackets and braces required to resist lateral loads.
2. Standard: Comply with MFMA-4 for factory-fabricated components for field assembly.
3. Channels: Continuous slotted galvanized steel channel with inturned lips, width selected for applicable load criteria.
4. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
5. Zinc-plated or galvanized carbon steel for indoor applications.
6. Stainless steel for outdoor and corrosive applications.
7. Metal framing system pipe clamps:

a. Galvanized steel clamp pipe support with elastic stop nut, and hex head machine screw, and manufactured to connect to metal framing system channels.
b. For insulated piping: Clamp shall have friction tape on inside of clamp surface, manufactured to connect to pipe clamp insulating insert over pipe.
c. For uninsulated piping: Clamp shall have an integral molded thermoplastic elastomer clamping insert on inside of clamp surface, manufactured to connect to uninsulated pipe.

F. Insulation protection:

1. Pipe covering protection shield:

   a. Shield: Galvanized steel, meeting the requirements of MSS SP-58 Type 40. Provide alignment ridges when used in conjunction with pipe hanger.
   b. Structural insulation insert: Structural insulation insert to form the insulation for the lower half of, or the entire pipe circumference. Provide ASTM C 533, Type I calcium silicate with 100-psig (688-kPa) minimum compressive strength; or ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength. Insert thickness shall match adjacent piping insulation thickness.

2. Combination insulating insert and insulation protection shield:

   a. Insulating insert material for cold and ambient system piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength and vapor barrier. Insert thickness shall match adjacent piping insulation thickness.
   b. Insulating insert material for hot system piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa) minimum compressive strength; or ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength. Insert thickness shall match adjacent piping insulation thickness.
   c. Insulation protection shield: Galvanized steel.
   d. Insulating insert and insulation protection shield shall cover entire circumference of pipe.
   e. Insulating insert length: Extend 2 inches minimum (50 mm) beyond insulation protection shield.

3. Pipe covering protection saddle:

   a. Saddle: Steel, meeting requirements of MSS SP-58 Type 39
   b. Insulation insert: Insulating material located in the space between saddle and pipe.

4. Pipe clamp insulating insert:

   a. Insulating insert material: Closed-cell, sponge or expanded rubber, ASTM C 534, Type I for tubing material, with integral supports constructed from non-compressive closed cell material, single piece construction with self-adhesive closure strips. Insert thickness shall match adjacent piping insulation thickness. If insulation thickness is not available, provide maximum available thickness and seal insulation vapor barrier at thickness transition.
   b. Insulation protection jacket: Aluminum or stainless steel, bonded to insulation insert.
   c. Insulating insert and jacket shall cover entire circumference of pipe.
   d. Equal to Armacell “Armafix” insulating inserts.

2.3 FASTENERS

A. Mechanical expansion anchors:

1. Self-drilling type expansion shields or machine bolt drop-in anchors for drilled holes. Fasteners to floor slabs shall be vibration and shock resistant. Load applied to fasteners shall not exceed 25 percent of manufacturer's stated load capacity in 3500 psi (24,000 kPa) concrete. Provide zinc-coated anchors for indoor applications and stainless-steel anchors for outdoor applications.
2. Basis of design: ITT Phillips Anchors "Red Head."

B. Fasteners to drywall or cavity wall construction:

1. Toggle bolts with hollow wall drive anchors or nylon anchors as required.
2. Basis of design: ITT Phillips Anchors "Red Head" toggle bolts.

C. Fasteners to wood construction: Lag bolts.

D. Bolts, nuts, and washers: ASTM A 307, or ASTM F 3125 where high strength is required.

2.4 CONCRETE AND GROUT

A. Concrete:

1. Concrete shall be no less than 3000-psi (25,000 kPa) strength.
2. Reinforcement: 6 by 6 inch (150 by 150 mm) welded steel wire fabric, ASTM A 1064.

B. Grout:

1. Premixed, non-shrink grout consisting of non-metallic aggregate, cement, and water-reducing and plasticizing agents; capable of developing minimum compressive strength of 7,000 psi (48,000 kPa) in 28 days.
2. Provide grout by one of the following manufacturers:

a. Sonneborn-Rexnord "Sonogrout"
b. L&M Construction Chemical Company "Crystex"
c. US Grout Corporation "Five-Star Grout"

PART 3 - EXECUTION

3.1 GENERAL

A. Provide hangers and supports in accordance with schedules at the end of this section, as modified by specifications for each location and type.

B. Comply with MSS SP-58. Provide hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

C. Provide hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

D. Where required, provide structural steel shapes or metal framing system channels and hardware to transfer load from a hanger location to multiple locations in the structure to get support from an appropriate location or to increase the strength of the connection to the structure.

E. Support horizontal piping from above with hangers and threaded rod where possible, unless otherwise indicated.

F. Riser support:

1. Support pipe risers through floor slabs with riser clamps.
2. Where pipe sleeves or associated water dams are not capable of accepting the weight of the piping, provide supplemental supports to transfer the weight of the piping to the structure.
3. Provide additional supports as needed not to exceed scheduled maximum vertical support spacing.

G. Provide hanger sizes to allow for continuous insulation for insulated piping systems.

H. Fabricate wall-mounted and floor-mounted supports using metal framing systems or structural steel where required.

I. Support groups of small piping along a structural wall using a metal framing system secured to the wall.

J. Trim threaded rods with a maximum excess length of 1 inch (25 mm). Provide protective rubber red end caps on the ends of threaded rods exposed and within 8 feet (2.4 meters) of the floor, roof, or grade below.

K. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

L. Install lateral bracing with pipe hangers and supports to prevent swaying.

M. Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

O. Coordinate with requirements for hangers that require vibration control. See Section 23 0548.

P. Trapeze pipe hangers: Provide where required for grouping of parallel runs of horizontal piping.

1. Weld steel according to AWS D-1.1.
2. Hang with threaded rods. Size threaded rods in accordance with MSS SP-58.

3. Design trapeze pipe hangers and supports based on supported load plus a 50 percent minimum safety factor.
4. Hanger spacing shall not exceed the requirements for the smallest pipe in the rack.
5. Hanger spacing shall not exceed 6 feet (1.8 m) where hung from wood.

Q. Metal framing systems: Provide where required for grouping of parallel runs of piping, and support together on field-assembled strut systems. Comply with MFMA-103 for metal framing system selections and applications.

R. Piping supported from grade:

1. Support with hangers, a metal framing system, and supplemental materials.

S. Where piping penetrates metal studs within metal stud partitions, provide polymer inserts manufactured for the purpose to isolate piping and insulation from the metal stud material.

3.2 BUILDING ATTACHMENTS

A. Attaching to structural walls:

1. Provide a minimum of two 0.375 inch (9.5 mm) minimum screw-type fasteners for attaching brackets and a minimum of three 0.5 inch (13 mm) minimum bolt-type fasteners for attaching structural supports.

B. Attaching to structural steel beams, channels, or angles:

1. Secure threaded rods to MSS SP-58 Type 28 beam clamps that are clamped to the bottom flange of steel beams for any pipe size.
2. Secure threaded rods to MSS SP-58 Type 23 beam clamps for steel shapes with a maximum flange thickness of 0.75 inch (19 mm) and for single pipes NPS 2 (DN 50) and smaller.

C. Attaching to bar joists:

1. Provide MSS SP-58 Type 19 top-beam C-clamps attached to top flange of the joists at panel points.
2. Piping perpendicular to joists:

a. Pipes NPS 2.5 (DN 65) and smaller: Support from at least every other joist to spread the load among joists. Where multiple pipes are grouped together, stagger hangers to distribute the load among available joists.
b. Pipes NPS 3 (DN 80) and larger: Support from every joist to spread the load among joists.
c. If additional support is required between joists, hang metal framing system channel or structural steel shape from joists using MSS SP-58 Type 19 C-clamps attached to the top flange of two joists, and hang piping from metal framing system channel or structural steel shape.

3. Piping parallel to joists:

    a. Hang metal framing system channel or structural steel shape from joists using MSS SP-58 Type 19 C-clamps attached to the top flange of two joists. Hang piping from metal framing system channel or structural steel shape.
    b. For pipes NPS 2.5 (DN 65) and smaller: A single pipe may be hung from a single joist.

D. Attaching to concrete slabs and composite slabs:

1. Obtain approval from the structural engineer and confirm allowable loads prior to supporting pipe from concrete slabs or composite slabs. Where approved, provide mechanical expansion anchors and steel bolts or rods.

E. Attaching to precast concrete hollow core plank:

1. Obtain approval from the structural engineer and confirm allowable loads prior to supporting pipe from precast concrete plank.
2. Floor construction with topping slab:

    a. Threaded rods shall pass through the plank and be secured on topside with nut, locknut, and plate washer.
    b. Plate washers: 4 by 8 inches by 0.125 inch thick (100 mm by 200 mm by 6 mm) thick for 0.375-inch and 0.5-inch (10-mm and 15-mm) rods; 6 by 12 inches by 0.187 inch thick (150 by 305 by 5 mm) for 0.625-inch (16-mm) and larger rods.
    c. Top of hanger assembly shall be concealed below surface of topping slab.
    d. Drill openings through precast planks for the passage of threaded rods with power-driven carbide-tip drills, in accordance with Architect's instructions. Do not cut reinforcing bar without specific approval of the Structural Engineer.

3. Existing floor construction: Provide toggle bolts or remove and repair topping slab and support pipe as indicated above.
4. Roof construction: Provide toggle bolts.
5. Where several pipes are run in parallel, stagger individual hangers to avoid concentrating the load on a single plank.
6. Provide supplemental steel with connections to multiple planks where required to spread a load among multiple planks.

F. Attaching to steel decks: Not permitted.

G. Attaching to metal grating:

1. Piping perpendicular to structural members supporting grating:

    a. Attach threaded rods to the structural members using MSS SP-58 Type 23 beam clamps.
    b. If intermediate support is needed for proper hanger spacing, attach additional threaded rods to 2.5 by 2.5 by 0.25-inch (90 by 90 by 8-mm) angles, 12 inches (305 mm) long, welded to the underside of the grating.

2. Piping NPS 2 (DN 50) and smaller parallel with structural members supporting grating:

    a. Attach threaded rods to 2.5 by 2.5 by 0.25-inch (90 by 90 by 8-mm) angles, 12 inches (305 mm) long, welded to the underside of the grating for piping between structural members.
    b. Attach threaded rods to the structural members using MSS SP-58 Type 23 beam clamps for piping under structural members.

3. Piping NPS 2.5 (DN 65) and larger parallel with structural members supporting grating:

    a. Support as specified above for bar joist construction.
    b. Hang metal framing system channel or structural steel shape from structural members using MSS SP-58 Type 23 beam clamps. Hang piping from metal framing system channel or structural steel shape.

4. Threaded rods shall have locknuts.

H. Attaching to wood construction:

1. Obtain approval from the structural engineer and confirm allowable loads prior to supporting pipe from wood construction. Where approved, provide the following:

    a. Beams: Lag bolts.
    b. Trusses: Follow roof truss manufacturers' recommendations for attachment locations, loads, spacing, and methods of attachment.
    c. Joists: Provide MSS SP-58 Type 34 side beam connectors.

3.3 INSTALLING EQUIPMENT FOUNDATIONS AND SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor. Provide lateral bracing, to prevent swaying.

B. Provide minimum four-inch (100-mm) -high concrete foundations (housekeeping pads) or as indicated on drawings, reinforced with welded-wire fabric, for floor-mounted equipment and where indicated. Anchor concrete foundations by dowels inserted into the floor slab.

C. Unless otherwise specified, provide concrete foundations, bolts, sleeves, and appurtenances as work of the section where the supported equipment is specified and in accordance with the requirements of Division 03.

D. Equipment shall be properly aligned and leveled and grouted where necessary. Support piping independently of equipment and so as not to cause a strain or thrust.

E. Coordinate exact size, configuration and location of equipment, foundations, and supports using approved shop drawings of equipment.

3.4 PIPING HANGER AND SUPPORT SCHEDULES

A. Refrigerant piping applications:

HANGERS & SUPPORTS FOR REFRIGERANT PIPING APPLICATIONS		
MSS SP-58 Classification	Description	Piping applications
Hung from Above		
N/A	Metal framing system with metal framing system pipe clamps and pipe clamp insulating inserts.	All sizes.
Supported from Below		
N/A	Metal framing system with metal framing system pipe clamps and pipe clamp insulating inserts.	All sizes.
Risers		
Type 8	Riser clamp.	All sizes

B. Minimum threaded rod sizes: Provide at least the following minimum rod diameters for single rods supporting a single pipe hanger.

PIPE SIZE	MINIMUM ROD DIAMETER
NPS 2 (DN 50) and below	0.375 inches (10 mm)
NPS 2.5 and NPS 3 (DN 65 and DN 75)	0.5 inches (15 mm)
NPS 4 and NPS 5 (DN 100 and DN 125)	0.625 inches (16 mm)
NPS 6 and NPS 8 (DN150 and DN 200)	0.75 inches (20 mm)
NPS 10 to NPS 12 (DN 250 to DN 300)	0.875 inches (22 mm)
NPS 14 to NPS 18 (DN 350 to DN 450)	1.0 inch (25 mm)
NPS 20 (DN 500) and above	1.25 inch (35 mm)

C. Maximum hanger and support spacing:

1. Provide additional hangers or supports for concentrated loads such as flanges, valves, expansion compensators, fittings, and other specialties.
2. Spacing schedule for metallic piping:

<table>
<tr><th>PIPE SIZE</th><th>COPPER HYDRONIC PIPING</th><th>STEEL HYDRONIC PIPING</th><th>STEEL STEAM PIPING</th></tr>
<tr><td>NPS 0.75 (DN 20) and below</td><td>5 feet (1.5 m)</td><td rowspan="3">7 feet (2.1 m)</td><td rowspan="3">9 feet (2.7 m)</td></tr>
<tr><td>NPS 1 (DN 25)</td><td>6 feet (1.8 m)</td></tr>
<tr><td>NPS 1.25 (DN 32)</td><td>7 feet (2.1 m)</td></tr>
<tr><td>NPS 1.5 (DN 40)</td><td rowspan="2">8 feet (2.4 m)</td><td>9 feet (2.7 m)</td><td>12 feet (3.7 m)</td></tr>
<tr><td>NPS 2 (DN 50)</td><td>10 feet (3 m)</td><td>13 feet (4.0 m)</td></tr>
<tr><td>NPS 2.5 (DN 65)</td><td>9 feet (2.7 m)</td><td>11 feet (3.4 m)</td><td>14 feet (4.3 m)</td></tr>
<tr><td>NPS 3 (DN 75)</td><td>10 feet (3 m)</td><td>12 feet (3.7 m)</td><td>15 feet (4.6 m)</td></tr>
<tr><td>NPS 4 (DN 100)</td><td rowspan="2">12 feet (3.7 m)</td><td>14 feet (4.3 m)</td><td rowspan="2">17 feet (5.2 m)</td></tr>
<tr><td>NPS 5 (DN 125)</td><td>16 feet (4.9 m)</td></tr>
<tr><td>NPS 6 (DN 150)</td><td>14 feet (4.3 m)</td><td>17 feet (5.2 m)</td><td>21 feet (6.4 m)</td></tr>
<tr><td>NPS 8 (DN 200)</td><td rowspan="7">16 feet (4.9 m)</td><td>19 feet (5.8 m)</td><td>24 feet (7.3 m)</td></tr>
<tr><td>NPS 10 (DN 250)</td><td>22 feet (6.7 m)</td><td>26 feet (7.9 m)</td></tr>
<tr><td>NPS 12 (DN 300</td><td>23 feet (7.0 m)</td><td>30 feet (9.1 m)</td></tr>
<tr><td>NPS 14 (DN 350)</td><td>25 feet (7.6 m)</td><td>32 feet (9.8 m)</td></tr>
<tr><td>NPS 16 (DN 400)</td><td>27 feet (8.2 m)</td><td>35 feet (10.7 m)</td></tr>
<tr><td>NPS 18 (DN 450)</td><td>28 feet (8.5 m)</td><td>37 feet (11.3 m)</td></tr>
<tr><td>NPS 20 (DN 500) and above</td><td>30 feet (9.1 m)</td><td>39 feet (11.9 m)</td></tr>
</table>

3. Provide hanger spacing to meet manufacturer’s recommendations and MSS SP-58 for plastic hydronic piping.

END OF SECTION 23 05 29

SECTION 23 05 48 - VIBRATION CONTROL SUPPORTS FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Vibration control supports for HVAC equipment.

1.2 RELATED SECTIONS

A. Hangers and supports: Section 23 05 29.

B. Flexible duct connections: Section 23 33 00.

1.3 SUBMITTALS

A. Product data: For each type of product, include a description, characteristics, materials, composition, finishes, and performance. Include the following:

B. Shop drawings:

1. Custom-fabricated supports.
2. For Specification D hanger, include scaled drawing showing degrees of hanger rod swing.

1.4 QUALITY ASSURANCE

A. The vibration isolation materials manufacturer shall be responsible for the proper selection of springs to accomplish the specified minimum static deflections for all spring and pad type isolators based on the weight distribution of equipment to be isolated.

B. The vibration isolation materials manufacturer shall be responsible for the structural design of steel beam bases and concrete inertia bases to support mechanical equipment scheduled to receive an isolation base.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis-of-design product: Subject to compliance with requirements, provide the specified Mason Industries product, or comparable product by one of the following:

1. Amber/Booth Company, Inc.
2. Kinetics Noise Control

3. Mason Industries
4. Vibro-Acoustics
5. Vibration Eliminator Company, Inc.
6. Vibration Mountings and Controls, Inc.

2.2 VIBRATION CONTROL SUPPORTS

A. Provide engineered supports for equipment and locations shown on drawings and specified in Part 3 below. The units shall prevent the transmission of vibration and mechanically transmitted sound to the building structure.

1. Select units in accordance with the weight distribution of the equipment, to produce reasonably uniform deflection. Deflections shall be as specified.
2. Units installed on exterior shall be galvanized.

B. Specification D: Hangers, combination spring and minimum 0.3-inch (8-mm) deflection neoprene in series.

1. Neoprene element: Molded with a rod isolation bushing that passes through the hanger box.
2. Spring diameters and hanger box lower hole sizes: Large enough to permit the hanger rod to swing through a 30-degree arc before contacting the edges of the hole.
3. Springs shall have a minimum additional travel to solid equal to 50 percent of rated deflection.
4. Basis of design: Mason Industries Type 30N.

C. Specification E: Hangers, combination spring and minimum 0.3-inch (8-mm) deflection neoprene in series with adjustment to transfer load to spring while holding supported object at fixed elevation. Include spring deflection indicator.

1. Neoprene element: Molded with a rod isolation bushing that passes through the hanger box.
2. Spring diameters and hanger box lower hole sizes: Large enough to permit the hanger rod to swing through a 30-degree arc before contacting the edges of the hole.
3. Springs shall have a minimum additional travel to solid equal to 50 percent of rated deflection.
4. Basis of design: Mason Industries Type PC30N.

D. Specification W: Neoprene waffle pads made from identical grids molded back to back, square waffle pattern with modular cutting seams to facilitate cutting pads to size in the field without the need for measuring, durometer stiffness as required for uniform loading over pad area and to support equipment weight, provide load-bearing metal plates adhered to pads where required to support large loads.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Adjust vibration control supports as recommended by manufacturer to eliminate transmission of vibration to building structure or other systems.

B. Replace springs that become permanently deformed with new springs.

C. Provide 0.25-inch (6-mm) structural plate sized as required between isolator and equipment.

3.2 FAN VIBRATION CONTROL

A. Suspended from structure: Provide Specification D hanger, selected for weight, with minimum 1.0 inch static deflection.

3.3 AIR-HANDLING UNIT VIBRATION CONTROL

B. Isolators for air-handling units may be provided as part of the unit (internal isolation) as specified in Section 23 73 22, but shall meet the requirements of this section.

C. Suspended from structure: Provide Specification D hanger, selected for weight, with minimum 1.0 inch static deflection.

3.4 REFRIGERATION COMPRESSOR VIBRATION CONTROL

A. Refrigeration compressors and equipment with self-contained refrigeration compressors:

1. Refrigeration compressors, condensing units, and other rotating equipment mounted at grade: Specification W neoprene pads.

3.5 VIBRATION CONTROLS ON PIPING

A. Piping: Provide Specification E vibration control supports in first three hangers at both the suction and discharge of pumps, chillers, compressors, and condensing units, and for the first three hangers on pipes connected to air-handling units. The static deflection shall be the same as specified for the mountings under the connected equipment.

1. If piping is connected to equipment mounted on slab on grade and hangs from structure under occupied spaces, the first three hangers shall have at least 0.75 inch (19 mm) deflection for pipe sizes up to and including NPS 3 (DN 80), 1.5 inch (38 mm) deflection for pipe sizes up to and including NPS 6 (DN 150) and 2.5 inch (64 mm) deflection thereafter.
2. Other hangers and mounts shall have a minimum spring deflection of 0.75 inch (19 mm).

3. Locate vibration control supports in hanger rods as close to the overhead supports as practical. On supports with double rods, use two vibration control supports.

END OF SECTION 23 05 48

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The Contractor shall engage and the Architect shall approve an independent balancing and testing subcontractor.

B. This section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:

1. Balancing airflow and water flow within distribution systems, including submains, branches, and terminals, to indicated quantities according to specified tolerances.
2. Adjusting total HVAC systems to provide indicated quantities.
3. Measuring electrical performance of HVAC equipment.
4. Setting quantitative performance of HVAC equipment.
5. Verifying that automatic control devices are functioning properly.
6. Reporting results of the activities and procedures specified in this section.

1.2 RELATED SECTIONS

A. Testing and adjusting requirements unique to particular systems and equipment are included in the sections that specify those systems and equipment.

B. Field quality-control testing to verify that workmanship quality for system and equipment installation is specified in system and equipment sections.

C. Duct leakage pressure testing: Section 23 31 13

1.3 PERFORMANCE REQUIREMENTS

A. Select and obtain approval of the testing and balancing subcontractor at the earliest possible time and before beginning ductwork installation.

B. The testing and balancing subcontractor shall visit the job site periodically, beginning with the initial stages of construction of the mechanical systems, and shall ensure that the necessary devices are properly installed so that specified testing and balancing can be performed.

1.4 SUBMITTALS

A. Submit qualifications of testing and balancing subcontractor, as required in article “Quality Assurance” below.

B. Submit certified balance report. In addition to general requirements for submittals, submit three copies of final reports and certificates, bound into a booklet.

1.5 QUALITY ASSURANCE

A. Testing and balancing subcontractor qualifications:

1. Current certified member of the Associated Air Balance Council, or certified by National Environmental Balancing Bureau for air and hydronic systems testing and balancing.
2. Has successfully completed at least five projects of similar size and scope.
3. Not affiliated with any other subcontractor participating in this project. Work performed by the subcontractor shall be limited to testing, adjusting, and balancing HVAC systems.

B. Testing and balancing work shall comply with one of the following standards:

1. National Standards for Testing and Balancing Heating, Ventilating and Air Conditioning Systems, published by the Associated Air Balance Council.
2. Procedural Standards for Testing Adjusting Balancing of Environmental Systems, published by the National Environmental Balancing Bureau.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Instruments: Approved and properly calibrated.

B. Pyrometer surface temperature measurements may be used for piping system water temperatures where thermometer wells are not provided in the piping.

PART 3 - EXECUTION

3.1 VERIFICATION OF CONDITIONS

A. Before beginning balancing, ascertain that systems are ready. Verify that filters for regular service are in place, as required in Section 23 41 00, Particulate Air Filtration.

3.2 PREPARATION

A. Witness air duct leakage tests required in Section 23 31 13, Metal Ducts, and advise and approve the methods and instruments used.

B. Using bench-calibrated instruments, field-calibrate pressure gages and dial-type duct thermometers.

3.3 BALANCING OF SYSTEMS, GENERAL

A. Tabulate settings of temperature control devices and ascertain that thermostats, controllers, and valves are set at specified or approved positions. Verify and certify that the sequence of operation for each system is as shown on drawings, specified, or approved.

B. Provide all labor and devices necessary for the testing and balancing work.

3.4 AIR SYSTEMS BALANCING

A. Balance all air distribution, supply, return, exhaust, and outdoor air systems and equipment.

B. Test and adjust fans to deliver design airflow at lowest possible speed. Adjust air-handling equipment to deliver the required air volumes. Note that air quantities scheduled on drawings do not include allowances for duct leakage. Preliminary adjustments of fan speed should be slightly in excess of scheduled airflow delivery. Make adjustments by adjusting adjustable sheaves, changing sheaves and associated belts, changing wiring connections of motors, or adjusting speed controller.

C. Test and adjust system to design airflow requirements to the greatest extent possible. Manual volume dampers in ducts shall be adjusted to obtain required airflow rates at grilles, registers, and diffusers. Dampers integral to airflow devices should be fully open or minimally closed for airflow fine adjustments.

D. Make pitot tube traverse of main supply, return, and outdoor air ducts to obtain total airflow for fan or air-handling unit.

E. Adjust rooms or zones to design airflow (supply, return, and exhaust).

F. Adjust general HVAC systems to design airflow within the following tolerances:

1. Total system supply, return, and exhaust: (design to plus 10 percent).
2. Outdoor air: (minus 5 percent to plus 5 percent).
3. Total supply, return, and exhaust for a room or space: (minus 5 percent to plus 5 percent).
4. Grilles, registers, and diffusers:

    a. One per room or space: (minus 5 percent to plus 5 percent).
    b. Two or more per room or space: (minus 10 percent to plus 10 percent).

G. Grilles, registers, and diffusers:

1. Identify each grille, register, and diffuser as to location and area. List manufacturer, type, and size.
2. Identify type of testing equipment used.
3. Test and adjust each grille, register, and diffuser to design airflow. List (design-actual) cfm (cubic meters per minute) and (design-actual) velocity in fpm (meters per second) when applicable.

4. Adjust diffusers, grilles, and registers to minimize drafts. Adjust blades in supply diffuser straightening grids to ensure uniform air distribution across diffuser.
5. Adjust linear slot diffusers to provide throw direction as indicated on the drawings. Unless otherwise noted, discharge pattern shall be horizontal. Where two-way throw is indicated, divide the number of slots equally for each direction.

H. Test and record the following data, as applicable, for air-handling equipment:

1. Manufacturer and model number.
2. Total airflow (design-actual).
3. Return air airflow (design-actual).
4. Outdoor air airflow (design-actual).
5. Total and external static pressure (design-actual). Include static pressure at suction, discharge, and between unit coil and filter components.
6. Entering air temperatures (db heating, db and wb cooling).
7. Leaving air temperatures (db heating, db and wb cooling).
8. Motor horsepower (rated-actual).
9. Voltage and phase (rated-actual).
10. Fan speed, rpm (rated-actual).
11. Amperage (rated-actual).

I. In cooperation with the control manufacturer's representative, set adjustments of automatically operated dampers to operate as specified.

3.5 HYDRONIC SYSTEMS BALANCING

A. Balance all hydronic piping systems.

B. Adjust and balance the following items listed under the various systems in accordance with the specified standards. Units with automatic flow control valves, measure and document the differential pressure across the valve to ensure it is within the specified operating range.

1. Domestic hot water system:

a. Pump
b. Return piping for flow to every branch

C. After the above items have been adjusted and balanced, submit a certified report listing the specification requirements and the operating conditions of these items as follows:

1. Pump:

a. Flow - gpm
b. Suction pressure
c. Discharge pressure
d. Pressure differential
e. Total dynamic head
f. Motor - HP voltage, hertz, phase, design full load amps

g. Motor - operating line voltage and amperage, overload heater ratings.

3.6 MARKING OF SETTINGS

A. Following final balance procedures, permanently mark the settings of valves, splitters, dampers, and other adjustment devices, so that adjustment can be restored if disturbed at any time. Set memory stops on balancing valves. Return and make required adjustments after submittal and approval of the Certified Balance Report.

END OF SECTION 23 05 93

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 23 07 00 - HVAC INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Definitions and general requirements applicable to the insulation systems specified in "Related Sections."

1.2 RELATED SECTIONS

A. HVAC piping insulation: Section 23 07 19.

B. Duct insulation: Section 23 07 13.

1.3 REFERENCES

A. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials

B. NFPA 255: Standard Method of Test of Surface Burning Characteristics of Building Materials

C. UL 723: Standard for Test for Surface Burning Characteristics of Building Materials

1.4 DEFINITIONS

A. Ceiling space: The space between the ceiling and the floor of an air-conditioned space above.

B. Roof space: The space between the ceiling and the roof, where building insulation is located at the roof level or the space between the ceiling and the floor of a non-air conditioned space above.

C. Attic space: The space between the ceiling and the roof, where building insulation is located at the ceiling level.

D. Air-conditioned areas or spaces: Areas or spaces where the occupied room temperature is maintained between 65 and 80 degrees F (18.3 and 26.7 degrees C).

E. Concealed insulation shall include work:

1. Above ceilings.
2. In crawl spaces and tunnels.
3. Where furred in and in pipe chases.

F. Exposed insulation shall include work:

1. In all rooms and areas.

2. In mechanical equipment rooms, penthouses, or other similar utility spaces.
3. In storage rooms.

G. Unconditioned areas: Areas outside of the insulated envelope.

H. Finished spaces: Areas of the building accessible to the public and to building occupants other than service personnel.

1.5 QUALITY ASSURANCE

A. Perform work in strict accordance with the building, fire and safety codes of the state, county or city in which the work is performed.

B. Insulation, including fittings and butt strips, jackets, facings, and accessories such as adhesives, mastics, cements, tapes and cloth, shall have a fire and smoke hazard rating and label as tested by ASTM E84, NFPA 255, and UL 723, not exceeding Flame Spread 25, Fuel Contributed 50, Smoke Developed 50.

C. All insulation and accessories shall be free of asbestos.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver insulation and accessory products in manufacturers' wrapping or cartons, identified on the exterior and bearing labels showing conformance to flame and smoke rating requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Refer to sections listed in "Related Sections."

PART 3 – EXECUTION (NOT USED)

END OF SECTION 23 07 00

SECTION 23 07 13 - DUCT INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Duct insulation.

B. Field-applied jackets.

C. Two-hour rated insulation systems.

1.2 RELATED SECTIONS

A. Painting: Division 09.

B. Definitions and general insulation requirements: Section 23 07 00.

C. Acoustical duct liner: Section 23 31 13.

1.3 REFERENCES

A. American Society of Testing and Materials

1. ASTM C 553: Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
2. ASTM C 612: Standard Specification for Mineral Fiber Block and Board Thermal Insulation
3. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials

1.4 SUBMITTALS

A. Product data:

1. For each type of product, include a description, characteristics, materials, composition, finishes, and performance.
2. Submit a single manufacturer for each product. Submittals that include multiple manufacturers for a single product are not acceptable.
3. Submit ICC-ES Evaluation Service Report (ESR) for 2-hour rated duct enclosure system for the manufactured system provided for this project.

B. Product application schedule: Indicating the following for each application:

1. Insulation material.
2. Insulation thickness.
3. Insulation jacket.
4. Vapor barrier continuity requirements.

C. Installer qualifications.

1.5 QUALITY CONTROL SUBMITTALS

A. Manufacturer's instructions: Recommended accessory materials and products; installation instructions.

1.6 QUALITY ASSURANCE

A. Installer qualifications: Installers shall be mechanics skilled in this trade, employed with a firm that has a minimum of five years of experience installing mechanical insulation.

B. Access doors required for the installation: Obtain from the manufacturer of the used for the two-hour rated insulation system.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store rigid insulation products to protect them from breakage.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The listed manufacturers and particular products are intended to set a standard for materials, composition, and performance. Products of other manufacturers may be proposed as permitted by the provisions of Division 01 and the article "Product Options" in Section 23 01 01.

B. Mineral fiber insulation:

1. CertainTeed Corporation.
2. Johns Manville.
3. Knauf Insulation
4. Manson Insulation
5. Owens-Corning.
6. Or approved equal.

C. Coatings, adhesives, and fabrics:

1. Childers
2. Foster
3. Manville Building Materials Group
4. Rock Wool Manufacturing Company
5. Trimac
6. Or approved equal.

D. Two-hour rated insulation:

1. 3M
2. Thermal Ceramics
3. Unifrax Corporation
4. Or approved equal.

2.2 MINERAL FIBER INSULATION MATERIALS

A. Flexible mineral fiber insulation: ASTM C 553, Type I, nominal density at least 1 pound per cubic foot (16 kg per cubic meter), k-factor of 0.27 at 75 degrees F (k(SI) of 0.037 at 24 degrees C) mean temperature, of thickness as specified in Part 3 below, with foil-scrim-kraft vapor-barrier jacket. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

1. Minimum 1.5 inches (38 mm) of thickness with R-value of R-4.5 (RSI-0.79) in the installed condition with 25% compression.
2. Minimum 2 inches (50 mm) of thickness with R-value of R-6 (RSI-1.06) in the installed condition with 25% compression.

B. Rigid mineral fiber insulation: ASTM C 612, Types IA-IB, nominal density at least 6 pounds per cubic foot (96 kg per cubic meter), with k-factor of 0.22 at 75 degrees F (k(SI) of 0.032 at 24 degrees C) mean temperature, of thickness as specified in Part 3 below, with factory-applied jacket composed of a reinforced white kraft and aluminum-foil laminate with the white kraft facing out. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

1. Minimum R-value of R-6.8 (RSI-0.79) with 1.5 inches (38 mm) of thickness.
2. Minimum R-value of R-9.1 (RSI-1.06) with 2 inches (50 mm) of thickness.

C. Mineral fiber insulation accessories

1. Mechanical fasteners: Adhesively attached, minimum 12-gauge zinc-plated steel pin welded to a 2 inch by 2-inch, 22-gauge minimum galvanized steel perforated baseplate and self-locking retaining washer. Pin length as required. Comply with the SMACNA HVAC Duct Construction for Mechanical Fasteners. Provide adhesive recommended by fastener manufacturer. Peel and press (self-sticking) type fasteners are not acceptable.

2. Tape for flexible mineral fiber insulation: Self-adhesive foil-scrim-kraft vapor-barrier tape with removable backing and pressure-sensitive acrylic adhesive, 3" (75 mm) wide minimum. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
3. Tape for rigid mineral fiber insulation: Self-adhesive foil faced vapor-barrier tape with removable backing and pressure-sensitive acrylic adhesive, 2" (50 mm) wide minimum. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
4. Mineral fiber insulation vapor barrier mastic:

    a. Vapor barrier coating for use over ASJ jackets to give a vapor barrier seal at joints, laps and punctures. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
    b. Basis of design: Foster 30-65 "Vapor-Fas".

5. Corner Angles: Aluminum, 0.040 inch (1.0 mm) thick, minimum 1 by 1 inch (25 by 25 mm).
6. Trapeze hanger support inserts: Calcium silicate insulation, ASTM C 533, Type I.

2.3 TWO-HOUR RATED INSULATION SYSTEM

A. Two-hour fire protection insulation enclosure: Flexible, fire-resistive, noncombustible insulation, and access doors; UL listed and rated, tested to ASTM E2336, and detailed in the ICC-ES Evaluation Service Report to provide a two-hour fire rating when installed on hot ducts, grease ducts and ducts subject to fire hazard. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

B. Construction: Calcium-magnesium-silica amorphous wool encapsulated in reinforced, noncombustible jacket.

C. Accessories: Tape, adhesives, fasteners, and other items recommended by the manufacturer and included in the rated system.

D. Basis of design: 3M "Fire Barrier;" Thermal Ceramics "FireMaster" or "Pyroscat;" Unifrax "FyreWrap."

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Apply insulation in a neat and workmanlike manner and in accordance with manufacturer's printed instructions.

B. Tape and seal terminations of insulation with vapor barrier mastic.

C. Provide continuous insulation and jacket through trapeze hanger supports. 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.

D. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

E. 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.

F. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

G. Install insulation with longitudinal seams at top and bottom of horizontal runs.

H. Install multiple layers of insulation with longitudinal and end seams staggered.

I. Install insulation with least number of joints practical.

J. Stagger joints.

K. Install insulation continuously around hangers.

L. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

3.2 INSTALLATION INSIDE BUILDINGS

A. Install in accordance with the Minimum Insulation Thickness and R-Value Schedule at the end of this section.

B. Concealed ducts: Provide flexible mineral fiber insulation.

1. Mechanical fasteners: On ducts more than 24 inches (610 mm) wide, secure insulation on the underside with mechanical fasteners as required to prevent sagging, 16” (406 mm) maximum on center and 3” (75 mm) maximum from joints. Secure insulation in place with washers firmly embedded in insulation. Cut excess portion of pins extending beyond washers. Cover exposed pins and washers with tape.
2. Transverse joints and longitudinal seams: Butt insulation with facing overlapping at least 2 inches (50 mm). Staple and seal with tape.
3. Seal breaks and punctures with tape.

C. Exposed ducts: Provide rigid mineral fiber insulation.

1. Mechanical fasteners: Fastened with mechanical fasteners. Fasteners shall be spaced 16" (406 mm) on center with a minimum of two rows per side of duct and 3" (75 mm) maximum from joints. Secure insulation in place with washers firmly embedded in insulation. Cut excess portion of pins extending beyond washers. Cover exposed pins and washers with tape.
2. Transverse joints and longitudinal seams: Provide a continuous unbroken vapor barrier. Create a facing lap by removing 2 inches (50 mm) from one edge and one end of insulation segments. Secure laps to adjacent insulation section with staples, 6 inches (150 mm) on center maximum. Seal seams and joints with tape.
3. Seal breaks and punctures with tape.
4. Apply corner angles to all outside corners and straight edges.
5. For curved surfaces, such as exposed elbows, score or cut insulating board in narrow strips as necessary for snug and neat fit.

D. Ductwork which transmits air that may be either cooled or heated, or untempered air, shall be insulated as specified below for cooling systems.

E. Where necessary to conceal the standing seams and reinforcing angles on exposed ducts, increase insulation thickness to 2 inches (50 mm).

F. Casings and headers of reheat coils shall be insulated with the same thickness as adjacent ductwork.

G. Installation on dedicated outdoor air ductwork.

1. Conditioned outdoor air or supply air ducts from dedicated outdoor air systems shall be insulated as specified for supply air ducts for cooling systems.
2. Return or exhaust air ducts from dedicated outdoor air systems shall be insulated as specified for return air ducts for cooling systems.

3.3 INSTALLATION OF TWO-HOUR RATED INSULATION SYSTEM

A. Provide two-hour rated fire protection insulation in the following locations:

1. Locations noted on the drawings

B. Install in accordance with the manufacturer's installation instructions to obtain the fire rating.

1. Install duct insulation enclosure by a factory-qualified installer. Install directly to the duct to provide a zero-clearance fire resistance-rated duct enclosure as required by the ICC-ES Evaluation Service Report (ERS).
2. Secure system to ducts and duct hangers and supports to maintain a continuous fire rating.
3. Insulate duct access panels and doors to achieve same fire rating as duct.
4. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 07.

3.4 SCHEDULES

Minimum Insulation Thickness and R-Value for Duct Insulation Inside Buildings[1]

	Default Unless Otherwise Noted	Exposed in Area Served	Ceiling, Chase, or Shaft Space in Air-Conditioned Area	Roof Space[3]	Roof Space[3] Return Plenum of Air-Conditioned Area	Attic Space[3] and other Unconditioned Space
Outside Air and Exhaust Air						
Outdoor air	1.5 inch (38 mm)	1.5 inch (38 mm)	1.5 inch (38 mm)	1.5 inch (38 mm)	1.5 inch (38 mm)	1.5 inch (38 mm)
Exhaust air from air-conditioned areas	Not required	Not required	Not required	1.5 inches (38 mm)	Not required	1.5 inch (38 mm) R-4.5 (RSI 0.79)
Exhaust air and pressure relief between exterior connection and ATC damper, but not less than 10 feet (3 meters)	1.5 inch (38 mm)	1.5 inch (38 mm)	1.5 inch (38 mm)	1.5 inch (38 mm)	1.5 inch (38 mm)	1.5 inch (38 mm)
Cooling Systems						
Supply air	1.5 inch (38 mm)	Not required	1.5 inch (38 mm)	1.5 inch (38 mm)	1.5 inch (38 mm)	2 inch (50 mm) R-6 (RSI 1.06)
Lined supply air	1.5 inch (38 mm)	Not required	Not required	1.5 inch (38 mm)	Not required	2 inch (50 mm) R-6 (RSI 1.06)
Pre-insulated round or oval supply air	1.5 inch (38 mm)	Not required	Not required	1.5 inch (38 mm)	Not required	2 inch (50 mm) R-6 (RSI 1.06)
Return air and transfer	1.5 inch (38 mm)	Not required	Not required	1.5 inch (38 mm)	Not required	2 inch (50 mm) R-6 (RSI 1.06)
Lined return air and transfer	Not required	Not required	Not required	Not required	Not required	1.5 inch (38 mm) R-4.5 (RSI 0.79)[2]
Pre-insulated round or oval return air and transfer	Not required	Not required	Not required	Not required	Not required	1.5 inch (38 mm) R-4.5 (RSI 0.79)[2]
Heating Systems						
Supply air	1.5 inch (38 mm)	Not required	1.5 inch (38 mm)	1.5 inch (38 mm)	1.5 inch (38 mm)	2 inches (50 mm) R-6 (RSI 1.06)
Lined supply air	Not required	Not required	Not required	Not required	Not required	2 inches (50 mm) R-6 (RSI 1.06)
Pre-insulated round or oval supply air	Not required	Not required	Not required	Not required	Not required	2 inches (50 mm) R-6 (RSI 1.06)
Return air and transfer	Not required	Not required	Not required	Not required	Not required	2 inches (50 mm) R-6 (RSI 1.06)
Lined return air and transfer	Not required	Not required	Not required	Not required	Not required	2 inches (50 mm) R-6 (RSI 1.06)
Pre-insulated round or oval return air and transfer	Not required	Not required	Not required	Not required	Not required	2 inches (50 mm) R-6 (RSI 1.06)

Notes:
1: Insulation thickness shall be increased to 2 inches (50 mm) where necessary to conceal standing seams and reinforcing angles on exposed ducts.
2: Insulation R-value added to the R-value of lined or pre-insulated duct exceeds R-6 (RSI 1.06).
3: See Section 23 07 00 for definitions of "Roof Space" and "Attic Space."

END OF SECTION 23 07 13

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 23 07 19 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Mineral fiber insulation materials.

B. Flexible elastomeric insulation materials.

C. Fasteners.

D. Field-applied jackets.

E. Field-applied fabric-reinforcing mesh.

1.2 RELATED SECTIONS

A. Firestopping: Division 07.

B. Painting: Division 09.

C. Definitions and general insulation requirements: Section 23 07 00.

D. Pipe hangers and protection shields: Section 23 05 29.

E. Pre-insulated refrigerant tubing system: Section 23 23 00.

1.3 REFERENCES

A. American Society of Testing and Materials

1. Standards for mineral fiber insulation materials

a. ASTM C 449: Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
b. ASTM C 547: Mineral Fiber Pipe Insulation.
c. ASTM C 553: Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
d. ASTM C 1136: Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

2. Standards for flexible elastomeric insulation materials

a. ASTM C411: Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation

b. ASTM C 534: Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

3. Standards for all insulation materials

a. ASTM C 450: Prefabrication and Field Fabrication of Thermal Insulating Fitting Covers for NPS Piping, Vessel Lagging, and Dished Head Segments.
b. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials

4. Standards for field applied jackets and accessories

a. ASTM C 1729: Standard Specification for Aluminum Jacketing for Insulation.
b. ASTM D 1784: Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
c. ASTM B 209: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

1.4 SUBMITTALS

A. Product data:

1. For each type of product, include a description, characteristics, materials, composition, finishes, and performance.
2. Submit a single manufacturer for each product. Submittals that include multiple manufacturers for a single product are not acceptable.

B. Product application schedule: Indicating the following for each application:

1. Insulation material.
2. Insulation thickness.
3. Insulation jacket.
4. Vapor barrier continuity requirements.

C. Installer qualifications.

1.5 QUALITY CONTROL SUBMITTALS

A. Manufacturer’s instructions: Recommended accessory materials and products; installation instructions.

1.6 QUALITY ASSURANCE

A. Installers shall be mechanics skilled in this trade, employed with a firm that has a minimum of five years of experience installing mechanical insulation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The listed manufacturers and particular products are intended to set a standard for materials, composition, and performance. Products of other manufacturers may be proposed as permitted by the provisions of Division 01 and the article "Product Options" in Section 23 01 01.

B. Mineral fiber insulation:

1. CertainTeed Corporation.
2. Johns Manville
3. Knauf Insulation
4. Manson Insulation
5. Owens-Corning
6. Or approved equal.

C. Flexible elastomeric insulation:

1. Aeroflex USA*
2. Armacell LLC*
3. K-Flex USA
4. Rubatex
5. Or approved equal.

D. Coatings, adhesives, and fabrics:

1. Childers
2. Foster
3. Manville Building Materials Group
4. Rock Wool Manufacturing Company
5. Trimac
6. Or approved equal.

2.2 MINERAL FIBER INSULATION MATERIALS

A. Mineral fiber preformed pipe insulation: Glass fibers bonded with a thermosetting resin, ASTM C 547 Type I, with factory-applied ASJ-SSL jacket. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

B. ASJ-SSL jacket:

1. All service jacket with self-sealing lap
2. White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip
3. Complying with ASTM C 1136, Type I.

C. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, pressure sensitive, complying with ASTM C 1136; 3 inch (75 mm) width. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

D. Mineral fiber blanket insulation: Glass fibers bonded with a thermosetting resin, ASTM C 553, Type IV, without facing. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

E. Mineral fiber preformed fitting and valve covers: Glass fibers bonded with a thermosetting resin, made from the same material and density as adjacent pipe insulation, meeting ASTM C 450 requirements for dimensions used in forming insulation to cover valves, elbows, tees, flanges, strainers, and unions. Provide with preformed PVC field-applied jacket. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

F. Mineral fiber insulation adhesive:

1. Solvent free, low VOC, water-based adhesive designed for bonding mineral fiber insulation to steel or aluminum surfaces, and compatible with service temperatures. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
2. Basis of design: Foster 85-60 “Quick-Tack”.

G. Mineral fiber insulation vapor barrier mastic:

1. Vapor barrier coating for use over ASJ jackets to give a vapor barrier seal at joints, laps and punctures. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
2. Basis of design: Foster 30-65 “Vapor-Fas”.

H. Insulating cement: Mineral fiber cement with a hydraulic-setting binder, conforming to ASTM C 449. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

2.3 FLEXIBLE ELASTOMERIC INSULATION MATERIALS

A. Flexible elastomeric preformed pipe insulation: Closed-cell, sponge- or expanded-rubber, ASTM C 534, Type I for tubular materials. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

B. Flexible elastomeric preformed fitting and valve covers: Closed-cell, sponge- or expanded-rubber, made from the same material and density as adjacent pipe insulation, meeting ASTM C 450 requirements for dimensions used in forming insulation to cover valves, elbows, tees, flanges, strainers, and unions. Provide with preformed PVC field-applied jacket. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

1. Where flexible elastomeric insulation is used on hot gas piping in VRF applications, insulation shall be tested in accordance with ASTM C411 at 250 degrees F (121 degrees C) for a 96 hour time period and shall meet an ASTM E 84 surface burning characteristic (flame spread/smoke developed) rating less than 25/50 at 2 inches (50 mm) of thickness.

C. Flexible elastomeric insulation adhesive:

1. Water resistant contact cement designed especially suited for bonding two impermeable surfaces and recommended for rubber foam, steel, or aluminum surfaces, and compatible with service temperatures. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
2. Basis of design: Foster 85-75 “Drion”.

D. Flexible Elastomeric Tape:

1. Black, closed cell, self-adhering, elastomeric thermal insulation tape for insulating pipes and fittings, 0.125 inch (3 mm) thick, 2 inches (50 mm) wide.
2. ASTM C 534 Grade 1.
3. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

E. Flexible elastomeric insulation vapor barrier coating:

1. Water-based latex enamel coating for use over flexible elastomeric insulation, providing a moisture-resistant protective finish suitable for both indoor and outdoor applications. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
2. Basis of design: Armacell “WB Armaflex” latex enamel.

2.4 FASTENERS

A. Aluminum bands: ASTM B 209, 0.75 inches (19 mm) wide and 0.020 inches (0.4 mm) thick.

2.5 FIELD-APPLIED JACKETS

A. Aluminum jacket:

1. Jacket material: Smooth aluminum, 0.016-inch (0.4 mm) thickness for Insulation of 24 inches (610 mm) outside diameter or less: 0.024 inch (0.6 mm) thickness for larger outside diameters, lined with a bonded moisture barrier, factory cut and rolled to size, conforming to ASTM C 1729.
2. Fitting covers: Manufacturer’s factory-fabricated fitting covers made from the same material, finish, and thickness as the jacket, suitable to the size of fittings and thickness of insulation. Provide factory fabricated fitting covers for elbows, tees, flanges, unions, reducers, end caps, valves, and other fittings. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
3. Aluminum straps: Same alloy as jacket, conforming to ASTM B 209.

B. Polyvinyl chloride (PVC) jacket:

1. Jacket material: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; 20 mils (0.5 mm) thick; roll stock ready for shop or field cutting and forming. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
2. Color: White.
3. Adhesive: As recommended by jacket material manufacturer. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
4. Fitting covers: Manufacturer's factory-fabricated fitting covers made from the same material, finish, and thickness as the jacket, suitable to the size of fittings and thickness of insulation. Provide factory fabricated fitting covers for elbows, tees, flanges, unions, reducers, end caps, valves, and other fittings. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
5. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket and fitting covers with acrylic adhesive; suitable for indoor and outdoor applications, 2 inch (50 mm) width, 6 mil (0.15 mm) thickness. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

2.6 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Fabric-reinforcing mesh:

1. Woven Glass-Fiber Fabric: Approximately 2 ounces per square yard (68 grams per square meter) for covering pipe and pipe fittings.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Provide interior piping insulation in accordance with the Minimum Insulation Thickness Schedule for Interior Applications at the end of this section, as modified by specifications for each location and type.

B. Provide field applied jackets in accordance with the Field-Applied Jacket Schedule at the end of this section, as modified by specifications for each location and type.

C. Provide mineral fiber insulation unless otherwise indicated.

D. Provide flexible elastomeric insulation for refrigerant piping, with the exception of VRF system hot gas piping, which shall be mineral fiber.

E. Insulate piping containing water and piping containing glycol solutions with the same thickness of insulation based on application and temperature.

F. Apply insulation in a neat and workmanlike manner and in accordance with manufacturer's printed instructions.

G. Maintain a continuous vapor barrier on systems that convey fluid at below-ambient temperatures, including the following applications:

1. Chilled water piping
2. Condenser water piping used in water side economizer applications
3. Geothermal piping
4. Refrigerant piping

H. Where a continuous vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

I. Installation at pipe hangers:

1. Insulation shall be continuous through hangers for all piping systems.
2. Install pipe covering protection shields with thickness of structural insulation inserts equal, under load, to that of adjoining insulation.
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.
5. Shields and structural insulation inserts are specified in Section 23 0529, Hangers and Supports for HVAC Piping and Equipment.

J. Where insulated piping systems pass through sleeves or openings in partitions and floors, the insulation shall be continuous through the sleeves and openings. See Firestopping specifications for coordinating insulation and firestopping.

K. 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.

L. 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.

M. Install insulation with longitudinal seams at top and bottom of horizontal runs.

N. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

O. Install insulation with least number of joints practical.

P. Finish installation with systems at operating conditions. Repair separations and cracking caused by thermal movement.

Q. Return piping systems shall be insulated to meet the temperature demands of supply piping systems. There shall be no reduction of insulation thickness for anticipated temperature change between supply and return.

3.2 INSTALLING MINERAL FIBER INSULATION

A. Install insulation with factory-applied jackets as follows:

1. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive.
2. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap.
3. Cover circumferential joints and longitudinal seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
4. Where a continuous vapor barrier is indicated, apply vapor-barrier mastic on longitudinal seams and circumferential joints and at ends adjacent to pipe flanges and fittings.
5. Repair damaged insulation jackets by applying same jacket material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere and seal patches.

B. 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 using mineral fiber preformed fitting and valve covers whenever possible. Install preformed fittings with adhesive.
3. Where mineral fiber preformed fitting and valve covers are not available, insulate using mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining pieces 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. Coat with mastic. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
4. Install fitted PVC cover. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
5. Valves: Insulate up to and including the bonnets, stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
6. Strainers: Insulate so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover.
7. Flanges and unions: Install preformed pipe insulation to outer diameter of flange or union. Make width of insulation section same as overall width of union or flange and bolts, plus twice the thickness of pipe insulation. Fill voids between inner circumference of flange or union insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation. Coat with vapor barrier coating and reinforcing mesh before applying fitting cover.

C. Installation of casings and headers of coils:

1. Adhere mineral fiber insulation to casings and headers, same thickness as adjacent piping.
2. Coat with mastic.
3. Finish with two coats of lagging finish coating with glass cloth and tape between coats.

3.3 INSTALLING FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and circumferential joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Installation on fittings and flanges:

1. Install insulation over fittings and flanges with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate using flexible elastomeric preformed fitting covers whenever possible. Install preformed fittings with adhesive. Tape and seal with vapor barrier coating.
3. Where flexible elastomeric preformed fitting covers are not available, insulate using mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining pieces and bonded with adhesive. Tape and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. Seal with vapor barrier coating.
4. Install fitted PVC cover. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
5. Flanges: Install pre-formed pipe insulation to outer diameter of pipe flange. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation. 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. Secure insulation to flanges and tape and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. Seal with vapor barrier coating.

3.4 INSTALLING FIELD-APPLIED JACKETS

A. Installing aluminum jacket:

1. Provide jacket tight to insulation.
2. Secure in place with aluminum straps at all circumferential joints and on minimum 12-inch (305-mm) centers.
3. Provide with 2-inch (50-mm) overlap at longitudinal seams and circumferential joints.
4. Interior Applications: Orient longitudinal seams to face a wall or ceiling.
5. Exterior Applications: Arrange overlap at longitudinal seams and joints to shed water. Seal seams and joints with weatherproof sealant recommended by insulation manufacturer.

B. Installing PVC jacket:

1. Provide jacket tight to insulation.

2. Provide with 1-inch (25-mm) overlap at longitudinal seams and circumferential joints.
3. For horizontal applications, install with longitudinal seams along top and bottom of pipes.
4. Seal with manufacturer's recommended adhesive. Apply two continuous beads of adhesive to seams and joints, one bead under the jacket lap and another finish bead along each seam and joint edge.
5. Seams and joints shall completely prevent the entrance of water.

3.5 INSTALLING EXTERIOR PIPING INSULATION

A. Locations:

1. Provide insulation for hydronic and refrigerant piping systems exterior of building heated space, including but not limited to attics and unheated parking garages.
2. Provide insulation wherever heat tracing is required.

B. Insulation:

1. Material:

a. As specified for interior systems, unless otherwise indicated.
b. Where no material is required for interior piping, such as condenser water piping not used in water-side economizer applications, and no specific material is indicated on the drawings, provide fiberglass insulation.

2. Thickness: Minimum 2 inches (50 mm) thick, or 0.5 inches (13 mm) thicker than scheduled for interior insulation on similar system, whichever is greater.

C. Start insulation 30 inches (760 mm) below grade, 30 inches (760 mm) below roof or 30 inches (760 mm) inside exterior wall. Secure insulation with aluminum bands on 12-inch (305-mm) centers.

3.6 SCHEDULES

A. Minimum insulation thickness schedule for interior VRF refrigeration applications: Where a pipe performs more than one duty indicated in the schedule, insulate for the more demanding duty.

MINIMUM INSULATION THICKNESS SCHEDULE FOR INTERIOR VRF REFRIGERATION APPLICATIONS (1)			
Application	Fluid Temperature Range	NPS 1.25 (DN 32) & Smaller	NPS 1.5 (DN 40) & Greater
Refrigerant Liquid Between Branch Selector Boxes & Terminal Units	40F to 104F (16.1C to 40C)	1-inch (25 mm)	
Refrigerant Liquid Between Outdoor Unit & Branch Selector Boxes	61F to 104F (16.1C to 40C)	1-inch (25 mm)	
Refrigerant Suction	61F to 104F (16.1C to 40C)	1-inch (25 mm)	
Refrigerant Hot Gas (2)	105F to 140F (40.6C to 60C)	1-inch (25 mm)	1.5-inch (38 mm)
(1) – See additional thickness requirements for exterior applications. (2) – Insulation must be rated for continuous operation at or above 250F (121C) for 10 minutes and must meet ASTM E 84 flame and smoke requirements for plenum applications. Insulation may be mineral fiber or may be EPDM based flexible elastomeric insulation that meets ASTM E 84 requirements at the thickness indicated.			

B. Minimum insulation thickness schedule for interior heat pump refrigeration applications:

MINIMUM INSULATION THICKNESS SCHEDULE FOR INTERIOR HEAT PUMP REFRIGERATION APPLICATIONS (1)			
Application	Fluid Temperature Range	NPS 1.25 (DN 32) & Smaller	NPS 1.5 (DN 40) & Greater
Refrigerant Liquid	61F to 140F (16.1C to 60C)	1-inch (25 mm)	1.5-inch (38 mm)
Refrigerant Suction/Hot Gas (2)	61F to 140F (16.1C to 60C)	1-inch (25 mm)	1.5-inch (38 mm)
Refrigerant Hot Gas (3)	105F to 140F (40.6C to 60C)	1-inch (25 mm)	1.5-inch (38 mm)
(1) – See additional thickness requirements for exterior applications. (2) – For heat pump applications where piping may be either hot gas or refrigerant suction depending on the mode of operation, insulate the piping to meet the more demanding requirements of refrigerant hot gas. (3) – Hot gas may be required for split system hot gas reheat applications.			

C. Field-applied jacket schedule:

FIELD-APPLIED JACKET SCHEDULE		
Application	PVC Jacket	Aluminum Jacket
Exterior applications	X	X
Crawl spaces and tunnels	X	
Pipe insulation exposed in finished areas within 8 feet (2440 mm) of the finished floor		X
Pipe insulation exposed in finished areas more than 8 feet (2440 mm) above the finished floor	X	
Pipe insulation exposed in mechanical rooms, penthouses, and other service areas not accessible to the public	X	

END OF SECTION 23 07 19

SECTION 23 08 00 - SYSTEMS COMMISSIONING

PART 1 - GENERAL

1.1 SUMMARY

A. The owner will acquire the services of an independent commissioning agent.

B. Upon completion of all systems startup, testing, adjusting, and balancing by the Contractors, the systems shall be commissioned in the presence of the Owner's commissioning agent in accordance with the commissioning agent's plan and requirements. The commissioning process shall include final testing and final adjustments.

C. The Contractors shall be responsible for coordinating the commissioning process to ensure that all necessary personnel including installers and manufacturer's representatives are available on site to assist during the commissioning process. Personnel shall be available to make final adjustments to systems as directed, respond to questions regarding the operation of systems, demonstrate the systems, and train the Owner's personnel to operate and maintain the systems.

D. The Contractors shall fully cooperate with the Owner during the commissioning process to include adjustments to air and water flow rates and adjustments to the operation of the environmental monitoring and control system to obtain the proper environmental conditions.

E. Provide additional time and services for commissioning which is required due to system or equipment deficiency.

1.2 DEFINITIONS

A. Architect: Includes Architect identified in the Contract for Construction between Owner and Contractor, plus consultant/design professionals responsible for design of HVAC, electrical, communications, controls for HVAC systems, and other related systems.

B. BoD: Basis of Design.

C. BoD-HVAC: HVAC systems basis of design.

D. CxA: Commissioning Authority.

E. OPR: Owner's Project Requirements.

F. Substantial Completion: Defined in the Conditions of the Contract. When testing specified in 'Testing' in Part 3 below has begun and is proceeding successfully, the Contractor may begin the process to certify Substantial Completion. Commissioning shall be completed before final completion.

G. Systems, Subsystems, and Equipment: Where these terms are used together or separately, they shall mean 'as-built' systems, subsystems, and equipment.

H. TAB: Testing, Adjusting, and Balancing.

1.3 CONTRACTOR'S RESPONSIBILITIES

A. Mechanical contractor:

1. Attend TAB verification testing.
2. Provide measuring instruments and logging devices to record test data, and data acquisition equipment to record data for the complete range of testing for the required test period.

B. HVAC instrumentation and control subcontractor: With the CxA, review control designs for compliance with the OPR and BoD, controllability with respect to actual equipment to be installed, and recommend adjustments to control designs and sequence of operation descriptions.

C. TAB subcontractor:

1. Contract documents review: With the CxA, review the Contract Documents before developing TAB procedures.

a. Verify the following:

(1) Accessibility of equipment and components required for TAB work.
(2) Adequate number and placement of duct balancing dampers to allow proper balancing while minimizing sound levels in occupied spaces.
(3) Adequate number and placement of balancing valves to allow proper balancing and recording of water flow.
(4) Adequate number and placement of test ports and test instrumentation to allow reading and compilation of system and equipment performance data needed to conduct both TAB and commissioning testing.
(5) Air and water flow rates have been specified and compared to central equipment output capacities.

D. Electrical contractor:

1. With the mechanical contractor, coordinate installations and connections between and among electrical and HVAC systems, subsystems, and equipment.

1.4 COMMISSIONING DOCUMENTATION

A. Test checklists: CxA shall develop test checklists for HVAC systems, subsystems, and equipment, including interfaces and interlocks with other systems. CxA shall prepare separate checklists for each mode of operation and provide space to indicate whether the mode under test responded as required. Standard checklists developed by organizations, such as AABC

Commissioning Group, are acceptable, if items noted below are included. Checklists shall include, but not be limited to, the following:

1. Calibration of sensors and sensor function.
2. Testing conditions under which test was conducted, including (as applicable) ambient conditions, set points, override conditions, and status and operating conditions that impact the results of test.
3. Control sequences for HVAC systems.
4. Strength of control signal for each set point at specified conditions, as recorded by automatic temperature control subcontractor.
5. Responses to control signals at specified conditions.
6. Sequence of response(s) to control signals at specified conditions.
7. Electrical demand or power input at specified conditions.
8. Power quality and related measurements.
9. Expected performance of systems, subsystems, and equipment at each step of test.
10. Narrative description of observed performance of systems, subsystems, and equipment. Notation to indicate whether the observed performance at each step meets the expected results.
11. Interaction of auxiliary equipment.
12. Issues log.

1.5 SUBMITTALS

A. The following submittals are in addition to those specified in Division 01 Section 'Submittal Procedures.'

B. Testing Procedures: CxA shall submit detailed testing plan, procedures, and checklists for each series of tests. Submittals shall include samples of data reporting sheets that will be part of the reports.

C. Certificate of Readiness: CxA shall compile certificates of readiness from each Contractor certifying that systems, subsystems, equipment, and associated controls are ready for testing, as specified in Division 01 and in 'Prerequisites for testing' in Part 3 below.

D. Certificate of Completion of Installation, Prestart, and Startup: CxA shall certify that installation, prestart, and startup activities have been completed. Certification shall include completed checklists provided by TAB Subcontractor as specified in Division 23 Section 'Testing, Adjusting, and Balancing.'

E. Certified Pipe Cleaning and Flushing Report: CxA shall certify that pipe cleaning, flushing, hydrostatic testing, and chemical treating have been completed.

F. Test and Inspection Reports: CxA shall compile and submit test and inspection reports and certificates required by the specifications, and shall include them in systems manual and commissioning report, whether witnessed by the CxA or not.

G. Corrective Action Documents: CxA shall submit corrective action documents.

H. Certified TAB Reports: CxA shall submit verified, certified TAB reports.

PART 2 - PRODUCTS

2.1 REPLACEMENTS

A. CxA will report any defective materials and equipment which become apparent during the commissioning process. The Contractor shall repair or replace defective materials and equipment with specified material and components. This work shall be accomplished at no addition to the Contract Sum.

PART 3 - EXECUTION

3.1 TESTING PREPARATION

A. Contractor's certification of readiness of systems or parts of the work for testing shall be as required in 'Submittals' in Part 1 above.

1. If CxA begins testing, and finds that the systems or equipment are not ready (false start), the additional cost to restart testing will be charged to the contractor or subcontractor who prepared the certificate of readiness, by the procedures provided in the Contract for changes in the work.
2. Evidence that a system or equipment is not ready: Ten percent of system or equipment is tested and fails to perform requirements.

B. Prerequisites for testing: Contractors and subcontractors shall:

1. Certify that HVAC systems, subsystems, and equipment have been completed, calibrated, and started; are operating according to the OPR, BoD, and Contract Documents; and that Certificates of Readiness are signed and submitted.
2. Certify that HVAC instrumentation and control systems have been completed and calibrated; are operating according to the OPR, BoD, and Contract Documents; and that pretest set points have been recorded and labeled in the field.
3. Certify that TAB procedures have been completed, and that TAB reports have been submitted, discrepancies corrected, and corrective work approved.
4. Test systems and intersystem performance after approval of test checklists for systems, subsystems, and equipment.
5. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shut down, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
6. Verify each operating cycle after it has been running for a specified period and is operating in a steady-state condition.
7. Inspect and verify the position of each device and interlock identified on checklists. Sign off each item as acceptable, or failed. Repeat this test for each operating cycle that applies to system being tested.

8. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.
9. Annotate checklist or data sheet when a deficiency is observed.
10. Verify equipment interface with monitoring and control system and TAB criteria; include the following:

    a. Supply and return flow rates for VAV and constant volume systems in each operational mode.
    b. Operation of terminal units in both heating and cooling cycles.
    c. Minimum outdoor-air intake in each operational mode and at minimum and maximum airflows.
    d. Building pressurization.
    e. Total exhaust airflow and total outdoor-air intake.
    f. Operation of indoor-air-quality monitoring systems.

11. Verify proper responses of monitoring and control system controllers and sensors to include the following:

    a. For each controller or sensor, record the indicated monitoring and control system reading and the test instrument reading. If initial test indicates that the test reading is outside of the control range of the installed device, check calibration of the installed device and adjust as required. Retest malfunctioning devices and record results on checklist or data sheet.
    b. Report deficiencies and prepare an issues log entry.

12. Verify that HVAC equipment field quality-control testing has been completed and approved. CxA shall direct, witness, and document field quality-control tests, inspections, and startup specified in individual Division 23 Sections.

C. The percentage of HVAC systems and equipment to be commissioned on this project include:

1. Split system heat pump dedicated outdoor air system: 100 percent
2. Variable Refrigerant Flow (VRF) Systems: 100 percent
3. Domestic water pressure tanks systems: 100 percent
4. Domestic hot water systems including pump and mixing valve: 100 percent
5. Exhaust systems: 100 percent
6. Lighting control system: 100 percent
7. Building automation system: 100 percent
8. Elevator sump pump: 100 percent
9. Sewage ejector pump in lift station: 100 percent

D. Testing instrumentation: Install measuring instruments and logging devices to record test data for the required test period. Instrumentation shall monitor and record full range of operating conditions and shall allow for calculation of total capacity of system for each mode of operation. For individual room cooling tests, provide temporary heaters to impose a cooling load indicated in BoD. Operational modes include the following:

1. Occupied and unoccupied.
2. Warm up and cool down.

3. Economizer cycle.
4. Emergency power supply.
5. Life-safety and safety systems.
6. Smoke control.
7. Fire safety.
8. Temporary upset of system operation.
9. Partial occupancy conditions.
10. Special cycles.

3.2 TAB VERIFICATION

A. TAB subcontractor shall coordinate with CxA for work required in Division 23 Section 'Testing, Adjusting, and Balancing.' TAB subcontractor shall copy CxA with required reports, sample forms, checklists, and certificates.

B. HVAC contractor and CxA shall witness TAB work.

C. TAB preparation:

1. TAB subcontractor shall provide CxA with data required for 'Pre-Field TAB Engineering Reports'.

    a. CxA shall use this data to certify that prestart and startup activities have been completed for systems, subsystems, and equipment installation.

D. Ductwork air leakage testing:

1. The HVAC contractor shall supply a copy of the ductwork air leakage testing report, witnessed by TAB subcontractor, as required in Section 23 3113, to the CxA.
2. On approval of ductwork air leakage testing report, the CxA shall coordinate verification testing of ductwork air leakage testing. Verification testing shall include random retests of portions of duct section tests, reported in original ductwork air leakage testing report. The HVAC contractor shall perform tests using the same instrumentation (by model and serial number) as for original testing; the CxA shall witness verification testing.

E. Verification of Final TAB Report:

1. CxA shall select, at random, 10 percent of report for field verification.
2. CxA shall notify TAB subcontractor 10days in advance of the date of field verification; however, notice shall not include data points to be verified. The TAB subcontractor shall use the same instruments (by model and serial number) that were used when original data were collected.
3. Failure of an item is defined as follows:

    a. For all readings other than sound, a deviation of more than 10 percent.

4. Failure of more than 10 percent of selected items shall result in rejection of final TAB report.

F. If deficiencies are identified during verification testing, CxA shall notify the HVAC contractor and Engineer, and shall take action to remedy the deficiency. Engineer shall review final tabulated checklists and data sheets to determine if verification is complete and that system is operating according to the Contract Documents.

G. CxA shall certify that TAB work has been successfully completed.

3.3 TESTING

A. Test systems and intersystem performance after test checklists for systems, subsystems, and equipment have been approved.

1. Contractor shall ensure that each system is ready for testing when tests are schedule, that is, plugged or capped for pressure and leak tests, and similar preparations.

B. Perform tests using design conditions whenever possible.

1. Simulate conditions by imposing an artificial load when it is not practical to test under design conditions and when written approval for simulated conditions is received from CxA. Before simulating conditions, calibrate testing instruments. Set and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.
2. Alter set points when simulating conditions is not practical and when written approval is received from CxA.
3. Alter sensor values with a signal generator when design or simulating conditions and altering set points are not practical. Do not use sensor to act as signal generator to simulate conditions or override values.

C. Scope of HVAC Contractor testing:

1. Testing scope shall include entire HVAC installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. It shall include measuring capacities and effectiveness of operational and control functions.
2. Test all operating modes, interlocks, control responses, responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. Detailed testing procedures: CxA, with HVAC contractor, TAB subcontractor, and HVAC instrumentation and control subcontractor, shall prepare detailed testing plans, procedures, and checklists for HVAC systems, subsystems, and equipment.

E. HVAC instrumentation and control system testing:

1. Field testing plans and testing requirements are specified in Division 23 Controls Section. The CxA, HVAC contractor, and the HVAC instrumentation and control subcontractor shall collaborate to prepare testing plans.

2. CxA shall convene a meeting of appropriate entities to review test report of HVAC instrumentation and control systems.
3. Testing shall include both the system at the project site and the related functions of the Owner's operations center.

F. Pipe cleaning, flushing, hydrostatic tests, and chemical treatment requirements are specified in Division 23 piping Sections. HVAC contractor shall prepare pipe system cleaning, flushing, and hydrostatic testing. CxA shall review and comment on plan and final reports. CxA shall certify that pipe cleaning, flushing, hydrostatic tests, and chemical treatment have been completed. Plan shall include the following:

1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed Drawings for each pipe sector showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
2. Description of equipment for flushing operations.
3. Minimum flushing water velocity.
4. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.

G. Refrigeration system testing: HVAC contractor shall prepare a testing plan to verify performance of chillers, refrigerant compressors and condensers, and other refrigeration systems. Plan shall include the following:

1. Sequence of testing and testing procedures for each item of equipment and section of pipe to be tested, identified by identification marker. Markers shall be keyed to Drawings showing the physical location of each item of equipment and pipe test section. Drawings shall be formatted to allow each item of equipment and section of piping to be physically located and identified when referred to in the system testing plan.
2. Tracking checklist for managing and ensuring that all pipe sections have been tested.

H. HVAC distribution system testing: HVAC contractor shall prepare a testing plan to verify performance of air steam, and hydronic distribution systems; special exhaust; and other distribution systems. Include HVAC terminal equipment and unitary equipment. Plan shall include the following:

1. Sequence of testing and testing procedures for each item of equipment and section of pipe to be tested, identified by identification marker. Markers shall be keyed to Drawings showing the physical location of each item of equipment and pipe test section. Drawings shall be formatted to allow each item of equipment and section of piping to be physically located and identified when referred to in the system testing plan.
2. Tracking checklist for managing and ensuring that all pipe sections have been tested.

I. Deferred testing:

1. If tests cannot be completed because of a deficiency outside the scope of the HVAC system, the deficiency shall be documented and reported to Owner. Deficiencies shall be resolved and corrected by appropriate parties and test rescheduled.
2. If the testing plan indicates specific seasonal testing, appropriate initial performance tests shall be completed and documented and additional tests scheduled.

J. Testing reports:

1. Reports shall include measured data, data sheets, and a comprehensive summary describing the operation of systems at the time of testing.
2. Include data sheets for each controller to verify proper operation of the control system, the system it serves, the service it provides, and its location. For each controller, provide space for recording its readout, the reading at the controller's sensor(s), plus comments. Provide space for testing personnel to sign off on each data sheet.
3. Prepare a preliminary test report. Deficiencies will be evaluated by Engineer to determine corrective action. Deficiencies shall be corrected and test repeated.
4. If it is determined that the system is constructed according to the Contract Documents, Owner will decide whether modifications required to bring the performance of the system to the OPR and BoD documents shall be implemented or if tests will be accepted as submitted. If corrective work is performed, Owner will decide if tests shall be repeated and a revised report submitted.

END OF SECTION 23 08 00

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 23 09 01 - AUTOMATIC TEMPERATURE CONTROL SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Complete new automatic temperature control (ATC) system.

B. Sequences of operation for automatically controlled equipment are shown on drawings. ATC subcontractor shall cooperate with the unit suppliers and provide all relays and wiring required to integrate the sequence of operation.

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. UL label, demonstration, training, and equipment installation: Section 23 05 00.

B. Duct smoke detectors: Section 28 31 00.

1.3 RELATED SECTIONS

A. Controls: Sections 23 09 01 through 23 09 23.

B. Balancing: Section 23 05 93.

1.4 SYSTEM DESCRIPTION

A. Provide a complete system of direct digital temperature controls with electronic and/or electric actuation.

B. The system shall consist of two levels of network communication and wiring, DDC controllers, application-specific controllers, software, operator I/O devices, sensors and other necessary input hardware, dampers, valves, actuators and other necessary output hardware, fire and smoke devices, electrical power surge protection, other necessary equipment and a complete system of wiring to fulfill the intent of the sequences of operation shown on the drawings.

1.5 DESIGN REQUIREMENTS

A. The products specified, scheduled, and shown on drawings are the basis of the design of this project.

B. For requirements affecting use of optional manufacturers, or substitutions, see Division 01 and Section 23 01 01, HVAC General Provisions, and Section 23 05 00, Common Work Results for HVAC.

1.6 SUBMITTALS

A. Product data: See individual controls sections.

B. Shop drawings: Provide a point schedule and composite control diagram of all equipment provided for each control sequence, including factory and field controls. Include a written description of sequences, in which each control device or item of equipment is identified by the designation indicated on the diagram.

C. Contractor qualifications: Submit a list of a minimum of three projects similar to this project in type, size, and duty, which has been operating satisfactorily for not less than five years.

1. Include project name, address, name and phone number of Owner's representative and project size and type.

D. Certifications:

1. Factory authorization and certification of the installing company.
2. Evidence of training and certification of each supervisor and mechanic assigned to this project.

E. Project record documents: As specified in Division 01 and Section 23 01 01, provide a drawing at the same scale as the contract drawings, showing the locations of all components installed.

1.7 QUALITY ASSURANCE

A. Subcontractor qualifications: One hundred percent company-owned, full-service, local branch or authorized factory-direct contractor for one of the acceptable national temperature control manufacturing companies named below, as follows:

1. Full service: Includes system engineering, shop drawing preparation, software programming, installation, commissioning, and service.
2. Factory-direct contractor: Is contracted directly with manufacturer to buy components and has direct access to manufacturer's local branch office for engineering, service, and technical support without any third-party involvement.
3. Experience: The branch or factory-direct contractor shall have completed at least three system installations of the same type, size, and design, which have successfully operated their sequence of operations for at least three years.
4. Supervisors and mechanics: Factory-trained and certified in the type of control system (pneumatic, electric, digital, electronic) being installed, and directly employed by the subcontractor.

    a. The programmer responsible for programming digital controllers shall have a minimum of three years' experience programming digital controllers of the manufacturer, for HVAC systems.

B. Qualified subcontractor shall prepare control diagrams.

C. Perform work in accordance with the plumbing, electrical, building, fire and safety codes of the state, county, or city in which the work is performed.

D. UL label: As specified in Section 23 05 00, Common Work Results for HVAC.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Direct digital system:

1. Johnson FX Tridium, installed by controls contractors that are approved by the State of DE (Modern Controls, Inc and Radius Services LLC).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Coordinate with equipment suppliers to integrate controls provided by manufacturers into the control sequences shown on drawings.

B. Mount devices and control panels provided by equipment manufacturers, and provide required control wiring.

C. Operate, test, calibrate, and adjust each control system until it operates as intended by the manufacturer and as specified in the control sequence.

3.2 TESTS

A. Thoroughly test and check the completed system to ascertain that all equipment is functioning as intended and that dampers and valves respond properly to their controls. Installer of work of this section shall cooperate with the equipment suppliers, and with balancing and testing work, to make necessary adjustments to ATC devices for proper operation of the completed system.

3.3 DEMONSTRATION AND TRAINING

A. Provide demonstration and training as specified in Section 23 05 00.

END OF SECTION 23 09 01

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 23 09 02 - CONTROL SYSTEMS WIRING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wiring.

B. Conduit and fittings.

C. Control power transformers.

D. Requirements to provide power for control systems.

1.2 RELATED SECTIONS

A. Automatic temperature control system: Sections 23 09 01 through 23 09 23.

B. Disconnect switches: Division 26.

1.3 SUBMITTALS

A. Product data: For each type of product, include a description, characteristics, materials, composition, finishes, and performance. Include the following:

1. Wiring.
2. Conduit and fittings.
3. Control power transformers.

1.4 QUALITY ASSURANCE

A. UL label: As specified in Section 23 05 00, Common Work Results for HVAC.

B. Control system power circuits shall not supply power to other building components such as lights or receptacles.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Electrical materials and devices shall be UL listed and shall meet the requirements of NEC (NFPA 70) and Division 26, Electrical.

2.2 WIRING

A. Wiring 50 V and below: Fully color coded, copper 600 V type THW or THHN, minimum No. 22 or as specified in Division 26, Electrical.

B. Wiring above 50 V: As specified in Division 26.

2.3 CONDUIT AND FITTINGS

A. Galvanized steel conduit: Minimum size 0.5 inches (16 mm), hot-dip galvanized with threads galvanized after cutting, one of the following:

1. Rigid full weight, heavy-wall steel conduit (RGS) conforming to UL 6 and ANSI C80.01.
2. Intermediate steel conduit (IMC) conforming to UL 1242 and ANSI C80.03.

B. Steel conduit fittings: Cast malleable iron fittings with smooth finish and full threaded hubs. Include steel or malleable iron locknuts, bushings, and other fittings.

1. Insulating bushings.

a. Basis of design: Thomas & Betts Series 22.

2. Hub fittings with recessed sealing ring and nylon insulated throat.

a. Basis of design: Thomas & Betts Series 370.

3. Fittings for exposed locations: Conduit outlet bodies, zinc- or cadmium-plated.

C. Electrical metallic tubing (EMT):

1. Minimum size 0.5 inch (16 mm), maximum 1.5 inch (41 mm), hot-dip galvanized or sherardized thin-wall steel conduit conforming to UL 797 and ANSI C 80.03.

2. Connectors and couplings for EMT: Concrete- or rain-tight, compression or set screw type, made of cadmium-plated steel with nylon insulating throat.

a. Basis of design: Thomas & Betts Series 5031, 5123 and 5120.

D. Flexible metal conduit:

1. Minimum size 0.5 inch (16 mm), made of sheet metal strip, interlocked construction, conforming to UL 1.

2. Connectors for flexible metal conduit: Angle wedge type with nylon insulated throat.

a. Basis of design: Thomas & Betts Series 3110 and 3130, “Tite-Bite.”

E. Liquidtight flexible metal conduit:

1. Conform to UL 360.
2. Liquidtight connectors: UL 14814A, with fittings and nylon-insulated throat.

a. Basis of design: Thomas & Betts Series 5331.

F. Surface metal raceway: Raceway dimensions 0.65 by 0.75 inches minimum size, complete with fittings, connectors, and accessories.

1. Basis of design: Wiremold No. 700.

G. Plastic conduit:

1. Polyvinyl chloride (PVC) Schedule 40, rated for use with 90-degree conductors, for exposed, underground, and encased applications, complying with NEMA Specification TC-2 and UL 651.

2. Plastic conduit fittings and cement:

a. Fittings: Complying with NEMA TC 3 and UL 514.
b. Cement: Solvent cement made by the manufacturer of the conduit and fittings.

2.4 CONTROL POWER TRANSFORMERS

A. Designed to provide power sources for 24-V ac control circuits, and precision built to ensure rated power, proper voltage regulation and maximum efficiency. Units shall be equipped with integral manual reset circuit breaker for over-current protection on the secondary winding. Output regulation shall be 10 percent from no load to full load.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Electrical equipment is specified in Division 26. Provide circuit breakers, disconnect switches, power wiring, control power transformers, control wiring, and other equipment, meeting requirements of Division 26, so the automatic temperature control system will function as specified and indicated on the drawings.

B. Control system power source: Provide power for control systems as follows:

1. Terminal equipment control applications:

a. Applications include VAV terminal units, fan-coil units, unit heaters, unit ventilators, and other similar space conditioning equipment dedicated to conditioning a single space.

b. Terminal equipment power may be used to power associated terminal equipment controllers with the following additional requirements.

(1) Provide power for the controller upstream of the terminal unit disconnect switch, allowing the controller to remain energized when power to the equipment is disconnected.
(2) Provide a fused disconnect between the power source and the controller.

c. Where these conditions cannot be met, provide circuit breakers in panelboards and power circuits to power terminal equipment controllers.
d. Where terminal equipment does not have a power connection, provide circuit breakers in panelboards and power circuits to power terminal equipment controllers.

2. Equipment control applications other than terminal equipment:

a. Applications include, but are not limited to, air-handling equipment, large, centralized exhaust systems, pumps, central plant equipment, and other non-terminal type equipment and systems.
b. Do not use equipment power as a source for control system power. Controllers shall remain energized when the power circuit to the equipment is deenergized.
c. Provide circuit breakers in panelboards and power circuits to power controllers.
d. Provide switches at each control panel to serve as disconnect switches; a panel may consist of multiple controllers within a single enclosure. Each panel shall be fused together.
e. Provide metal-oxide varistors to protect controllers.

3. Servers, switches, and other central control system components:

a. Provide circuit breakers in panelboards and power circuits to power central control system components.
b. Provide UPS and surge protection.

4. Provide circuit breakers that match and are compatible with other breakers in a panelboard.
5. Provide optional standby power for controls that support equipment provided with optional standby power.

C. Conduit:

1. Install conduit and wiring as specified in Division 26.
2. Where necessary to connect conduit to motors or motor-driven equipment, or to attach conduit to fan housings or air-handling units which contain fans, use a 24-inch (610-mm) looped section of flexible metallic conduit.

D. Data systems:

1. Provide data systems, including outlets, cabling, and required infrastructure, to support the manufacturers' requirements.

E. Make each run of cable or conductor connecting two points with a single continuous piece of cable or conductor. Do not splice. Cable or conductor may be extended by use of suitable connectors if approved by the Architect.

F. Shielding:

1. All input, output, and communications wire is to be shielded except when specifically disallowed by the controller or end device manufacturer.
2. All shields on controller input and output wiring shall be terminated except when specifically disallowed by the controller or end device manufacturer. The shield must be terminated at the controller end only.
3. RS-485 communication shield wiring shall be continuous from one end of the trunk to the other and must only be terminated at the 'originating' router.
4. The shields (foil and drain wire) from individual wire segments at a controller must be twisted, and the free end of the shield taped back (using electrical tape) to one of the communication wires. A portion of the shield must be exposed to allow a technician to verify the continuity of the shield.

G. When connecting to electrical wiring of equipment provided with pilot lights, connect to circuit so that pilot light is energized only when equipment is energized.

H. When connecting to electric wiring of fans with Hand/Off/Automatic (HOA) switches and isolation dampers, connect to circuit so that isolation dampers open in both Hand and Automatic positions.

I. Securely attach disconnect switches and starters to the wall with anchors.

END OF SECTION 23 09 02

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 23 09 07 - CONTROL DAMPERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Control dampers.

B. Damper operators.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION;

A. Dampers: See Section 23 31 13 for installation requirements.

1.3 RELATED SECTIONS

A. Damper position switches: Section 23 09 13.

B. Smoke detectors: Section 28 31 00.

C. Ductwork: Section 23 31 13.

D. Fire dampers, motorized fire dampers, and smoke dampers: Section 23 33 00.

E. Control sequences: Shown on drawings.

1.4 SUBMITTALS

A. Product data: For each type of product, include a description, characteristics, materials, composition, finishes, test data, ratings, and performance. Include the following:

1. Control dampers.
2. Damper operators.

B. Product schedule: Provide a control damper schedule with the following as a minimum:

1. Associated equipment identifier.
2. Duct and damper size.
3. Torque required per damper.
4. Normal position of each damper. Identify spring fail position of associated operator.
5. Damper type, parallel or opposed blade.
6. Model number of each damper.
7. Operator model number.
8. Quantity of operators per damper.
9. Torque specification of associated actuator.

10. Control signal and characteristics of each operator; two-position vs modulating and operating voltage.

C. Operation and maintenance data: Include operating and maintenance data for the following in the project Operation and Maintenance Manual as specified in Division 01 with supplemental requirements as specified in Section 23 01 01:

1. Control dampers.
2. Damper operators.

PART 2 - PRODUCTS

2.1 CONTROL DAMPERS

A. Supply and return dampers: Dampers for two-position control may be parallel blade type. Dampers for modulating control shall be balanced, multi-louver, opposed-blade type. Modulating dampers used in pairs for mixing applications shall be parallel blade type with blades oriented towards the opposite damper to promote air turbulence and mixing.

1. Blades: Interlocking, minimum 16 gauge galvanized steel. Maximum blade width: 8 inches (205 mm). Maximum blade length: 48 inches (1220 mm) without intermediate bearing and frame stiffener.
2. Frames:

    a. Dampers shall be mounted horizontally in a welded channel angle or flat steel frame filled with solid air-stops which shall prevent air leakage between frame and blades. Provide corner braces on frames that measure more than 24 by 24 inches (610 by 610 mm).
    b. Finish: Two coats of black enamel.

3. Operation: Provide blades with brass pivots in non-stick, corrosion-resistant bearings securely mounted in damper frames. Hardware and operating linkage shall be brass or cadmium plated steel. Linkage shall be adjustable in length; joints shall be pin and clevis or ball and socket, free of excessive play. Dampers shall be capable of being positioned accurately from 100 percent open to 100 percent closed and of maintaining any position indefinitely. Dampers requiring 100 percent closure shall have neoprene gasketed edges.
4. Basis of design: Ruskin Model CD35.

B. Outdoor air (OA), pressure relief (PR), and exhaust air (EA)] dampers: Low-leakage damper, AMCA-rated Class 1 in accordance with AMCA 511, leakage no more than 4 cfm per square foot at 1-inch w.g. when tested in accordance with AMCA 500D.

1. Blades: Interlocking, minimum 0.125- inch (3.2-mm) thick extruded aluminum, airfoil shape, maximum width 6 inches.

    a. Dampers for two-position control: May be parallel-blade type.
    b. Dampers for modulating control: Opposed-blade type.

c. Modulating dampers used in pairs for mixing applications shall be parallel blade type with blades oriented towards the opposite damper to promote air turbulence and mixing.

2. Frames: Minimum 0.125-inch (3.2-mm) thick extruded aluminum, with provisions for mounting.
3. Edge seals: Inflatable, replaceable, double-edge blade seal, mechanically held. Flexible metal frame seal.
4. Operation: Linkage out of airstream, axles 0.5-inch (13-mm) diameter and hexagonal, molded synthetic bearings.
5. Basis of design: Ruskin CD 50.

2.2 DAMPERS OPERATORS

A. Electric damper operators:

1. Electric motor type, suitable for ambient conditions of operation, with internal overload protection.
2. Stroke time: Select to be compatible with equipment and system operation, 30 seconds maximum.
3. Smoke control system actuators shall comply with governing code and NFPA requirements.
4. Power: 50 percent more than the minimum required to operate the associated damper.
5. Failsafe: Internal spring return shall drive damper to a failsafe position on loss of power unless indicated otherwise, generally outside air and exhaust air dampers shall close and return air dampers shall open, dampers serving emergency generators and other emergency equipment shall have a failsafe position to allow the equipment to operate.
6. Field adjustment: Actuators shall be field selectable to fail open or fail closed without actuator replacement, actuators shall be adjustable to any fixed position within its range when the actuator is not powered.
7. Modulating actuators shall be capable of stopping at all points across full range, and starting in either direction from any point in range.
8. Position feedback:

   a. Where indicated, equip two-position actuators with damper position switches for remote monitoring of position.
   b. Where indicated, equip modulating actuators to provide a position feedback control signal for remote monitoring.

9. Position indication: Provide a position indicator and graduated scale on each actuator indicating open and closed travel limits.
10. NEMA Type 4 or Type 4X operators or enclosures shall be provided for outdoor and unprotected applications.
11. Damper attachment: Unless otherwise required for damper interface, provide actuator designed to be directly coupled to damper shaft without need for connecting linkages.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Furnish dampers to be set in place under Section 23 31 13, Metal Ducts, under the supervision of the control subcontractor.

B. Install operators on control dampers. Operation of particular dampers in conjunction with operation of air-handling equipment is described in control sequences. Provide all necessary accessories to properly connect operators to the dampers.

C. Damper operators to be readily accessible for operation and maintenance, and with ample clearance. Provide access doors for operators in inaccessible locations.

D. Set screws shall be set on a flat space on a round shaft. Provide a double set screw as a lock.

END OF SECTION 23 09 07

SECTION 23 09 13 - INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Control devices and accessories.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Thermowells: See Section 22 11 16 for installation requirements.

1.3 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Duct-mounted smoke detectors: See Division 28 for product data.

1.4 RELATED SECTIONS

A. Domestic water piping: Division 22.

B. Cutting and patching: Section 23 01 01.

C. UL label, demonstration, training, and equipment installation: Section 23 05 00.

D. Automatic temperature control system: Sections 23 09 01 through 23 09 23.

1.5 REFERENCES

A. NSF 61: Drinking Water System Components – Health Effects

B. UL 508: Standard for Industrial Control Equipment

1.6 SUBMITTALS

A. Product data: For each type of product, include a description, characteristics, materials, composition, finishes, and performance.

B. Operation and maintenance data: Include operating and maintenance data for each control device in the project Operation and Maintenance Manual as specified in Division 01 with supplemental requirements as specified in Section 23 01 01.

1.7 MAINTENANCE

A. Provide two sets of manufacturer's special tools for operating tamperproof fasteners, marked to identify their use. Deliver to the Owner's storage area as directed and obtain a signed transmittal.

B. Provide all keys to enclosures, thermostat guards and equipment marked to identify their use. Deliver to the Owner's storage area as directed and obtain a signed transmittal.

PART 2 - PRODUCTS

2.1 CONTROL DEVICES, GENERAL

A. Instruments with temperature or pressure set points shall be provided with a means of adjustment over a reasonable range.

B. Adjustable temperature control devices shall be graduated and calibrated in degrees F. Markings such as WARMER and COOLER are not acceptable unless specifically required on the drawings.

C. Devices mounted outdoors shall be weathertight construction or mounted in weathertight enclosure or inside weathertight units.

2.2 TEMPERATURE DEVICES

A. Freezestat:

1. Sensing element: Liquid filled flexible capillary with a minimum length of 20 feet (6 meters). Responding to lowest temperature in any 1-foot (30 mm) portion of the sensing element.
2. Two-position single pole double throw contacts with manual reset.
3. Manual set point adjustment with a temperature set point range of 15F to 55F (-9C to 13C), with stop limit minimum to 34F (2C), manually adjustable with screwdriver.
4. Basis of design: Honeywell.

B. Room temperature sensor:

1. Temperature sensing element mounted under a bright white, non-yellowing, plastic cover.
2. Provide mounting plate compatible with the mounting surface shape and electrical box used.
3. Concealed wiring connection.
4. Provide with the following:

a. Manual set point adjustment: Manual set point adjustment shall allow for modification of the temperature by the occupant. Set point adjustment may be locked out, overridden or limited as to time or temperature through software by an authorized operator.

b. Temperature indicator: Temperature indicator shall be a digital readout and shall be visible without removing the sensor cover.
c. Override switch: Override switch shall initiate override of the unoccupied mode to occupied mode when activated by the occupant. The override function may be locked out, overridden or limited as to the time through software by an authorized operator.

5. Provide room temperature sensors coordinated with the requirements of associated controllers. The sensor may be either RTD or thermistor type with transmitter providing the following minimum performance requirements are met:

a. Accuracy: ± 0.5 degree F (0.3 degrees C)
b. Operating range: 35 to 115 degrees F (2 to 46 degrees C)
c. Set point adjustment range: 55 to 95 degrees F (2 to 30 degrees C)
d. Calibration adjustments: None required.
e. Installation: Up to 100 feet from controller.
f. Set point modes: Independent Heating, Cooling, Night Setback-Heating, Night Setback-Cooling.

C. Outside air temperature sensor:

1. Nickel RTD temperature sensor with transmitter, sensing air temperature, with single-point sensing element in rigid a protective sheath.
2. Temperature range: -40 to 140 degrees F (-40 to 60 degrees C).
3. Accuracy: ± 0.5 degrees F (0.3 degrees C).
4. Enclosure: NEMA 3R or NEMA 4X.
5. Basis of design: ACI.

D. Air system insertion temperature sensor:

1. Nickel RTD temperature sensor with transmitter, sensing air temperature, with single-point sensing element in rigid stainless steel sheath within air stream.
2. Temperature range: -40 to 250 degrees F (-40 to 121 degrees C).
3. Accuracy: ± 0.5 degrees F (0.3 degrees C) at 70 degrees F (21.1 degrees C).
4. Provide insertion length to achieve sensing at middle of air path, up to 18 inches (457 mm).
5. Enclosure: Junction box, with gasket for attachment to duct or equipment, with removable cover; NEMA Type 1 for indoor applications and Type 4 for outdoor applications.
6. Basis of design: ACI Duct Series.

E. Air system averaging temperature sensor:

1. Nickel RTD temperature sensor with transmitter, sensing air temperature, with flexible copper sensing element in air stream and mounting clips.
2. Temperature range: -40 to 240 degrees F (-40 to 115 degrees C).
3. Accuracy: ± 0.075% of reading.
4. Enclosure: Junction box, with gasket for attachment to duct or equipment, with removable cover; NEMA Type 1 for indoor applications and Type 4 for outdoor applications.
5. Basis of design: Minco.

F. Immersion hydronic temperature sensor:

1. Nickel RTD temperature sensor with transmitter, sensing fluid temperature, with single-point sensing element in rigid stainless steel sheath within a pipe-mounted thermowell.
2. Accuracy: ± 0.75 degree F (0.45 degrees C) within a range from 0 to 250 degrees F (-18 to 121 degrees C).
3. Provide insertion length sufficient to sense at middle of pipe, up to 6 inches (150 mm).
4. Basis of design: Siemens Immersion Well Temperature Sensors.

2.3 PRESSURE DEVICES

A. Air static pressure sensors:

1. Duct static pressure sensor/transmitter: Glass-on-silicon capacitance type with integral sensing tip, and temperature compensation.

a. Range: Field selectable for any of the following:

(1) 0 to 1.25 inches w.g.
(2) 0 to 2.5 inches w.g.
(3) 0 to 5 inches w.g.

b. Output: 4-20 mA, 0 to 5-V DC, or 0 to 10-V DC
c. Accuracy: ± 1%.
d. Enclosure: NEMA 4.
e. Basis of design: MAMAC.

B. Filter differential pressure devices:

1. Filter differential pressure sensor/transmitter with digital gauge and switch (interior applications): Differential pressure controller and gauge with integrated single-pole, double-throw control relay switches; pipe connections for extended pressure sensing elements; programmable set point adjustment via keypad; and digital LCD display. Relay contacts shall be used for an alarm input to the building automation system. Low-voltage analogue signal output for differential pressure measurement by the building automation system. Output contacts rated for 1 amp at 30-V DC.

a. Range: Select a range approximately 2 times device set point, suitable for application with pressure limit beyond expected fluid pressure during operation. Able to withstand surge pressures possible to be produced by system fans.
b. Output: 4-20 mA.
c. Accuracy:

(1) ± 1.5% for gauges with a range up to 0.25 inches w.g.
(2) ± 0.5% for gauges with a range up to 5 inches w.g.

d. Operating conditions: 32 to 140 degrees F (0 to 60 degrees C).
e. Basis of design: Dwyer.

C. Air pressure high-limit or low-limit pressure switch: Duct-mounted or unit-mounted, fast acting diaphragm type manual reset switches with pipe connections for extended pressure sensing elements, and screw type set point adjustment. Two switches shall each be single pole, double throw. One set of contacts shall be used for control function. The second set of contacts shall be used for an alarm input to the building automation system. Rated for 4 amps at 120-V to 250-V AC. Provide NEMA 250 Type 1 enclosure for dry indoor installations and NEMA 250 Type 4 enclosure for wet and outdoor installations.

1. Repeatability: ± 4%.
2. Range: Select the range to be approximately 2 times device set point, suitable for application with high limit or low limit beyond expected fluid pressure during operation. Able to withstand surge pressures possible to be produced by system fans.
3. Operating conditions: -30 to 180 degrees F (-34 to 82 degrees C).
4. Basis of design: Dwyer.

2.4 HUMIDITY AND ENTHALPY DEVICES

A. Duct-mounted humidity and temperature sensor/transmitter: Factory calibrated, configurable humidity parameters including relative humidity, dew point, enthalpy, and wet bulb temperature.

1. Accuracy:

   a. Relative humidity: ± 1.5% between 0 and 90% RH.
   b. Temperature: ± 0.2 degrees F (0.1 degrees C) at 68 degrees F (20 degrees C).

2. Range: 0 to 100% RH.
3. Outputs: 4-20 mA or 0 to 10-V DC for relative humidity and temperature.
4. Metal housing, IPP66 or NEMA 4, integral sensor probe, for mounting to duct or casing.
5. Basis of design: Vaisala.

B. Outside air humidity and temperature sensor/transmitter:

1. Accuracy:

   a. Relative humidity: ± 3% between 0 and 90% RH.
   b. Temperature: ± 0.4 degrees F (0.2 degrees C).

2. Humidity Range: 0 to 100% RH.
3. Temperature Range: -40 to 140 degrees F (-40 to 60 degrees C)
4. Outputs: 4-20 mA for relative humidity and temperature.
5. Enclosure: IP65.
6. Basis of design: Vaisala.

2.5 FLOW MEASUREMENT DEVICES

A. Thermal dispersion duct and plenum airflow measuring station:

1. Sensors:

    a. Mounting brackets: Constructed of aluminum or stainless steel and shall hold one or more sensor probes as required to achieve specified accuracy.
    b. Sensor probes: Constructed of anodized aluminum alloy tubes and holding one or more sensor nodes as required to achieve specified accuracy.
    c. Sensor nodes: Provided with two bead-in-glass, hermetically sealed thermistors potted in a marine grade waterproof epoxy.
    d. Wiring: Sensor probes shall be individually wired to the transmitter with wiring protected from the elements and suitable for direct exposure to water, UV exposure, and exposure to temperatures ranging from -20° F to 160° F (-28.9° C to 71° C).

2. Transmitter:

    a. Microprocessor-based.
    b. Automatic zeroing.
    c. Adjustable for altitudes other than sea level.
    d. Capable of determining airflow rate and temperature average of all connected sensor nodes in an array.
    e. Capable of providing a high and/or low airflow alarm.
    f. Capable of identifying a sensor node and ignoring any node in a fault condition.
    g. Display: LCD, alpha-numeric 16 character, displaying airflow rate and alarm status.
    h. Output: Two field selectable (0 to 10-V DC or 4-20 mA) analog output signals (one for airflow and one for temperature or alarm) and one Ethernet BACnet connection. Network communications shall provide: the average airflow rate, temperature, Hi-Lo airflow set point alarm, system status alarm, individual sensor node airflow rates and individual sensor node temperatures.
    i. Provide a Bluetooth interface with Android or iOS devices and free Android or iOS software for real-time airflow and temperature monitoring.
    j. The transmitter shall be powered by 24-V AC or 24-V DC.

3. Performance: Airflow monitoring station shall be calibrated to measure the variable airflow from 10% of design airflow to 100% design flow, maintaining an accuracy of ± 3% of reading, between -40 and 158 degrees F (-40 to 70 degrees C). The station shall compensate for outdoor air temperature fluctuations that affect mass flow rate of air.
4. Airflow straightener: Provide for duct-mounted AMS as recommended by the AMS manufacturer. Framed, 1.5-inch-thick aluminum honeycomb, 3/8-inch cells, less than 0.02-inch w.g. air pressure drop at 1,000 fpm, effect equal to adding 4 diameters of straight duct.
5. Basis of design:

    a. Ebtron Gold.
    b. Ruskin.

B. Thermal dispersion fan inlet airflow measuring station:

1. Sensors:

a. Sensor mounting brackets: Constructed of aluminum or stainless steel, and shall hold two or more sensor nodes per fan inlet as required to achieve specified accuracy.
b. Sensor nodes: Provided with two bead-in-glass, hermetically sealed thermistors potted in a marine grade waterproof epoxy.
c. The fan inlet airflow traverse probes shall not significantly impact fan performance or contribute to fan generated noise levels.
d. Wiring: Sensor probes shall be individually wired to the transmitter with wiring protected from the elements and suitable for direct exposure to water, UV exposure, and exposure to temperatures ranging from -20° F to 160° F (-28.9° C to 71° C).

2. Transmitter:

a. Microprocessor-based.
b. Automatic zeroing.
c. Adjustable for altitudes other than sea level.
d. Capable of determining airflow rate and temperature average of connected sensor nodes.
e. Capable of providing a high and/or low airflow alarm.
f. Capable of identifying a sensor node and ignoring any node in a fault condition.
g. Display: LCD, alpha-numeric 16 character, displaying airflow rate and alarm status.
h. Output: Two field selectable (0 to 10-V DC or 4-20 mA) analog output signals (one for airflow and one for temperature or alarm) and one Ethernet BACnet connection. Network communications shall provide: the average airflow rate, temperature, Hi-Lo airflow set point alarm, system status alarm, individual sensor node airflow rates and individual sensor node temperatures.
i. Provide a Bluetooth interface with Android or iOS devices and free Android or iOS software for real-time airflow and temperature monitoring.
j. The transmitter shall be powered by 24-V AC or 24-V DC.

3. Performance: Airflow monitoring station shall be calibrated to measure the variable airflow from 10% of design airflow to 100% design flow, maintaining an accuracy of ± 3 to 10% of reading, between -20 and 120 degrees F (-29 to 49 degrees C). The station shall compensate for outdoor air temperature fluctuations that affect mass flow rate of air.
4. Basis of design:

a. Ebtron.
b. Ruskin.

C. Pitot tube fan inlet airflow measuring station:

1. Sensors:

a. Mounting brackets: Constructed of aluminum or stainless steel, and intended for use in fan inlets.
b. Sensors: Pitot tube type, of configuration to achieve required performance.
c. The fan inlet airflow traverse probes shall not significantly impact fan performance or contribute to fan generated noise levels.

2. Transmitter:

    a. Microprocessor-based.
    b. Automatic zeroing.
    c. Display: LCD, alpha-numeric displaying airflow rate.
    d. Output: Field selectable (0 to 10-V DC or 4-20 mA) analog output.
    e. The transmitter shall be powered by 24-V AC or 24-V DC.

3. Performance: Airflow monitoring station shall be calibrated to measure the variable airflow from 15% of design airflow to 100% design flow, maintaining an accuracy of ± 3% of reading.
4. Basis of design: Air Monitor Corporation.

D. Differential pressure transmitter for fan-manufacturer-provided pitot tube airflow measuring stations

1. General:

    a. Microprocessor-based.
    b. Transmitter and gauge with integrated single-pole, double-throw control relay switches.
    c. Pipe connections for remote pressure sensing element.
    d. Programmable via keypad; and digital LCD display.
    e. Programmable for pressure, velocity, or airflow measurement.
    f. Relay contacts shall be used for status input to the building automation system.
    g. Low-voltage analogue output shall be used for differential pressure, velocity, or airflow measurement by the building automation system.
    h. Output contacts rated for 1 amp at 30-V DC
    i. Output: 4-20 mA analog output.

2. Accuracy: ± 0.5% up to 100 inches w.g. (24.8 kPa)
3. Range: Select a range approximately 50% above anticipated pressure reading, suitable for application with pressure beyond expected fluid pressure during operation, and able to withstand surge pressures possible to be produced by fans.
4. Operating conditions: 32 to 140 degrees F (0 to 60 degrees C).
5. Basis of design: Dwyer.

2.6 DAMPER POSITION SWITCHES

A. Damper position switch:

1. Mechanical switch mounted to a bracket connected to the damper frame, with linking rod or bar and blade clip to connect the switch to the blade. Device shall contain two SPST or SPDT switches, one to indicate the damper is open, and one to indicate it is closed.
2. Basis of design: Ruskin or TAMCO.

2.7 CURRENT DEVICES

A. Current switch:

1. Switch for motor loads not associated with a variable frequency drive:

a. Split-core or solid core current switch with adjustable trip range.
b. Suitable for use with electronically commutated motors.
c. Provide with LED visual indication of output status.
d. Temperature range: 5 to 140 degrees F (-15 to 60 degrees C).
e. Humidity range 10 to 90% RH
f. Normally open:

(1) Normally open switch closes when current flows to the monitored load is on.
(2) Sensor shall induce power for its operation from the monitored load.
(3) Trip range: A range of 0.5 to 175 amperes is available within the series.

g. Basis of design: Veris Industries Hawkeye.

2. Switch for loads with a variable frequency drive:

a. Split-core or solid core current switch with adjustable microprocessor managed trip range. The normal range or current draw for each frequency band shall be learned by the microprocessor from motor operation and stored in non-volatile memory.
b. Provide with LED visual indication of output status.
c. Temperature range: 5 to 140 degrees F (-15 to 60 degrees C).
d. Humidity range 10 to 90% RH
e. Normally open:

(1) Normally open switch closes when current flows to the monitored load is on.
(2) Sensor shall induce power for its operation from the monitored load.
(3) Trip range: 0.5 to 175 amperes.

f. Basis of design: Veris Industries Hawkeye.

B. Current sensing transducer:

1. Split-core current sensing transducer.
2. Transducer produces a 4-20 mA signal in proportion to current draw of the monitored load.
3. Suitable for use with electronically commutated motors.
4. Sensor shall induce power for its operation from the monitored load.
5. Accuracy ±2% of full scale from 10% to 100% of selected range.
6. Response time: 2 seconds.
7. Temperature range: 5 to 140 degrees F (-15 to 60 degrees C).
8. Humidity range 10 to 90% RH.
9. Basis of design: Veris Industries Hawkeye.

2.8 WATER DETECTION DEVICES

A. Condensate overflow switches: Switch manufactured to detect condensate overflow in compliance with the requirements of International Mechanical Code and UL 508 to prevent condensate overflow. Device shall contain a float switch and wiring for connection to controls.

1. Drain pan auxiliary connection switch: Float switch designed for direct connection to drain pan secondary connection with removable cap for cleaning and switch inspection.
2. Secondary drain pan float switch: Float switch with clamp for connection to lip of secondary drain pan.
3. Basis of design: Rectorseal.

2.9 EMERGENCY FAN DISCONNECT SWITCH DEVICES

A. Emergency fan disconnect switch (keyed switch with “Knox Box”):

1. Switch: Single pole, operated by a keyed lock with stainless-steel device plate. Operation of the switch shall de-energize air-handling units where indicated in sequences of operation. Provide a recessed junction box for the switch in finished locations.
2. Keys: Provide two keys; one to be located in the Owner’s “Knox Box” installed near the main entry doors, and one extra. Provide each key with a permanently fastened metal or plastic tag as specified for identification in Section 23 05 00, engraved “Emergency Fan Disconnect Switch.”
3. Nameplate: White letters on black background with the following text “AHU EMERGENCY DISCONNECT SWITCH.”
4. Provide independent output contacts for fire alarm system monitoring.
5. Basis of design: The Knox Company.

2.10 ACCESSORIES AND AUXILIARY CONTROLS

A. Thermowell: Furnish thermowells of stainless- steel materials for sensors installed in pipes. Provide heat transfer compounds compatible with the sensor and thermowell. Compression type fittings between sensors and thermowells are not acceptable.

B. Nameplate: Plastic, as specified in Section 23 05 00, Common Work Results for HVAC, minimum size 0.75 inch by 2.5 inches, minimum letter size 0.1875 inch, identifying equipment and use.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Provide wiring between control devices, equipment, and controllers as required by sequences of operation and as scheduled on Control Point Schedules.

B. Configure control devices to accomplish sequences of operation.

C. Calibrate control devices.

D. Coordinate with the Owner to establish set points for control devices.

E. Provide accessories and auxiliary controls, including but not limited to relays, switches, and pushbuttons required for the successful operation of this system. Identify each switch and pushbutton with a nameplate.

F. Provide control devices in accessible locations. Provide access doors for devices installed behind non-removal ceilings, walls, ducts or equipment. Document locations of remote devices on record drawings.

G. Provide mounting brackets where devices are mounted on insulated ducts or equipment to permit continuous required insulation thickness.

H. Provide insulated base plates for devices mounted on exterior walls.

I. Provide wall-mounted devices with mounting plates or junction boxes securely attached to the wall. Provide recessed junction boxes in finished spaces. Provide surface-mounted junction boxes in unfinished spaces. Securely anchor wall-mounted devices with tamperproof screws.

J. Mounting height from floor to top of control for wall-mounted devices with human interface in public areas shall be 48 inches (1220 mm), as required for accessibility to persons using wheelchairs.

K. Provide guards for wall-mounted devices where noted and where devices are subject to damage. Mount guard, or guard base, to wall with at least four tamperproof screws, entirely independent of device and its wall plate, cover, and electrical box.

L. Provide solar shields to protect control devices sensing outdoor air conditions from direct and reflected solar radiation. Control devices may be located behind OA intake louvers but ahead of any control dampers.

M. Provide components and connective piping and tubing with pressure and temperature ratings that meet or exceed the service pressure and temperature of the associated system.

3.2 INSTALLING TEMPERATURE DEVICES

A. Freezestat:

1. Provide a removable galvanized frame with 1-inch square mesh wire and attach freeze stat capillary tubing to mesh.
2. Where capillary tubing passes through duct or unit casing, provide split flange fitting to seal hole and protect the capillary tubing in the duct or casing.

3. Provide more than one freezestat where the size of the duct or unit casing requires more than one to achieve adequate coverage and provide wiring to produce the required safety and alarm functionality. Provide coverage not be less than 1 linear foot of capillary tube per 1 square foot of coil surface.
4. Mount freezestat head or control unit in an accessible location that is temperature conditioned above 40 degrees.
5. Use one switch terminal of freezestat to accomplish safety functions required in the control sequence.
6. Use the second switch terminal of the freezestat to communicate an alarm to the building automation system.
7. Manually adjust the set point of the freezestat.

B. Room temperature sensor:

1. Provide manual override on temperature sensors as noted in sequence of operation.
2. Coordinate the location of all room temperature sensors with light switches and architectural cabinetry/furniture.
3. Provide setpoint capability appropriate for the use.

C. Outside air temperature sensor:

1. Provide in a location that is accessible and safe from damage, and where measurement is not influenced by adjacent equipment or exhaust air streams.
2. Locate on a north facing vertical surface where possible.
3. Provide a radiation shield.
4. Provide transmitter in an accessible location.

D. Air system insertion temperature sensor:

1. Provide insertion sensors to measure air temperatures in ducts or equipment in applications where air condition is uniform such as return air applications and unit supply air and coil discharge locations downstream of supply fans.
2. Provide with the sensors in ducts and air-handling unit casings with sensitive portion of the element installed as close as possible to the center of a duct cross section and located to sense near average temperature. Do not exceed 24 inches (610 mm) in sensor length.
3. Provide return-air sensor in location that senses return-air temperature without influence from outdoor or mixed air.
4. Rigidly support sensor from the duct or air-handling unit casing and seal penetration airtight.
5. Provide transmitter in an accessible location.

E. Air system averaging temperature sensor:

1. Provide averaging sensors to measure air temperatures in ducts or equipment in applications where air condition is not uniform and may be stratified such as mixed air and coil discharge applications that condition mixed air prior to it being fully mixed via a supply fan.
2. Provide transmitter in an accessible location. Rigidly support the transmitter from the duct or air-handling unit casing and seal penetration airtight.

3. Provide a removable galvanized frame with 1-inch square mesh wire and attach averaging element to mesh.
4. Where averaging element passes through duct or unit casing, provide split flange fitting to seal hole and protect the capillary tubing in the duct or casing.
5. Provide more than one sensor where the size of the duct or unit casing requires more than one to achieve adequate coverage and provide wiring to produce the required sensing functionality from the group of sensors.

F. Immersion hydronic temperature sensor:

1. Provide sensors in thermowells. See Section 23 21 13 for installation requirements.

3.3 INSTALLING PRESSURE DEVICES

A. Air static pressure sensors:

1. Duct static pressure sensors/transmitter:

a. Rigidly support duct mounted sensors from the duct and seal penetration airtight.
b. Provide transmitter in an accessible location.
c. Provide mounting brackets where required to permit continuous insulation.

B. Filter differential pressure device

1. Provide air-pressure sensors for each switch or sensor/transmitter connection. Provide sensors in an accessible location for inspection and replacement.
2. Provide tubing from sensors to switch or sensor/transmitter connections.
3. Adjust switch or relay set point to a pressure corresponding to end of filter life and within the pressure limits of the filter and holding frame being protected. Refer to submittal data for anticipated final filter pressure drop and confirm set point with Owner’s desired maintenance schedule. Refer to filter manufacturer’s literature for filter pressure ratings.
4. Provide differential pressure switch for exterior applications.
5. Provide differential pressure sensor/transmitter with digital gauge for interior applications.

C. Air pressure high-limit or low-limit pressure switch:

1. Provide low-limit suction or high-limit discharge switches where required by sequences of operation.
2. Provide air-pressure sensors for each switch connection. Provide sensors in an accessible location for inspection and replacement.
3. Provide tubing from sensors to switch connections.
4. Adjust switch set point to a pressure beyond normal unit operation, but within the pressure limits of the unit and/or ductwork being protected. Refer to duct construction schedule for duct pressure limits. Refer to manufacturer’s literature for unit pressure ratings.

3.4 INSTALLING HUMIDITY AND ENTHALPY DEVICES

A. Duct-mounted humidity and temperature sensor/transmitter:

1. Rigidly support duct mounted sensors from the duct and seal penetration airtight.
2. Provide transmitter in an accessible location.
3. Provide mounting brackets where required to permit continuous insulation.

B. Outside air relative humidity and temperature sensor/transmitter:

1. Provide in a location that is accessible and safe from damage, and where measurement is not influenced by adjacent equipment or exhaust air streams.
2. Locate on a north facing vertical surface where possible.
3. Provide a radiation shield.
4. Provide transmitter in an accessible location.

3.5 INSTALLING FLOW SWITCHES

A. Air flow switch:

1. Provide switch in horizontal air path.
2. Follow manufacturer's recommendations for installation distance from fans and elbows where turbulent conditions could be present.
3. Trim switch if required for ducts with limited height.
4. Mount on top of duct and seal.

3.6 INSTALLING FLOW MEASUREMENT DEVICES

A. Airflow measuring stations and devices:

1. Provide according to the manufacturer's recommendations.
2. Field calibrate vs. balancing information to maximize accuracy.

3.7 INSTALLING DAMPER POSITION SWITCHES

A. Damper position switch: Connect to damper frame and damper blade per the manufacturer's recommendations. Integrate with hard-wired safety circuits and building automation system as indicated in control sequences. Position switch installation on a damper shaft is not acceptable.

3.8 INSTALLING CURRENT DEVICES

A. Current switch:

1. Provide current switches where indicated to monitor the status of loads and determine if they are on when commanded on.

2. Calibrate device trip settings for loads that are not affiliated with variable frequency drives during testing and balancing so device is able to sense belt of shaft breakage.
3. Provide separate current transformer and associated wiring for loads with current greater than device rating.
4. Loop wiring through device for loads with current less than device rating.
5. Electronically commutated motors: Calibrate device trip settings by determining passive current draw when motor is connected to power source but shaft is not rotating, and adjusting the trip setting to be higher than the passive current. Loop wires to increase the measured current if the passive current is below the device trip setting.

B. Current sensing transducer:

1. Provide current sensing transducers where indicated to monitor the current draw of loads.
2. Field select device range to best match equipment that will be monitored.
3. Calibrate and scale signal output so BAS displays the load for the user in kW or HP.
4. Provide separate current transformer and associated wiring for loads with current greater than device rating.
5. Loop wiring through device for loads with current less than device rating.
6. Field-determine appropriate range of current draw during normal operation and configure an alarm in the building automation system when operation is outside of the range.
7. Field calibrate each current sensing relay using a NIST certified electrical amperage meter.

3.9 INSTALLING WATER DETECTION DEVICES

A. Condensate overflow switch: Provide where scheduled or where shown in sequences of operation. Connect to equipment controls to stop condensate production when the switch is activated.

3.10 INSTALLING EMERGENCY FAN DISCONNECT SWITCH

A. Emergency fan disconnect switch: Provide switch and accessories where indicated on drawings, and where required by sequences of operation, in locations approved by the Authority Having Jurisdiction. Connect switch to building automation system. Provide controls to shut down associated air-handling systems as indicated in sequences of operation.

3.11 INSTALLING ACCESSORIES AND AUXILIARY CONTROLS

A. Thermowell: Furnish for each immersion temperature sensor. See Section 22 11 16 for installation requirements.

B. Nameplate: Provide as specified in Section 23 05 00, Common Work Results for HVAC, where required to identify special-purpose instruments or where the function of the item is not obvious, such as timers and switches. Nameplates shall be mounted with vandal-proof screws on the wall immediately below the item.

3.12 DEMONSTRATION AND TRAINING

A. Provide demonstration and training as specified in Section 23 05 00.

B. Instruct Owner's personnel in use of calibration kit to perform annual calibration of carbon dioxide sensors.

END OF SECTION 23 09 13

SECTION 23 09 23 - DIRECT DIGITAL BUILDING SYSTEMS CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Direct digital building control (DDC) system.

B. Network communications.

C. DDC panels.

D. System software.

E. Application-specific controllers.

F. Operator I/O devices.

1.2 RELATED SECTIONS

A. Coordination, installer qualifications, and acceptable manufacturers: Section 23 09 01.

B. Automatic temperature control system: Sections 23 09 01 through 23 09 23.

C. Control sequences: Shown on drawings.

1.3 SUBMITTALS

A. Product data:

1. Hardware: For each type of product, include a description, characteristics, materials, composition, finishes, and performance. Include the following:

   a. DDC panels.
   b. Application-specific controllers.
   c. Operator I/O devices.

2. Software: For each type of software, include a description, characteristics, and performance. Include the following:

   a. System software.
   b. Operator workstation software.

B. Shop drawings:

1. Wiring diagrams. Differentiate between factory-installed and field-installed wiring.

C. Installer qualifications: Submit as required in Section 23 0901, Automatic Temperature Control System. Include, in addition to other requirements, the location of the support facility from which warranty and service will be provided, and a list of the names, titles, and training of the individuals who will be responsible for the work of this project.

D. Certifications:

1. Data sheet or copy of government approval form showing that the system complies with FCC Regulations, Part 15, Section 15.
2. Results of functional and diagnostic field tests and calibrations, specified in Part 3. Submit copies of the installing technician's checklist showing that the system has been completely set up and is ready to operate.
3. Submit Compliance Inspection Checklist, initialed and dated, showing satisfactory completion of the installation tests specified in Part 3.

E. Operation and maintenance data: Include operating and maintenance data for the following in the project Operation and Maintenance Manual as specified in Division 01 with supplemental requirements as specified in Section 23 01 01:

1. As-built versions of submittal Product Data.
2. As-built versions of submittal Shop Drawings.
3. Names, addresses, email addresses, and 24-hour telephone numbers of Installer and service representatives for DDC system and products.
4. Operator's manual with procedures for operating control systems including logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing set points and variables.
5. Backup copy of graphic files, programs, and databases on electronic media.
6. List of recommended spare parts with part numbers and suppliers.
7. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
8. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation software, and graphics software.
9. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.
10. Owner training materials.

1.4 WARRANTY AND SERVICE

A. General requirements: Provide all services, materials and equipment necessary for the successful operation and maintenance of the entire DDC system for the period of the general project correction period required by General Conditions, Division 01, and Section 23 01 01. Provide parts, software, and labor required for the work. Schedule maintenance and adjustments to minimize effects on facility operations.

B. The adjustment and repair of the system includes computer equipment, software updates, transmission equipment, and sensors and control devices. Provide the manufacturer's required adjustments and other work necessary to maintain system operation.

C. Personnel: Provide qualified personnel to accomplish work promptly and satisfactorily. Notify Owner in writing of the name of the designated service representative, and of changes in personnel.

D. Schedule of work: Schedule major inspections in June and December and minor inspections in March and September. Minor inspections shall include visual checks and operational tests of each item of equipment. Major inspections shall include all work described for minor inspections and the following work:

1. Clean equipment, including interior and exterior surfaces.
2. Perform signal, voltage, and system isolation checks of system workstations and peripherals.
3. Check and calibrate each field device. Check all analog points and digital points.
4. Run diagnostics and correct diagnosed problems.
5. Resolve and correct other observable problems.

E. Emergency service: Qualified personnel shall be available to provide service to the complete system. Furnish owner with a telephone number where service representative can be reached at all times. Service personnel shall be at the site within 8 hours after receiving a request for service, and shall restore the control system to proper operating condition within 24 hours.

F. Operation: Performance of scheduled adjustments and repair shall verify operation of the system as demonstrated by the initial performance test.

G. System modifications: Make recommendations for system modification in writing to Owner. Do not make any system modifications, including operating parameters and control settings, without prior written approval of Owner. Modifications to the system shall be incorporated into the operations and maintenance manuals and other documentation.

H. Software: During the project correction period, provide all software updates and verify operation in the system in a timely manner. Instruct the system operators, and incorporate updates into the operations and maintenance manuals and software documentation. At the end of the correction period, continue to notify Owner of software revisions.

PART 2 - PRODUCTS

2.1 GENERAL PRODUCT DESCRIPTION

A. The DDC system shall integrate multiple building functions including equipment supervision and control, alarm management, energy management, and historical data collection.

B. The building control system shall include the following:

1. Network DDC panels
2. Network application-specific controllers (ASCs)
3. Portable operator’s terminals
4. Personal computer operator workstation(s)

C. The system shall be modular and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, DDC panels, application-specific controllers, and operator devices.

D. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. Each DDC panel shall operate independently by performing its own specified control, alarm management, operator I/O, and data collection. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

E. Without depending on a control processing device, DDC panels shall be able to:

1. Access any data from or send control commands and alarm reports directly to any other DDC panels or combination of panels on the network.
2. Send alarm reports to multiple operator workstations.

2.2 NETWORKING COMMUNICATIONS

A. The DDC system shall network operator workstations.

1. A high performance peer-to-peer network.
2. An application-specific local area network (LAN).

B. Peer-to-peer network level:

1. Operator workstations and DDC panels shall directly reside on a network such that communications shall be executed directly between DDC panels, directly between workstations, and between DDC panels and workstations on a peer-to-peer basis.
2. Inherent in the system's design shall be the ability to expand or modify the network either via a LAN, or auto-dial telephone line modem connections, or via a combination of the two networking schemes.
3. All operator devices, either network-resident or connected via modems, shall have the ability to access all point status and application report data or execute control functions for any and all other devices via the peer-to-peer network. Access to data shall be based on logical identification of building equipment. No hardware or software limits shall be imposed on the number of devices with global access to the network data.
4. Network design shall include the following provisions:

a. Provide high-speed data transfer rates for alarm reporting, quick report generation from multiple controllers and upload/download efficiency between network devices. An alarm occurring at any DDC panel shall display at one or more workstations or alarm printers within 5 seconds.
b. Support of any combination of DDC panels and operator workstations directly connected to the peer-to-peer network. The network shall support a minimum of 32 devices.
c. Message and alarm buffering to prevent information from being lost.
d. Error detection, correction, and retransmission to guarantee data integrity.

e. Synchronization of real-time clocks, to include automatic daylight savings time updating among all DDC panels.
f. Commonly available, multiple source, networking components and protocols shall be used to allow the DDC system to coexist with other networking applications such as office automation. ETHERNET and ARCNET are acceptable technologies.
g. Use of an industry standard IEEE 802.x protocol. Communications must be of a deterministic nature to assure calculable performance under worst-case network loading.

C. Application-specific local area network (LAN):

1. This level communication shall support a family of application-specific controllers and shall communicate bidirectionally with the peer-to-peer network through DDC panels for transmission of global data.
2. Application-specific controllers shall be arranged on the LANs in a functional relationship with DDC panels. For example, a VAV terminal unit controller shall be on a LAN from the DDC panel that is controlling its corresponding AHU.
3. A maximum of 32 application-specific controllers may be configured on each LAN.

D. Communication capability:

1. Automatic communications shall allow DDC panels to communicate with remote operator stations and remote terminals, as indicated in the sequence of operations.
2. DDC panels shall automatically communicate with workstations to report alarms or other significant events.
3. Operators at the workstation shall be able to perform all control functions, all report functions, and all database generation and modification functions as described for workstations connected via the network. Routines shall automatically answer communications from remote DDC panels. The fact that communications are taking place with remote DDC panels shall be invisible to an operator.
4. Communications shall use standard web browser via local area network.

2.3 DDC PANEL

A. Microprocessor-based panels with a minimum word size of 16 bits: Multi-tasking, multi-user, real-time digital control processors consisting of modular hardware with plug-in enclosed processors, communication controllers, power supplies and input/output point modules. Each DDC panel shall be capable of operating as a stand-alone controller, performing its specified control functions independently of other controllers in the network. Controller size shall be sufficient to fully meet the requirements of this specification and the point list on the drawings.

B. Each DDC controller shall have sufficient memory, a minimum of 1 megabyte, to support its own operating system and databases, including:

1. Control processes
2. Energy management applications
3. Alarm management applications
4. Historical and trend data for points specified

5. Maintenance support applications
6. Custom processes
7. Operator I/O
8. Communications
9. Manual override monitoring

C. Each DDC panel shall support:

1. Monitoring of the following types of inputs, without the addition of equipment outside the DDC panel:

a. Analog inputs

(1) 4-20 mA
(2) 0-10 Vdc
(3) Thermistors
(4) 1000-ohm RTDs

b. Digital inputs

(1) Dry contact closure
(2) Pulse accumulator
(3) Voltage sensing

2. Direct control of electronic actuators and control devices. Each DDC panel shall be capable of providing the following control outputs without the addition of equipment outside the DDC panel:

a. Digital outputs

(1) Contact closure (motor starters, sizes 1-4)

b. Analog outputs

(1) 0-20 psi
(2) 4-20 mA
(3) 0-10 Vdc

D. Additional space for future point connections, each DDC panel: Minimum 10 percent.

1. Provide sufficient internal memory for the specified control sequences with at least 25 percent of the total memory available for future use.

E. Each DDC panel shall have at least two RS-232C serial data communication ports for operation of operator I/O devices.

F. Each DDC panel shall have point discrete, on-board, limited access Hand/Off/Auto operator override switches for digital control type points and gradual switches for analog control type points. These override switches shall be operable whether the panel processor is operational or not. DDC panels shall monitor the status of all overrides and remotely report each override control operation.

G. DDC panels shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Graduated intensity LEDs or analog indication of value shall also be provided for each analog output. Status indication shall be visible without opening the panel door.

H. Each DDC panel shall continuously perform self-diagnostics, communication diagnosis, and diagnosis of all panel components, and provide both local and remote annunciation of detected component failures, low battery conditions, or repeated failure to establish communication.

I. Provide isolation at each peer-to-peer network termination and each field point termination, to suppress induced voltage transients, meeting requirements of IEEE C62.41.

J. In the event of the loss of normal power, each DDC panel shall shut down in an orderly process which shall prevent the loss of database or operating system software. Provide nonvolatile memory for critical controller configuration data and battery backup sufficient to support the real-time clock and volatile memory for a minimum of 72 hours.

1. Upon restoration of normal power, the DDC panel shall automatically resume full operation without manual intervention.
2. Should DDC panel memory be lost for any reason, reloading the DDC panel shall be possible via the local RS-232C port, via telephone line dial-in, or from an operator workstation.

K. Provide a DDC panel for each AHU or other HVAC system as indicated on the drawings. It is intended that each unique system be provided with its own point-resident DDC panel.

2.4 SYSTEM SOFTWARE

A. General:

1. Provide all necessary software to form a complete control system as described in this specification.
2. The software programs specified in this section shall be integral in DDC panels and shall not be dependent upon any higher-level computer for execution.

B. Control software:

1. The DDC panels shall have the ability to perform the following pre-tested control algorithms:

a. Two-position control
b. Proportional control

c. Proportional plus integral control
d. Proportional, integral, plus derivative control
e. Control loop tuning

2. Include a provision for limiting the number of times each piece of equipment may be cycled within any one-hour period.
3. Shall protect against excessive demand during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.
4. Upon the resumption of normal power, the control software shall analyze the status of controlled equipment, compare it with normal occupancy scheduling, and turn equipment on or off as necessary to resume normal operations.

C. DDC panels shall be able to perform any or all of the following energy management routines:

1. Time-of-day scheduling
2. Calendar-based scheduling
3. Holiday scheduling
4. Temporary schedule overrides
5. Start-stop time optimization
6. Automatic Daylight Savings Time switchover
7. Night setback control
8. Enthalpy switchover (economizer)
9. Peak demand limiting
10. Temperature-compensated duty cycling
11. Fan speed/CFM control
12. Heating/cooling interlock

a. All programs shall be executed automatically without the need for operator intervention and shall be flexible enough to allow user customization. Programs shall be applied to building equipment as described in the control sequences.

D. DDC panels shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.

1. It shall be possible to use any of the following in a custom process:

a. Any system measured point data or status
b. Any calculated data
c. Any results from other processes
d. User-defined constants
e. Arithmetic functions (+, -, *, /,square root, exp, etc.)
f. Boolean logic operators (and/or, exclusive or, etc.)
g. On-delay/off-delay/one-shot timers

2. Custom processes may be triggered based on any combination of the following:

a. Time interval
b. Time of day
c. Date

d. Other processes
e. Time programming
f. Events (e.g., point alarms)

3. The custom control programming feature shall be documented in English.

E. Alarm management shall monitor and direct alarm information to operator devices. Each DDC panel shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to noncritical alarms, minimize network traffic, and prevent alarms from being lost. At no time shall the DDC panel's ability to report alarms be affected by operation of a PC workstation or local I/O device, or by communications among panels on the network.

1. All alarm or point change reports shall include the point's English language description and the time and date of occurrence.
2. The user shall be able to define the specific system response to alarm at each point. Alarms shall be prioritized. Each DDC panel shall automatically inhibit the reporting of selected alarms during system shutdown and start-up. Users shall have the ability to manually inhibit alarm reporting for each point.
3. Alarm reports and messages shall be directed to a user-defined list of operator devices.
4. In addition to the point's descriptor and the time and date, the user shall be able to print, display, or store an alarm message to more fully describe the alarm condition or direct operator response.
5. Operator-selected alarms shall initiate a call to a remote operator device.

F. A variety of historical data collection utilities shall manually or automatically sample, store, and display system data for points as specified in the I/O summary.

1. DDC panels shall store and report point history data for selected analog and digital inputs and outputs. Methods of collection shall be either by a predefined time interval or upon a predefined change of value.
2. DDC panels shall provide high resolution sampling for verification of control loop performance. Operator-initiated automatic and manual loop tuning algorithms shall be provided for operator-selected PID control loops as identified in the point I/O summary. Provide capability to view or print trend and tuning reports.

G. DDC panels shall automatically accumulate and store run-time hours for digital input and output points as specified in the point I/O summary.

H. DDC panels shall automatically sample, calculate, and store consumption totals on a daily, weekly or monthly basis for user-selected analog and digital pulse input type points as specified in the point I/O summary.

I. DDC panels shall have the ability to count events such as the number of times a pump or fan system is cycled on and off. Event totalization shall be performed on a daily, weekly, or monthly basis for points as specified in the point I/O summary.

2.5 APPLICATION-SPECIFIC CONTROLLERS (ASC)

A. Each DDC panel shall be able to extend its performance and capacity through the use of remote application-specific controllers (ASCs).

B. Each ASC shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor-based, multi-tasking, real-time digital control processor.

C. Terminal equipment controllers:

1. System shall control each piece of equipment through direct connection to a DDC or ASC.
2. Controllers shall include all point inputs and outputs necessary to perform the specified control sequences. As a minimum, 50 percent of the point outputs (except for unit ventilator controllers) shall be of the universal type, either modulating or two-position. Terminal equipment controllers utilizing proprietary control signals and actuators shall not be acceptable. Provide DDC panels or ASCs with industry standard outputs for control of terminal equipment.
3. Each controller shall perform its primary control function independent of other DDC panel LAN communication, or if LAN communication is interrupted. The controller shall receive its real-time data from the DDC panel time clock and shall ensure LAN continuity. Each controller shall include algorithms incorporating proportional, integral, and derivative (PID) gains for all applications. All PID gains and biases shall be field-adjustable by the user via terminals as specified herein.
4. Provide each terminal equipment controller with sufficient memory to accommodate point databases, operating programs, local alarming and local trending. All databases and programs shall be stored in nonvolatile EEPROM, EPROM and PROM, or minimum of 72-hour battery backup shall be provided. The controllers shall be able to return to full normal operation without user intervention after a power failure of unlimited duration. Operating programs shall be field-selectable for specific applications. Specific applications may be modified to meet the user's exact control strategy requirements, allowing for additional system flexibility. Controllers that require factory changes of applications are not acceptable.

2.6 PERSONAL COMPUTER OPERATOR WORKSTATION

A. Provide personal computer operator workstations for command entry, information management, network alarm management, and database management functions. All real-time control functions shall be resident in the DDC panels.

1. Provide workstation(s) of equal capability located at the mechanical room.
2. Workstation shall consist of a flat panel color monitor, personal computer with minimum 3 GB RAM, 160-GB hard drive and controller, mouse, 16 x DVD +/ RW, 56.0 Kb modem, and 101-key enhanced keyboard. Personal computer shall have a minimum 2.5 GHZ Intel Pentium Dual Core processor or equivalent by AMD, 10/100/1000 Network Interface with RJ-45 ethernet port.

3. The display provided for system operation shall have a diagonal screen measurement of no less than 19 inches and a minimum display resolution of no less than 1440 x 900 pixels. Separate controls shall be provided for color, contrasts and brightness. The screen shall be nonreflective.

B. Provide a laser printer with 600 by 600 dpi resolution at each workstation location for recording alarms, operator transactions, and systems reports.

2.7 PORTABLE OPERATOR'S TERMINAL (POT)

A. Provide portable operator terminals with a minimum LCD display of 80 characters by 25 lines and a full-featured keyboard. The POT shall be handheld and plug directly into individual distributed control panels as described below. Provide a user-friendly, English-language-prompted interface, not codes requiring look-up charts.

B. Functions of the POT connected at any DDC controller:

1. Access all DDC panels on the network.
2. Backup and restore DDC controller data bases for all system panels, not just the DDC Controller connected to.
3. Display all point, selected point and alarm point summaries.
4. Display trending and totalization information.
5. Add, modify, or delete any existing or new system point.
6. Command, change setpoint, enable or disable any system point.
7. Program and load custom control sequences as well as standard energy management programs.

C. Functions of the portable operator's terminal connected to any application-specific controller:

1. Provide connection capability at either the ASC or a related room sensor to access controller information.
2. Provide status, setup, and control reports.
3. Modify, select, and store controller data base.
4. Command, change setpoint, enable or disable any controller point.

2.8 OPERATOR WORKSTATION SOFTWARE

A. Basic interface description:

1. Operator workstation interface software shall use English-language prompting, English-language point identification, and industry standard PC application software. The software shall provide, as a minimum, the following functions.

a. Graphical viewing and control of environment.
b. Scheduling and override of building operations.
c. Collection and analysis of historical data.
d. Definition and construction of dynamic color graphic displays.

e. Editing, programming, storage, and downloading of controller databases.

2. Provide a graphical user interface which shall use a mouse or similar pointing device and "point and click" approach to menu selection. Users shall be able to start and stop equipment or change setpoints from graphical displays with the pointing device.

   a. Provide that all operations can also be performed using the keyboard as a backup interface device.

   b. Provide at least 10 special function keys to perform often-used operations.

3. The software shall provide multi-tasking that allows the user to run several applications simultaneously. The mouse shall be used to quickly select and switch between multiple applications. This shall be accomplished through the use of Microsoft Windows or similar industry standard software that supports concurrent viewing and controlling of systems operations.
4. Multiple-level password access protection shall be provided to allow the user manager to limit workstation control, display, and data base manipulation capabilities.
5. Software shall allow the operator to perform commands including, but not limited to, the following:

   a. Start up or shut down selected equipment
   b. Adjust setpoints
   c. Add/modify/delete time programming
   d. Enable/disable process execution
   e. Lock/unlock alarm reporting for points
   f. Enable/disable totalization for points
   g. Enable/disable trending for points
   h. Override PID loop setpoints
   i. Enter temporary override schedules
   j. Define holiday schedules
   k. Change time/date
   l. Automatic daylight savings time adjustments
   m. Enter/modify analog alarm limits
   n. Enter/modify analog warning limits
   o. View limits
   p. Enable/disable demand limiting for each meter
   q. Enable/disable duty cycle for each load

6. Reports shall be generated and directed to either CRT displays, printers, or disk. As a minimum, the system shall allow the user to easily obtain the following types of reports:

   a. A general listing of all points in the network
   b. List of all points currently in alarm
   c. List of all points currently in override status
   d. List of all disabled points
   e. List of all points currently locked out
   f. DDC controller trend overflow warning
   g. List all weekly schedules

h. List of holiday programming
i. List of limits and deadbands

B. Scheduling:

1. Provide a graphical spreadsheet-type format for time-of-day scheduling and overrides of building operations. Provide the following spreadsheet graphic types as a minimum:

   a. Weekly schedules
   b. Zone schedules
   c. Monthly calendars

2. Weekly schedules shall be provided for each building zone or piece of equipment with a specific occupancy schedule. Each schedule shall include columns for each day of the week as well as holiday and special day columns for alternate scheduling on user-defined days. Equipment scheduling shall be accomplished by simply inserting occupied and unoccupied times into appropriate information blocks on the graphic. In addition, temporary overrides and associated times may be inserted into blocks for modified operating schedules. After overrides have been executed, the original schedule will automatically be restored.
3. Provide zone schedule for each building zone. Each schedule shall include all commandable points residing within the zone. Each point may have a unique schedule of operation relative to the zone's occupancy schedule, allowing for sequential starting and control of equipment within the zone. Scheduling and rescheduling of points may be accomplished easily via the zone schedule graphic.
4. Monthly calendars for a 24-month period shall allow scheduling of holidays and special days in advance. Holidays and special days shall be user-selected with the pointing device and shall automatically reschedule equipment operation as previously defined on the weekly schedules.

C. Collection and analysis of historical data:

1. Trending capabilities shall allow the user to easily monitor and preserve records of system activity over an extended period of time. Any system point may be trended automatically at time-based intervals or changes of value, both of which shall be user-definable. Trend data may be stored on hard disk for future diagnostics and reporting.
2. Trend data report graphics shall allow the user to view all trended point data. Reports may be customized to include individual points or predefined groups of at least 6 points. Provide additional functionality to allow any trended data to be transferred easily to an off-the-shelf spreadsheet package. This shall allow the user to perform custom calculations such as energy use, equipment efficiency, and energy costs and shall allow for generation of these reports on high-quality plots, graphs, and charts.

D. Dynamic color graphic displays:

1. Color graphic floor plan displays and system schematics for each piece of mechanical equipment, including air-handling units, chilled water systems and hot water boiler systems, shall be provided as indicated in the point I/O summary to optimize system performance analysis and speed alarm recognition.

2. The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection, or text-based commands.
3. Dynamic temperature values, humidity values, flow values, and status indication shall be shown in their actual respective locations and shall automatically update to represent current conditions without operator intervention.
4. The environment of the PC operator workstation shall allow the user to simultaneously view several graphics at a time to analyze total building operation or to allow the display of a graphic associated with an alarm to be viewed without interrupting work in progress.
5. Graphic generation software shall allow the user to add, modify, or delete system graphic displays.

E. System configuration and definition:

1. All temperature and equipment control strategies and energy management routines shall be definable by the operator. System definition and modification procedures shall not interfere with normal system operation and control.
2. The system shall be provided complete with all equipment and documentation necessary to allow an operator to independently perform the following functions:

    a. Add/delete/modify DDC panel
    b. Add/delete/modify operator workstations
    c. Add/delete/modify application-specific controllers
    d. Add/delete/modify any points type and all associated parameters and tuning constants
    e. Add/delete/modify alarm reporting definition for points
    f. Add/delete/modify control loops
    g. Add/delete/modify energy management applications
    h. Add/delete/modify time and calendar-based programming
    i. Add/delete/modify totalization for points
    j. Add/delete/modify historical data trending for points
    k. Add/delete/modify custom control processes
    l. Add/delete/modify all graphic displays, symbols and cross-reference to point data
    m. Add/delete/modify dial-up telecommunication definition
    n. Add/delete/modify all operator passwords
    o. Add/delete/modify alarm messages

F. Additional workstation software:

1. Automatic communications shall include the following features as a minimum:

    a. Manual communication from the workstation to remote networks shall be accomplishable using only a mouse to select and request the desired remote connection.
    b. Alarms shall automatically communicate with the workstation for display at the terminal and for hard-copy printout at the associated event printer.
    c. Alarms shall, at the operator’s option, communicate with a stand-alone printer to provide for real-time alarm printouts even when the workstation is off-line (such as when it is being used to run operator-selected third party software).

d. Trend data shall be scheduled for automatic updating to the workstation at operator-selected times. The operator shall also have the option of manually collecting trend data at any time.

PART 3 - EXECUTION

3.1 HARDWARE AND SOFTWARE INSTALLATION

A. Install the control system in accordance with manufacturer's instructions, complete and operating as shown and specified.

B. See drawings for the level of controller required for each type system control.

3.2 TESTS

A. Installer shall test, calibrate, and adjust the system and perform final field test. Engineer shall witness tests.

B. Final field test:

1. Sensors: Cross-check each sensor by comparing the reading at the sensor to a standard traceable to the National Institute of Standards and Technology (NIST).
2. Control points: Cross-check each control point by comparing the control command to the field-controlled device.
3. Verify that systems are operable from local controls in the specified failure mode upon panel failure or loss of power.
4. Submit test results as required in "Submittals" in Part 1 above.

C. Compliance inspection: Schedule compliance inspection only after installer has conducted all the test operations required above and successfully completed them, as substantiated by the required submittals. Conduct the compliance inspection with the Owner's designated representative and the Engineer. Conduct each activity described on the "Compliance Inspection Checklist" attached at the end of this Section. When each activity is satisfactorily completed, the Owner's representative (user) and the Engineer (A/E) will initial and date the line provided on the checklist.

1. If any item on the checklist cannot be complied with, submit a written explanation.
2. Complete the checklist and submit as required in "Submittals" in Part 1.

3.3 OPERATING INSTRUCTIONS

A. Coordinate instruction period with requirements of Section 23 05 00.

B. Provide competent instructors to give full instruction to designated personnel in the adjustment, operation, and maintenance of the system installed, rather than a general training course. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. Training shall be held during normal work hours of 8:00 a.m. to 4:30 p.m. weekdays as follows:

C. Provide two 8-hour days of training for Owner's operating personnel. Training shall include:

1. Explanation of drawings, operations, and maintenance manuals.
2. Walk-through of the job to locate control components.
3. Operator workstation and peripherals.
4. DDC panel and ASC operation/function.
5. Operator control functions including graphic generation and field panel programming.
6. Operation of portable operator's terminal.
7. Explanation of adjustment, calibration, and replacement procedures.

D. Provide 4 hours of additional training quarterly for a period of one year from final completion of the project.

E. The Owner may require personnel to have more comprehensive understanding of the hardware and software. Additional training shall be available from the installer, after completion of the work of the project. Provide description of available local and factory customer training.

END OF SECTION 23 09 23
Compliance Inspection Checklist follows Section.

COMPLIANCE INSPECTION CHECKLIST

Project: _____
_____
_____
_____

1. Manually generate an alarm at a remote DDC panel to demonstrate the capability of the workstation and alarm printer to receive alarms within 5 seconds.

   User_____ Date_____ A/E_____ Date_____

2. Disconnect an operator workstation in the central control room and manually generate an alarm at a remote DDC panel to demonstrate the capability of the system printer to receive alarms when the workstation is disconnected from the system.

   User_____ Date_____ A/E_____ Date_____

3. Disconnect one DDC panel from the network to demonstrate that a single device failure shall not disrupt or halt peer-to-peer communication. Panel to be disconnected shall be selected by the Engineer.

   User_____ Date_____ A/E_____ Date_____

4. At a DDC panel of the Engineer's choice, display on the portable operator's terminal:

   a. At least one temperature setpoint and at least one status condition, (for example, on or off for a system or piece of equipment attached to that panel), as well as for points at another DDC panel on the network.
   b. The diagnostic results as specified for a system or piece of equipment attached to that panel as well as for a system or piece of equipment attached to another DDC panel.
   c. The ability to add a new point to the DDC panel with the POT and have it automatically uploaded to the workstation to modify that panel's stored database.

   User_____ Date_____ A/E_____ Date_____

5. At an ASC of the Engineer's choice, disconnect the LAN connection to demonstrate its lack of reliance on a DDC panel to maintain full control functionality.

   User_____ Date_____ A/E_____ Date_____

END OF CHECKLIST

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 23 23 00 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Refrigerant piping.

B. Refrigerant piping accessories.

1.2 RELATED SECTIONS

A. Piping materials and methods: Section 23 05 00.

B. Piping hangers and supports: Section 23 05 29.

C. Piping insulation: Section 23 07 19

D. Equipment:

1. Air-cooled refrigerant condensing units: Section 23 63 13.
2. Air-handling units with coils: Section 23 73 22.
3. Variable-refrigerant-flow HVAC systems: Section 23 81 29.

1.3 REFERENCES

A. Air Conditioning, Heating, and Refrigeration Institute

1. AHRI 495: Performance Rating of Refrigerant Liquid Receivers
2. AHRI 730: Flow Capacity Rating of Suction Line Filters and Suction Line Filter Driers
3. AHRI 750: Thermostatic Refrigerant Expansion Valves
4. AHRI 760: Performance Rating of Solenoid Valves for Use with Volatile Refrigerants

B. American Society of Testing and Materials

1. ASTM B 280: Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
2. ASTM C 1427-07: Standard Specification for Extruded Preformed Flexible Cellular Polyolefin Thermal Insulation in Sheet and Tubular Form

C. American Society of Mechanical Engineers/American National Standards Institute

1. ASME/ANSI B16.22: Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings

D. American Society of Refrigerating and Air-Conditioning Engineers

1. ASHRAE 15: Safety Standard for Refrigeration Systems.
2. ASHRAE Standard 34: Designation and Classification of Refrigerants
3. ASHRAE Standard 147: Reducing the Release of Halogenated Refrigerants from Refrigerating and Air-Conditioning Equipment and Systems

E. American Welding Society

1. AWS A5.8/A5.8M: Specification for Filler Metals for Brazing and Braze Welding

F. Society of Automotive Engineers

1. SAE J533: Flares for Tubing

G. UL

1. UL 429: Standard for Safety Electrically Operated Valves

1.4 DESIGN REQUIREMENTS

A. Refrigerant piping shall be sized by the manufacturer of the refrigeration compressor, as specified in sections describing refrigeration equipment.

B. Design pressures: Calculated in accordance with "System Design Pressure" in ASHRAE 15.

1.5 SUBMITTALS

A. Product data:

1. Pipe, fittings, and joining materials: For each type of pipe, fitting, and joining material:

a. Include a description, characteristics, materials, composition, finishes, and performance.
b. Submit a single manufacturer for each product. Submittals that include multiple manufacturers for a single product are not acceptable.

2. Valves and piping accessories: For each additional product used in the project, include a description, characteristics, body material, composition, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions, and required clearances. Include the following:

a. Each type of valve.
b. Each type of device and accessory.

B. Shop drawings:

1. Pre-insulated tubing, including sizes and approximate lengths of lines.

2. Built-up system piping diagram, including sizes, details, and accessories.
3. Submit system design pressures for use in testing system. In accordance with the International Mechanical Code, "Field Test" for refrigeration systems, including the pressures listed on the condensing unit, compressor, or compressor unit nameplate, and the settings of pressure relief devices.

C. Certifications: Provide certificate of field tests in a form acceptable to the authority having jurisdiction, as part of the permit and inspection records. Certificate shall include no less than:

1. Name of refrigerant.
2. Field test pressure applied to high and low sides of the system.
3. Signature and printed name of the installer.

D. Operation and maintenance data: Include operating and maintenance data for each refrigerant piping accessory in the project Operation and Maintenance Manual as specified in Division 01 with supplemental requirements as specified in Section 23 01 01.

1.6 QUALITY ASSURANCE

A. Comply with ASHRAE 15 for leak testing, and installation.

B. Pipe shall be certified by the manufacturer to meet referenced standards and shall bear a label, directly on the pipe, indicating compliance.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Refrigerant: R-410A, R-32, R-454B.

2.2 PIPING (PRE-INSULATED TUBING)

A. Refrigerant pipe:

1. Pre-insulated Type L soft drawn seamless copper tubing, ASTM B 280. Provide complete with factory-applied, closed-cell insulation and jacketing in accordance with ASTM C 1427-07, Type I, Grade I, suitable for a maximum operating temperature of 250 degrees F, and meeting the minimum insulation thickness requirements of Section 23 07 19.
2. Basis of design: H Max pre-insulated copper line sets.

2.3 PIPE AND FITTINGS (BUILT-UP SYSTEMS)

A. Refrigerant pipe: ASTM B 280 Type ACR hard-drawn seamless copper tubing.

B. Fittings: Wrought copper, solder-joint type, ANSI B16.22.

C. Brazing Filler Metals: AWS A5.8/A5.8M.

1. Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.
2. Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

D. Brazing Flux: Non-corrosive.

E. Threaded pipe joint compound: Pipe joint compound recommended by the manufacturer for use at the temperature and pressure of the system.

F. Threaded pipe joint tape: Polytetrafluoroethylene (PTFE) pipe thread tape, "Teflon."

2.4 ACCESSORIES (BUILT-UP SYSTEMS)

A. System: Provide the listed accessories as a minimum on each built-up system, in accordance with approved shop drawings and as recommended by the refrigeration equipment manufacturer. Accessories provided by the equipment manufacturer with the equipment are acceptable.

B. Isolation valves:

1. Forged brass body ball valve.
2. Full port.
3. Extended copper connections suitable for brazing.
4. Brass ball.
5. Polytetrafluoroethylene PTFE seals, “Teflon”.
6. Vented ball cavity.
7. Blow out proof stem.
8. Double O-ring stem seals.
9. Positive shut-off in both directions.
10. Factory tested.
11. UL listed.
12. Working Pressure Rating: 500 psig (3450 kPa).
13. Maximum Operating Temperature: 275 degrees F (135 degrees C).

C. Check valves:

1. Body: Forged brass, or cast bronze; globe pattern.
2. Bonnet: Bolted forged brass, or cast bronze; or brass hex plug.
3. Piston: Removable polytetrafluoroethylene seat.
4. Closing Spring: Stainless steel.
5. End Connections: socket or threaded.
6. Maximum Opening Pressure: 0.50 psig (3.4 kPa).
7. Working Pressure Rating: 500 psig (3450 kPa).
8. Maximum Operating Temperature: 275 deg F (135 deg C).

D. Service valves:

1. Body: Forged brass with brass cap including key end to remove core.

2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig (3450 kPa).

E. Solenoid Valves:

1. Comply with AHRI 760 and UL 429; listed and labeled by a National Recognized Testing Laboratory.
2. Body and Bonnet: Plated steel.
3. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
4. Seat: Polytetrafluoroethylene.
5. End Connections: Threaded.
6. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch (16-GRC) conduit adapter, and a coil compatible with the control signal and available power.
7. Working Pressure Rating: 500 psig (3450 kPa).
8. Maximum Operating Temperature: 240 degrees F (116 degrees C).

F. Safety Relief Valves:

1. Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by a National Recognized Testing Laboratory.
2. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
3. Piston, Closing Spring, and Seat Insert: Stainless steel.
4. Seat: Polytetrafluoroethylene.
5. End Connections: Threaded.
6. Working Pressure Rating: 500 psig (3450 kPa).
7. Maximum Operating Temperature: 240 degrees F (116 degrees C).

G. Thermostatic Expansion Valves:

1. Comply with AHRI 750.
2. Body, Bonnet, and Seal Cap: Forged brass or steel.
3. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
4. Packing and Gaskets: Non-asbestos.
5. Capillary and Bulb: Copper tubing filled with refrigerant charge.
6. Suction Temperature: 40 degrees F (4.4 degrees C).
7. Superheat: Adjustable.
8. Provide reverse-flow option for heat-pump applications.
9. End Connections: Socket, flare, or threaded.
10. Working Pressure Rating: 500 psig (3450 kPa).

H. Strainers:

1. Body: Forged brass or cast bronze.
2. Drain Plug: Brass hex plug.
3. Screen: 100-mesh monel.
4. End Connections: Socket or flare.

5. Working Pressure Rating: 500 psig (3450 kPa).
6. Maximum Operating Temperature: 275 degrees F (135 degrees C).

I. Moisture/Liquid Indicators:

1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in parts per million (ppm).
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig (3450 kPa).
7. Maximum Operating Temperature: 240 degrees F (116 degrees C).

J. Filter Dryers:

1. Comply with AHRI 730.
2. Replaceable-core.
3. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
4. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
5. Desiccant Media: Activated alumina and activated charcoal.
6. Provide units designed for reverse flow for heat-pump applications.
7. End Connections: Socket.
8. Access Ports: NPS 1/4 (DN 8) connections at entering and leaving sides for pressure differential measurement.
9. Maximum Pressure Loss: 2 psig (14 kPa).
10. Working Pressure Rating: 500 psig (3450 kPa).
11. Maximum Operating Temperature: 240 degrees F (116 degrees C).

K. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch (20-mm) misalignment in minimum 7-inch- (180-mm-) long assembly.
4. Working Pressure Rating: Factory test at minimum 500 psig (3450 kPa).
5. Maximum Operating Temperature: 250 degrees F (121 degrees C).

L. Mufflers:

1. Body: Welded steel with corrosion-resistant coating.
2. End Connections: Socket or flare.
3. Working Pressure Rating: 500 psig (3450 kPa).
4. Maximum Operating Temperature: 275 degrees F (135 degrees C).

M. Receivers:

1. Comply with AHRI 495.
2. Comply with 2010 ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
3. Comply with UL 207; listed and labeled by an NRTL.
4. Body: Welded steel with corrosion-resistant coating.
5. Tappings: Inlet, outlet, liquid level indicator, and safety relief valve.
6. End Connections: Socket or threaded.
7. Working Pressure Rating: 500 psig (3450 kPa).
8. Maximum Operating Temperature: 275 degrees F (135 degrees C).

N. Liquid Accumulators:

1. Comply with AHRI 495.
2. Body: Welded steel with corrosion-resistant coating.
3. End Connections: Socket or threaded.
4. Working Pressure Rating: 500 psig (3450 kPa).
5. Maximum Operating Temperature: 275 degrees F (135 degrees C).

PART 3 - EXECUTION

3.1 INSTALLATION (GENERAL)

A. Install piping as indicated on the drawings and in accordance with provisions of Section 23 05 00 and the piping system application article at the end of Part 3.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Actual size and configuration of refrigerant piping shall be in conformance with the recommendations of the refrigeration equipment manufacturer.

C. Install refrigerant piping according to ASHRAE 15 and the International Mechanical Code, including the following:

1. Limitations on exposed piping within exits.
2. Requirements for refrigerant piping shafts.
3. Protection of concealed A2L refrigerants piping.
4. Shaft ventilation requirements for A2L refrigerant piping.

D. Hang horizontal piping NPS 2 (DN 50) and smaller using a metal framing system, clamps, and insulation inserts in accordance with Section 23 05 29. For pre-insulated tubing systems, remove section of factory-applied insulation at metal framing system and provide specified clamps and insulation inserts. Seal ends of piping insulation and inserts in accordance with manufacturer's instructions.

E. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

F. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls.

G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

H. Install piping adjacent to machines to allow service and maintenance.

I. Install piping free of sags and bends.

J. Select components with pressure rating equal to or greater than system operating pressure.

K. Install piping as direct as possible, with a minimum number of joints, elbows, and fittings.

L. Arrange piping to allow inspection and service of refrigeration equipment.

M. Install valves and specialties in accessible locations to allow for service and inspection.

N. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

O. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

3.2 INSTALLATION (PRE-INSULATED TUBING)

A. Install piping and seal ends of piping insulation as shown on drawings and in accordance with manufacturer's instructions and approved shop drawings.

3.3 INSTALLATION (BUILT-UP SYSTEM)

A. Install piping as shown on drawings and in accordance with manufacturer's instructions and approved shop drawings.

B. Brazed joints:

1. Install piping with brazed joints where possible.
2. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation. To permit flow and to avoid pressure build-up, make sure one end of the pipe is open.

C. Flared fittings:

1. Install piping with flared joints where required for connections.
2. Flare joints shall conform to SAE J533.

D. Threaded joints:

1. Install piping with threaded joints where required for connections.
2. Make threaded connections with pipe joint compound approved for the service, or "PTFE" tape.

E. Isolation valves:

1. Provide isolation valves in suction and discharge lines of compressors.
2. Provide isolation valves at the inlet and outlet of liquid receivers.
3. Provide isolation valves on inlet and outlet side of filter dryers. Provide an additional isolation valve and pipe and fittings to bypass the filter dryer.

F. Check valves: Install a check valve at the compressor discharge.

G. Service valves:

1. Provide service valves to enable pressure testing, refrigerant charging, and system evacuation.
2. Provide service valves between isolation valves and compressor suction connections if they not an integral part of the isolation valves or compressor equipment.
3. Provide service valves for gage taps at inlet and outlet of strainers if they are not an integral part of valves and strainers.

H. Solenoid valves:

1. Provide solenoid valves upstream from each expansion valve.
2. Provide solenoid valves in horizontal lines with coil at top.

I. Safety relief valves:

1. Install safety relief valves where required by the ASME Boiler and Pressure Vessel Code.
2. Vent safety relief valves to the atmosphere in accordance with ASHRAE 15 and ASHRAE 34.

J. Thermostatic expansion valves:

1. Provide thermostatic expansion valves as close as possible to distributors on evaporators.
2. Install valve so diaphragm case is warmer than bulb.
3. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
4. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

K. Strainers: Provide strainers upstream from and adjacent to solenoid valves and thermostatic expansion valves, unless they are furnished as an integral assembly for the device being protected.

L. Moisture/Liquid Indicators: Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

M. Filter driers: Provide filter dryers in liquid line between compressor and thermostatic expansion valve.

N. Flexible connectors: Provide flexible connectors at compressor connections.

O. Muffler: Provide muffler on the discharge side of the compressor, between the flexible connector and the condenser.

P. Receivers: Provide receivers sized to accommodate pump-down charge.

Q. Liquid accumulators: Provide liquid accumulator at compressor suction.

3.4 INSTALLATION (VARIABLE-REFRIGERANT-FLOW HVAC SYSTEMS)

A. Isolation valves:

1. Where branch controller boxes are not furnished with factory-installed isolation valves, install isolation valves furnished by the branch controller box manufacturer on all piping upstream of the branch controller box so the branch controller box can be isolated without system interruption.
2. Where branch controller boxes are not furnished with factory-installed isolation valves, install isolation valves furnished by the branch controller box manufacturer on all piping to the indoor units from each branch controller box so the branch controller box and indoor units can be isolated without system interruption.

3.5 LEAK TEST

A. After the refrigeration systems have been installed, and prior to insulation of field joints, perform a leak test before evacuating the systems.

1. The cylinder of oil-pumped nitrogen shall be equipped with a shutoff valve, pressure reducing valve, cylinder pressure gauge, line pressure gauge, and bleed valve.

B. Remove controls or relief valves which could be damaged by test pressures.

C. Separate the high side from the low side and bleed in enough refrigerant to raise the system pressure to 12 to 15 psig (83 to 103 kPa). Then, using oil-pumped dry nitrogen, raise the pressures to the test pressures established as required in "Submittals" in Part 1 above.

D. Test the entire system for leaks:

1. Meet or exceed the requirements of the International Mechanical Code.
2. Pressure test for not less than 60 minutes.
3. Test at the design pressure listed on the system condensing unit.

E. Bleed off the pressure into cylinders, in accordance with ASHRAE Standard 147, and repair leaks. Do not attempt to repair a leak while the system is under pressure. Do not repair bad joints by remelting and adding more brazing material. Take joint apart, thoroughly clean, and remake as a new joint.

F. Retest the system if a leak is found.

G. When tests and repairs are complete, replace valves or controls removed for protection.

H. Submit test certificate required in "Submittals" in Part 1 above.

3.6 EVACUATION

A. To evacuate the system, use a vacuum pump capable of producing a vacuum with a maximum pressure of 1 mm (0.039 inches) mercury (133 microns) absolute pressure. Proceed as follows:

1. Connect an accurate high vacuum gauge, such as a Stoke's or Zimmerli gauge, to the system. Do not use compound gauges.
2. Connect the vacuum pump to both the high and low sides of the system. Leave the compressor suction and discharge valves closed. Evacuate the system to 2.5 mm (0.098 inches) mercury (333 microns) absolute pressure. Keep ambient air temperatures above 60 degrees F (15.6 degrees C) during the evacuation.
3. Break the system vacuum with oil-pumped dry nitrogen. Open the compressor suction and discharge service valves and re-evacuate the system to 2.5 mm (0.098 inches) mercury (333 microns) absolute pressure.
4. After the system has been double evacuated to 2.5 mm (0.098 inches) mercury (333 microns) absolute pressure, close the vacuum-pump suction valve and stop the pump. Allow the system to stand under a vacuum a minimum of 12 hours and recheck the vacuum. Notify the Architect in time for him to verify the test pressure at beginning and end of time limit, before proceeding to charge the system.

3.7 CHARGING

A. Charge the system with refrigerant through the liquid-line charging valve. Use a clean strainer-drier in the charging line, along with a pressure gauge and shut-off valve to control pressures. Before starting the compressor, ascertain that the oil sight glass, if provided, is 75 percent full, and suction and discharge valves back-seated.

3.8 FINAL START-UP PROCEDURE

A. Check out operating and safety controls in accordance with the compressor manufacturer's recommendations.

B. Recheck the oil level in the sight glass at frequent intervals. It should not drop below 50 percent level.

C. Adjust compressor suction unloaders, if provided, for proper evaporator-compressor balance to maintain the scheduled minimum discharge temperature.

D. Reinspect the system after it has been in normal operation for at least 72 hours. At this time, instruct the Owner in the operation and maintenance of the equipment, as required in the equipment section.

3.9 LUBRICATION

A. If it becomes necessary to add oil to the system, use only the oil recommended by the compressor manufacturer.

3.10 PIPING SYSTEM APPLICATIONS

A. Provide built-up piping for the following equipment:

1. Air-handling units with coils
2. Air-cooled refrigerant condensing units

B. Provide built-up piping or pre-insulated piping for variable refrigerant flow systems as indicated:

1. Piping between outdoor unit modules: Built-up
2. Piping between outdoor units and branch controller boxes: Built-up
3. Piping between branch controller boxes and indoor units:

    a. Exposed piping and piping NPS1 (DN 25) and larger shall be built-up piping.
    b. Concealed piping smaller than NPS 1 (DN 25) may be built-up piping or pre-insulated tubing.

END OF SECTION 23 23 00

SECTION 23 31 13 - METAL DUCTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. HVAC metal supply, return, and exhaust ductwork and plenums in pressure classes from -2 to +10 inches w.g. (-500 to +2490 Pa).

B. Shop-fabricated or factory-fabricated ducts and fittings:

1. Single-wall round duct.
2. Double-wall round duct.
3. Rectangular double-wall duct.

C. Joint and sealing materials.

D. Acoustical lining.

E. Air duct leakage testing.

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Control dampers: Section 23 09 07.

1.3 RELATED SECTIONS

A. Duct identification: Section 23 05 00.

B. Curbs and support rails: Section 23 05 06.

C. Flashing ducts through roof: Section 23 05 06.

D. Firestopping: Division 07.

E. Balancing: Section 23 05 93.

F. Insulation: Section 23 07 13.

G. Control dampers: Section 23 09 07.

H. Duct support: Section 23 31 14.

I. Duct accessories: Section 23 33 00.

J. Flexible ducts: Section 23 33 46.

K. Louvers: Division 08.

1.4 REFERENCES

A. ACGIH-01: American Conference of Governmental Industrial Hygienists

1. Industrial Ventilation: A Manual of Recommended Practice.

B. ASHRAE

1. ASHRAE Handbook of Fundamentals.

C. ASTM

1. ASTM C 423: Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
2. ASTM C 1071: Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).
3. ASTM D 1330: Rubber Sheet Gaskets.
4. ASTM E2336: Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems
5. ASTM G 21: Determining Resistance of Synthetic Polymeric Materials to Fungi.
6. ASTM G 22: Determining Resistance of Synthetic Polymeric Materials to Bacteria.

D. SMACNA

1. HVAC DCS: SMACNA HVAC Duct Construction Standards, Metal and Flexible.
2. RIDCS: SMACNA Round Industrial Duct Construction Standards.
3. HVAC Air Duct Leakage Test Manual.

E. UL 181: Factory-Made Air Ducts and Air Connectors.

1.5 DEFINITIONS

A. Seam: Joining of two longitudinal (parallel to the direction of airflow) edges of duct surface material. All other duct surface connections are joints.

B. Joints: Transverse joints (perpendicular to the direction of airflow); branch and subbranch intersections; duct collar tap-ins; louver and air terminal connections to ducts; access door and access panel frames and jambs; duct, plenum, and casing abutments to building structures.

1.6 SYSTEM PERFORMANCE REQUIREMENTS

A. The duct system design, as indicated, has been used to select and size air moving and distribution equipment and other components of the air system. Do not change the layout or configuration of the duct system except as specifically approved in writing. Accompany requests for modifications with calculations showing that the proposed design will provide the original design results without increasing system total pressure.

1.7 SUBMITTALS

A. Product data: For each type of product, include a description, characteristics, materials, composition, finishes, and performance. Include the following:

1. Acoustical duct lining, adhesive, and sealants.
2. Factory-fabricated ducts and fittings.
3. Joint and sealing materials.

B. Product application schedules:

1. Schedule of duct systems with applicable pressure classes, leakage classes, duct materials, and duct material thicknesses.
2. Schedule of sealing methods for each type of seam and joint.

C. Shop drawings:

1. Fabrication, assembly, and installation for each duct system:

a. Indicate duct dimensions, sheet metal thickness, reinforcement spacing, and seam and joint construction.
b. Indicate components and attachments to other work.

2. Calculations when required as specified in “System Performance Requirements” above.
3. Layout drawings for the entire ductwork system, including plans and sections, drawn at the same scale as the contract drawings, except no smaller than 0.125 inch equals one foot.

D. Test reports: Air Duct Leakage Test Summary: Submit data on forms as indicated in the SMACNA HVAC Duct Leakage Test Manual. (See sample form at end of section.)

1.8 QUALITY ASSURANCE

A. Specified and scheduled duct construction exceeds SMACNA requirements. Comply with specifications and schedules, and for materials or methods not specified or scheduled, comply with SMACNA HVAC DCS and RIDCS.

B. Comply with NFPA 90A and 90B.

C. Where shop-fabricated ductwork and fittings are permitted, products shall meet or exceed the quality of material, quality of construction, and performance of the basis of design factory-fabricated product.

D. Where shop-fabricated ductwork and fittings are proposed, contractor shall provide a listing of ten comparable projects completed within the last five years using shop-fabricated ductwork and fittings of the type proposed as evidence of quality and performance.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis-of-design products: Subject to compliance with requirements, provide specified or noted products, or comparable product by one of the following:

1. Factory-fabricated ducts and fittings:

a. Eastern Sheet Metal
b. Hamlin Sheet Metal
c. LaPine Metal Products
d. Linx Industries
e. McGill Airflow Corp.
f. MKT Metal Manufacturing
g. Phoenix Metals
h. Semco Mfg. Inc.
i. SPIRAmir
j. Or approved equal.

2. Manufactured joint connectors:

a. Ductmate Industries
b. C.L. Ward & Family Inc.
c. Or approved equal.

B. Special use ducts and fittings: Scheduled manufacturers and named products are intended to set a standard for materials, quality of construction, and performance.

2.2 MATERIALS

A. Metal sheets:

1. Galvanized steel sheets: Lock-forming quality, ASTM A 653/A 653M, coating designation G90 (Z275).

2. Stainless steel sheets: ASTM A 480/A 480M, Type 304.

a. Ducts exposed to view: No. 4 finish on exposed surface.
b. Concealed ducts: No. 2B finish.

B. Tie rods: Galvanized steel, minimum diameter 0.25 inch (6 mm) for ducts up to 36 inches (900 mm); 0.375 inch (9 mm) for ducts over 36 inches (900 mm).

2.3 SHOP-FABRICATED OR FACTORY-FABRICATED DUCTS AND FITTINGS

A. Single-wall, rectangular duct and fittings:

1. Fabricate according to SMACNA HVAC DCS.

B. Single-wall, flat lock longitudinal-seam round duct and fittings:

1. Fabricate according to SMACNA HVAC DCS.
2. Seam: Flat lock; snap-lock seam not permitted.

C. Single-wall, spiral round duct and fittings for concealed applications: Provide the following construction unless otherwise indicated for special applications,

1. Material: Galvanized steel.
2. Seams: Spiral lock seam.
3. Joint basis of design: Round fittings, McGill Airflow “Uni-Seal” fittings, lap and riveted/screwed and sealed.
4. Fittings for branch connections shall be conical type.
5. Centerline radius of elbows shall be 1.5 times the diameter.
6. Duct access door basis of design: Type AR-W.
7. Basis of Design: McGill Airflow “Uni-Seal” spiral duct with “Uni-form” fittings.

D. Single-wall, spiral round duct and fittings:

2. Material: Galvanized steel or stainless steel where indicated.
3. Seams: Spiral lock seam.
4. Joints:

a. Basis of Design: Round fittings, McGill Airflow “Uni-Seal” fittings, spot or tack welded and sealed.
b. Basis of Design: McGill Airflow “”Uni-gasket” fittings.

5. Fittings for branch connections shall be conical type.
6. Centerline radius of elbows shall be 1.5 times the diameter.
7. Duct access door basis of design: Type AR-W.
8. Basis of Design: McGill Airflow “Uni-Seal” spiral duct with “Uni-form” fittings.

Single-Wall Round Duct Minimum Metal Thickness		
Duct Element	Steel Gauge	Aluminum Thickness
Ducts up to 14 inches diameter	26	0.032 inches
Ducts 15 through 26 inch diameter	24	0.040 inches
Ducts 27 through 36 inch diameter	22	0.050 inches
Ducts 37 through 50 inch diameter	20	0.064 inches
Ducts 51 through 60 inch diameter	18	0.071 inches
Ducts 61 inches and over (welded joints required)	16	0.090 inches
Fittings up to 36 inch diameter	20	0.064 inches
Fittings 37 to 50 inch diameter	18	0.071 inches
Fittings over 51 inches in diameter	16	0.090 inches

E. Double-wall, insulated, spiral round duct and fittings:

1. Walls: galvanized steel, inner duct perforated.
2. Construction: Spiral lock seam.
3. Insulation: Fiberglass, coated to prevent particles from penetrating the fiberglass, resistance to microbial growth of fungi in accordance with ASTM G 21 and bacteria in accordance with ASTM G 22, maximum 1.5 pounds per cubic foot density, 1 inch thick.
4. Dimensions indicated on the drawings are outside duct dimensions.
5. Basis of Design: McGill Airflow Corporation "Acousti-K27."

F. Double-wall, insulated rectangular ducts and fittings:

1. Dimensions indicated on the drawings are the outside dimensions of the duct.
2. Thermal conductivity: 0.26 at 75 degrees F (0.037 at 24 degrees C) mean temperature.
3. Outer shell: Galvanized steel, 22 gauge, Pittsburgh lock construction, with "TDC" end connectors.
4. Insulation: Fiberglass, coated to prevent particles from penetrating the fiberglass, resistance to microbial growth of fungi in accordance with ASTM G 21 and bacteria in accordance with ASTM G 22, maximum 1.5 pounds per cubic foot density, 1 inch thick.
5. Inner liner: Perforated galvanized steel sheet, 22 gauge, Pittsburgh lock construction.
6. End connections: Manufactured joint connectors.
7. Basis of Design: McGill Airflow "Rectangular-k27"

2.4 JOINT AND SEALING MATERIALS

A. Flexible joint material for connections to vibrating equipment: Specified in Section 23 3300, Duct Accessories.

B. Duct joint and seam sealants: UL classified, fire-resistive, conforming to NFPA 90A and 90B, high pressure type (up to 10 inches (2490 Pa) SMACNA pressure class), the following products are the basis of design:

1. Indoor application: Hardcast "Iron Grip" (IG-601) brush-on water-based vinyl acrylic sealing mastic.
2. Outdoor application:

    a. Hardcast "Versa-Grip" (VG-102) brush-on indoor/outdoor water-based polyester/synthetic resin sealant with UV inhibitors.
    b. Hardcast "Aluma-Grip" (AFT-701) pressure sensitive sealant on a roll. Two-mil (0.05-mm) aluminum foil backing, peel-off release liner, 33-mil (0.8-mm) modified elastomeric butyl sealant (100 percent solids). To be used outdoors only.

3. Flange gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

2.5 ACOUSTICAL LINING

A. Fiberglass acoustical lining for rectangular ductwork.

1. Fiberglass, ASTM C 1071, Type 1, flexible; meeting requirements of NFPA 90A and 90B, bonded with thermosetting resin.
2. Density: Nominal 2 pounds per cubic foot (32 kg per cubic meter).
3. Facing: Black composite sprayed-on surface, recommended by manufacturer to prevent particles from penetrating the fiberglass, and to be cleaned by vacuum or dusting.
4. Resistance to microbial growth: Tested and shown to support no growth of:

    a. Fungi in accordance with ASTM G 21.
    b. Bacteria in accordance with ASTM G 22.

5. Thickness:

    a. Typical: One inch (25 mm) thick, ASTM C 423 (Type A mounting) noise reduction coefficient (NRC) at least 0.60.
    b. Where indicated: Two inches (51 mm) thick, ASTM C 423 (Type A mounting) NRC at least 0.95.

6. Adhesive for acoustical lining:

    a. Non-flammable elastomer adhesive designed for attaching low density duct liner and fibrous glass insulation to sheet metal.
    b. Basis of Design: Foster 85-60.

PART 3 - EXECUTION

3.1 COORDINATION

A. Before fabricating ductwork, make field measurements and coordinate layout of ductwork shown on the drawings with building components and work of other trades. Resolve conflicts and obtain written approval for deviations before fabrication or buying ductwork.

B. Provide for and install control dampers, manual volume dampers, backdraft dampers, smoke dampers, thermometers, coils, sound attenuators, duct accessories and similar equipment furnished under this or other sections of the specifications.

C. Coordination with other work:

1. Wall, partition, ceiling, and floor penetrations:

    a. Penetrations with fire dampers, smoke dampers, or fire/smoke dampers: Connect ductwork to the damper in accordance with the damper listing after the damper installation is complete. Do not install the ductwork through the wall.
    b. Penetrations with fire dampers, smoke dampers, or fire/smoke dampers:

(1) Fill void between the architectural element and the duct with mineral wool.
(2) Provide metal trim angles around the perimeter of the rectangular duct.
(3) Provide a slip on flange around the perimeter of round or flat oval ducts.

2. Exterior wall penetrations: Flash ducts passing through exterior walls as detailed on the drawings.
3. Louvers: Slope ductwork down toward the louver. Provide connections as indicated below:

   a. Ductwork connection full size of louver: Provide angles, flanges, or damper collars as required to connect the ductwork to the louver.
   b. Ductwork connections smaller than the full size of the louver: Blank off any unused portion of the louver with double-wall insulated metal panels with metal faces constructed of the same material as the connecting duct, and 1.5 inch (38 mm) thick minimum fiberglass insulation. Seal edges of panel insulation with sheet metal channels. Connect ductwork to insulated metal panel with using angles or flanges.
   c. Damper connection to louver: Provide metal angle or channel frames as required for mounting ATC dampers and manual dampers to louvers.

4. Electrical panels and equipment:

   a. Do not install ductwork over electrical panels and equipment unless otherwise indicated.
   b. Where ductwork must be installed over electrical panels and equipment, provide aluminum sheet metal drain troughs under piping with drains piped to a safe location.

5. Accessories with frames: Where ATC dampers and other accessories with frames are mounted in ductwork, connect ductwork to frames in a manner to provide 100 percent free area for air passage. Seal ductwork connections to frames with gaskets or duct sealant. Secure connections with pop rivets or sheet metal screws spaced no more than 3 inches (75 mm) on centers around both sides of entire frame.
6. Fire suppression systems: Coordinate with fire suppression system sprinkler systems where required in dust collecting, paint spray booth exhaust, and Type I kitchen hood exhaust systems.

3.2 INSTALLING METAL DUCTWORK

A. Dimensions indicated on drawings are outer dimensions of ducts. Dimensions indicated for double-wall ducts are outer dimensions of outer wall.

B. Construct ductwork using the Duct Construction Schedule on the drawings. Schedule includes duct system pressure class requirements, minimum sheet metal gauges, leakage allowances, and maximum reinforcement spacing. These requirements exceed the requirements of SMACNA HVAC DCS. Engineered duct systems using metal gauges or reinforcing less than required in the schedules on the drawings are not acceptable.

C. Material: Construct ductwork of galvanized steel, except where another material is noted on drawings or specified.

D. Joints: Provide one of the following duct joints, except where other criteria are noted on the drawings or specified. Snap-lock or flat-lock seams are not acceptable.

1. Joint connections constructed in accordance with SMACNA HVAC DCS,
2. Manufactured duct connection system basis of design: Ductmate Industries "Ductmate," selected to assure compliance with leakage factors indicated on the drawings.

E. Where specific materials and seam and joint construction are specified for a specific application, all ductwork carrying any concentration of air for that application, no matter how dilute, shall be constructed according to the requirements of the application.

F. Provide duct systems complete with built-in accessories as specified herein, in other sections of the specifications, as indicated on the drawings, and, where not otherwise indicated, in accordance with SMACNA HVAC DCS.

G. Thoroughly clean duct and duct fittings before they are installed, and keep them clean until the acceptance of the completed work. Use a duct cap cover on all unfinished ends to prevent moisture, dirt particles, dust, and debris from entering the installed ductwork during construction.

H. Install metal ductwork neat in appearance. Interior surfaces shall be smooth and free of obstructions. Duct lines shall be true and smooth.

I. Except in systems with minimum velocity standards, contractor has the option to eliminate reducing transitions and extend ductwork full size, providing space is available and conflict with work of other trades does not occur. Systems with minimum velocity standards include the following:

1. Type 1 kitchen hood exhaust
2. Laundry dryer exhaust
3. Fume hood exhaust
4. Paint spray booth exhaust
5. Dust collecting
6. Welding exhaust.

J. Make bends and turns in ductwork using offsets and curved or square elbows as indicated on the drawings. Provide full radius elbows (centerline radius equals 1.5 times duct width). Provide turning vanes in square elbows. Make 90-degree branch duct connections using 45-degree entry fittings unless otherwise indicated.

K. Generally, it is intended that horizontal ductwork be a minimum of 10 inches (255 mm) above suspended ceiling (where applicable) to allow removal of ceiling panels and ceiling-mounted light fixtures and devices. Coordinate duct installation to achieve that clearance wherever possible.

L. Unless otherwise indicated, exposed ductwork shall be mounted as high as possible.

M. Brace large ductwork connected to fans and air-handling units with metal angles to prevent vibration and duct damage, and to reduce noise.

N. Construct gravity duct systems (nonfan-powered), such as pressure relief ducts and transfer ducts, in accordance with SMACNA HVAC DCS minimum one inch pressure class unless otherwise scheduled.

O. Cross break or bead ducts of dimensions of 12 inches (305 mm) and over in pressure classes under 2 inches (500 Pa).

P. Where ducts will be exposed, remove labels and clean surfaces. Where required, prepare surface for painting.

Q. Single-wall plenums, casings, and access doors: Construct in accordance with SMACNA HVAC DCS.

R. Install control dampers furnished under Section 23 09 07, Control Dampers.

3.3 INSTALLING ROUND DUCT

A. Provide round single-wall and double-wall ductwork where indicated on plans.

B. Assemble spiral round ducts and fittings using duct sealant and sheet metal screws as recommended by the manufacturer.

C. Single-wall ductwork:

1. Exposed: Spiral round duct and fittings unless otherwise indicated.
2. Pressure class 3.0 inches w.g. or greater: Spiral round duct and fittings unless otherwise indicated.
3. Serving other than a single diffusers: Spiral round duct and fittings unless otherwise indicated.
4. Concealed, pressure class of 2.0 inches w.g. or less and serving a single air outlet: Longitudinal-seam duct and fittings.

D. Double-wall ductwork: Provide insulated spiral round duct and fittings with perforated inner liner and solid outer wall.

3.4 SEALING DUCTWORK

A. Seal all longitudinal and transverse joints, seams, and connections with the following exceptions:

1. Sealant may be omitted from welded joints and seams provided duct leakage is within the required tolerance.
2. Sealant may be omitted from locking-type joints and seams (other than snap-lock and button-lock) in ductwork with a pressure class below 2 inches of water column (500 Pa)

where permitted by code requirements and provided duct leakage is within the required tolerance.

B. Sealing leakage performance: Seal ductwork to meet duct leakage factors scheduled on the drawings.

C. Sealing procedures:

1. Prior to sealing, ductwork shall be clean and dry, free of oil or grease.
2. Apply sealant in accordance with the manufacturer's recommendations.
3. Allow time for sealant to dry or cure, in accordance with manufacturer's recommendations, before leak testing.

D. Sealant material:

1. Galvanized steel ductwork: Brush-on or pressure sensitive sealant, as applicable.

3.5 AIR DUCT LEAKAGE TESTS

A. Continuously examine ductwork during construction to ascertain that it is sealed properly.

B. General test procedures:

1. Leakage test procedures shall be in accordance with SMACNA Leakage Test Manual.
2. After installation and prior to insulating, test all ductwork for air leakage. Ducts to be tested, test pressures, and leakage factors (maximum volume of leakage per 100 square foot (9.3 square meter) of duct surface area) shall be as scheduled on the drawings.
3. The ductwork quantity to be tested exceeds SMACNA leakage test manual recommendations.
4. Conduct tests before any equipment is connected that would be subject to damage from the test pressure. Provide temporary blank-offs or caps.
5. Notify parties whose presence is necessary for the test; and in all cases, the Architect and testing and balancing subcontractor in writing at least two normal work days prior to the actual test.
6. While system is under test pressure, survey joints for audible leaks. Mark leakage points, shut down blower, and make repairs. Retest after duct sealant has dried or cured.
7. If test duct sections exceed the allotted leakage levels, locate sources of leakage, make repairs and repeat test procedures until acceptable leakage levels are demonstrated.

3.6 INSTALLING ACOUSTICAL LINING

A. Where indicated on drawings, or required by specifications, install acoustic lining on interior surfaces of ducts. Sizes shown on the drawings for rectangular ducts are sheet metal dimensions and include allowance for liner thickness. Install in accordance with SMACNA HVAC DCS, except as the following requirements are more stringent.

1. Adhesive: Adhere liner to interior surfaces of duct with 100 percent coverage. Before assembling lined sections, coat exposed abutting edges of liner with adhesive.
2. Mechanical fasteners: On 16-inch (406-mm) maximum centers on top and sides; on 4-inch (100-mm) centers within 2 inches (50 mm) of leading edge of transverse joints on top, bottom, and sides.

END OF SECTION 23 31 13
Leakage test form follows Section

PROJECT NAME _____ PROJECT NO. _____ PAGE _____ OF _____

AIR DUCT LEAKAGE TEST SUMMARY

AIR SYSTEM _____ LEAKAGE CLASS (GL) _____

FAN CFM (Q) _____ SPECIFIED TEST PRESSURE (Pt) _____

DUCT CONSTRUCTION PRESSURE CLASS (P_c) _____

DESIGN DATA				FIELD TEST DATA RECORD							
SUBJECT DUCT	SURFACE AREA (FT^2)	ALLOWABLE LEAKAGE		DIAMETER		PRESSURE "W.G."		DATE	PERFORMED BY	WITNESSED BY	ACTUAL CFM
		FACTOR (CFM/100 FT^2)	CFM (TEST SECTION)	ORIFICE	TUBE	DUCT	ACROSS ORIFICE				
TOTAL SYSTEM											
TEST SECTION(S)											

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 23 31 14 - HANGERS AND SUPPORTS FOR DUCTWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Duct hangers and supports.

B. Trapeze duct hangers.

C. Metal framing systems.

D. Fasteners.

1.2 RELATED SECTIONS

A. Support rails: Section 23 05 06.

B. HVAC Duct Insulation: Section 23 07 13.

1.3 REFERENCES

A. ASTM International

1. ASTM A 307: Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
2. ASTM A 492: Standard Specification for Stainless Steel Rope Wire
3. ASTM A 603: Standard Specification for Metallic-Coated Steel Structural Wire Rope
4. ASTM F 3125: Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated

B. American Welding Society

1. AWS-D.1.1: Structural Welding – Steel

C. Metal Framing Manufacturer’s Association

1. MFMA-4: Metal Framing Standards Publication
2. MFMA-103: Guidelines for the Use of Metal Framing

D. Manufacturer’s Standardization Society

1. MSS SP-58: Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

E. SMACNA

1. HVAC Duct Construction Standards - Metal and Flexible

1.4 SUBMITTALS

F. Product data: For each type of product, include a description, characteristics, materials, composition, finishes, and performance. Include the following:

1. Hangers and supports.
2. Fasteners.

G. Product application schedule: Include the following:

1. Provide a schedule of building attachment types and associated attachment hardware.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Metal framing systems:

1. Anvil International
2. PHD Manufacturing, Inc.
3. PHP Systems/Design
4. Unistrut
5. Or approved equal.

2.2 HANGERS AND SUPPORTS

A. General: Comply with requirements of SMACNA's HVAC Duct Construction Standards - Metal and Flexible.

B. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum, or galvanized steel shapes and plates coated with zinc chromate.

C. Threaded rod: Continuously threaded, size and spacing in compliance with SMACNA's HVAC Duct Construction Standards - Metal and Flexible.

1. Zinc-plated or galvanized carbon steel for indoor applications.
2. Stainless steel for outdoor and corrosive applications.

D. Nuts and washers: Provide the same material used for threaded rods.

E. Straps: Match duct material, size and spacing in compliance with SMACNA's HVAC Duct Construction Standards - Metal and Flexible.

F. Steel cables:

1. Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.
2. Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A492.
3. Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Metal framing systems:

1. Description: Shop- or field-fabricated, duct-support assembly made of channels, nuts, bolts, structural connections, accessories, fittings, and other manufactured components including brackets and braces required to resist lateral loads.
2. Standard: Comply with MFMA-4 for factory-fabricated components for field assembly.
3. Channels: Continuous slotted steel channel with inturned lips, width selected for applicable load criteria.
4. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
5. Zinc-plated or galvanized carbon steel for indoor applications.
6. Stainless steel for outdoor and corrosive applications.

H. Duct attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

I. Guying and bracing materials:

1. Provide galvanized steel cable and guying tensioners and/or galvanized steel angle to provide any required guying and bracing where forces on exterior ductwork are beyond the capability of the associated metal framing system and its attachment to structure.

2.3 FASTENERS

A. Mechanical expansion anchors:

1. Self-drilling type expansion shields or machine bolt drop-in anchors for drilled holes. Fasteners to floor slabs shall be vibration and shock resistant. Load applied to fasteners shall not exceed 25 percent of manufacturer's stated load capacity in 3500 psi (24,000 kPa) concrete. Provide zinc-coated anchors for indoor applications and stainless-steel anchors for outdoor applications.
2. Basis of design: ITT Phillips Anchors "Red Head."

B. Fasteners to wood construction: Lag bolts.

C. Bolts, nuts, and washers: ASTM A 307, or ASTM F 3125 where high strength is required.

PART 3 - EXECUTION

3.1 GENERAL

A. Comply with SMACNA's HVAC Duct Construction Standards - Metal and Flexible.

B. Provide hangers, supports, fasteners, and attachments as required to properly support ductwork from the building structure.

C. Provide support complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

D. Hanger Spacing: Comply with SMACNA's HVAC Duct Construction Standards - Metal and Flexible for maximum hanger spacing. Provide hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1220 mm) of each branch intersection.

E. Where required, provide structural steel shapes or metal framing system channels and hardware to transfer load from a support location to multiple locations in the structure to get support from an appropriate location or to increase the strength of the connection to the structure.

F. Support horizontal rectangular ductwork from above with trapeze hangers and threaded rod or straps where possible, unless otherwise indicated.

1. Ducts 54 inches (1370 mm) wide and under:

a. Support with trapeze hangers or straps.
b. Strap hangers, where used, shall extend down sides of ducts, and attach to underside with at least two sheet metal screws per strap.

2. Ducts over 54 inches (1370 mm) wide: Support with trapeze hangers.

G. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum interval of 16 feet (5 m).

H. Fabricate wall-mounted and floor-mounted supports using metal framing systems or structural steel where required.

I. Trim threaded rods with a maximum excess length of 1 inch (25 mm). Provide protective rubber red end caps on the ends of threaded rods exposed and within 8 feet (2.4 meters) of the floor, roof, or grade below.

J. Install lateral bracing to prevent swaying.

K. Install supports so that duct loads not be transmitted to connected equipment.

L. Provide trapeze hangers where required to hang ductwork using threaded rod.

1. Weld steel according to AWS D-1.1.
2. Hang with threaded rods.
3. Design trapeze angers and supports based on supported load plus a 50 percent minimum safety factor.

M. Where ductwork is exposed, hang ductwork as follows:

1. Rectangular ductwork:

   a. Provide trapeze support.
   b. Provide straps where duct dimensions allow.

2. Round ductwork: Hang according to the manufacturer's recommendations with one of the following methods.

   a. Hang with two threaded rods and pre-manufactured duct supports formed to fit the profile of the ductwork.
   b. Hang with a single strap and pre-manufactured duct supports formed to fit the profile of the ductwork.
   c. Hang with a single threaded rod and swivel loop hanger.

3.2 BUILDING ATTACHMENTS

A. Attaching to structural walls:

1. Provide a minimum of two 0.375 inch (9.5 mm) minimum screw-type fasteners for attaching brackets and a minimum of three 0.5 inch (13 mm) minimum bolt-type fasteners for attaching structural supports.

B. Attaching to structural steel beams, channels, or angles:

1. Secure threaded rods to MSS SP-58 Type 28 beam clamps that are clamped to the bottom flange of steel beams for any pipe size.
2. Secure threaded rods to MSS SP-58 Type 23 beam clamps for beams with maximum flange thickness of 0.75 inch (19 mm).

C. Attaching to bar joists:

1. Provide MSS SP-58 Type 19 top-beam C-clamps attached to top flange of the joists at panel points.
2. If support is required between joists, hang metal framing system channel or structural steel shape from joists using MSS SP-58 Type 19 C-clamps attached to the top flange of two joists, and hang ductwork from metal framing system channel or structural steel shape.

D. Attaching to concrete slabs and composite slabs:

1. Obtain approval from the structural engineer and confirm allowable loads prior to supporting ductwork from concrete slabs or composite slabs. Where approved, provide one of the following as required:

    a. Mechanical expansion anchors and steel bolts or rods.
    b. Screws designed for attachment to concrete.
    c. Powder actuated fasteners.

E. Attaching to precast concrete hollow core plank:

1. Obtain approval from the structural engineer and confirm allowable loads prior to supporting ductwork from precast concrete plank.
2. Floor construction with topping slab:

    a. Threaded rods shall pass through the plank and be secured on topside with nut, locknut, and plate washer.
    b. Plate washers: 4 by 8 inches by 0.125 inch thick (100 mm by 200 mm by 6 mm) thick for 0.375-inch and 0.5-inch (10-mm and 15-mm) rods; 6 by 12 inches by 0.187 inch thick (150 by 305 by 5 mm) for 0.625-inch (16-mm) and larger rods.
    c. Top of hanger assembly shall be concealed below surface of topping slab.
    d. Drill openings through precast planks for the passage of threaded rods with power-driven carbide-tip drills, in accordance with Architect's instructions. Do not cut reinforcing bar without specific approval of the Structural Engineer.

3. Existing floor construction:

    a. Provide toggle bolts or remove and repair topping slab and support ductwork as indicated above.

4. Roof construction:

    a. Provide toggle bolts.

5. Provide supplemental steel with connections to multiple planks where required to spread a load among multiple planks.

F. Attaching to steel decks:

1. Obtain approval from the structural engineer and confirm allowable loads prior to supporting ductwork from steel decks. Where approved, provide screws in the lower plane of corrugated steel decks.

G. Attaching to metal grating:

1. Ductwork perpendicular to structural members supporting grating:

a. Attach threaded rods to the structural members using MSS SP-58 Type 23 beam clamps.

b. If intermediate support is needed for proper hanger spacing, attach additional threaded rods to 2.5-inch by 2.5-inch by 0.25-inch (90 by 90 by 8-mm) angles, 12 inches (305 mm) long, welded to the underside of the grating.

2. Ductwork parallel with structural members supporting grating:

a. Attach threaded rods to 2.5-inch by 2.5-inch by 0.25-inch (90 by 90 by 8-mm) angles, 12 inches (305 mm) long, welded to the underside of the grating for ductwork between structural members.
b. Attach threaded rods to the structural members using MSS SP-58 Type 23 beam clamps for ductwork under structural members.

3. Threaded rods shall have locknuts.

H. Attaching to wood construction:

1. Obtain approval from the structural engineer and confirm allowable loads and connection points prior to supporting ductwork from wood construction. Where approved, provide the following:

a. Beams: Lag bolts.
b. Trusses: Follow roof truss manufacturers' recommendations for attachment locations, loads, spacing, and methods of attachment.
c. Joists: Provide MSS SP-58 Type 34 side beam connectors.

END OF SECTION 23 31 14

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 23 33 00 - DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Flexible connections.

B. Screens.

C. Manufactured units:

1. Volume extractors.
2. Air turning vanes.
3. Spin-in fittings.

D. Duct access doors.

E. Sound attenuators.

F. Dampers.

G. Constant airflow regulators.

H. Fire dampers.

I. Combination fire/smoke dampers

J. Duct clamps.

1.2 RELATED SECTIONS

A. Access doors: Division 08.

B. Louvers: Division 08.

C. Duct-mounted smoke detectors: Section 28 31 00.

D. Diffusers, registers, and grilles: Section 23 37 13.

E. Damper actuators: Automatic temperature control sections.

1.3 REFERENCES

A. AMCA 210: Laboratory Methods of Testing Fans for Rating.

B. ASTM E 477: Test for Measurement of Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.

C. ASTM E 2016: Standard Specification for Industrial Woven Wire Cloth.

D. NFPA 90A: Installation of Air Conditioning and Ventilating System.

E. NFPA 90B: Installation of Warm Air Heating and Air-Conditioning Systems.

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

G. SMACNA-05: Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems.

H. SMACNA HVAC DCS: HVAC Duct Construction Standards, Metal and Flexible.

I. UL 555: Fire Dampers.

1.4 SUBMITTALS

A. Product data: Each type of duct accessory, included the following:

1. Include rated capacities, operating characteristics, materials, finishes, and furnished specialties and accessories.
2. Include manufacturer's written installation instructions for each type of fire damper, combination fire/smoke damper, and smoke damper.

B. Shop drawings: Detail equipment assemblies and indicate dimensions, loadings, required clearances, method of field assembly, components, locations, and size of each field connection. Detail these accessories:

1. Special fittings and manual and automatic volume damper installations.
2. Fire, combination fire/smoke, and smoke damper installations, including sleeves and duct access doors.

C. Certifications: Certified test data for dynamic insertion loss; sound power levels; airflow performance data, and static pressure loss.

D. Operation and maintenance data: Include operating and maintenance data for the following in the project Operation and Maintenance Manual as specified in Division 01 with supplemental requirements as specified in Section 23 01 01.

1. Dampers.
2. Constant airflow regulators.
3. Fire dampers.

1.5 QUALITY ASSURANCE

A. Work of this section shall comply with NFPA 90A and 90B, and SMACNA HVAC DCS.

1.6 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 and location of intended use. Deliver and store in a location directed by the Owner, or as indicated below.

1. Fusible links: One extra link for every four fire dampers installed in the project, with a minimum of two of each type. Store in the fire sprinkler cabinet, unless otherwise directed.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers' names and specific products are described in the articles below to set a standard for materials, quality of construction, options and details, and performance. Provide named products, or equal products by other named manufacturers.

2.2 FLEXIBLE CONNECTIONS

A. Flexible joint fabric: Woven glass fabric with coating, complying with NFPA 701 for fire retardance and NFPA 90A for use in duct systems.

1. For use indoors:

a. Coated with polychloroprene (DuPont "Neoprene"), 30 ounces per square yard (850 g per 0.8 square meter).
b. Basis of design: Ventfabrics "Ventglas."

2. For use outdoors:

a. Coated with DuPont weather-, sunlight- and ozone-resistant "Hypalon," 26 ounces per square yard (732 g per 0.8 square meter).
b. Basis of design: Ventfabrics "Ventlon,"

2.3 SCREENS

A. Bird screen: ASTM E 2016, general industrial-use wire cloth, Grade C, medium light or heavier, nominal 0.5-inch (13-mm) mesh and 0.063-inch (1.6-mm) wire diameter, aluminum or stainless steel.

1. Frame: Removable, rewirable, of same material and finish as the duct or accessory to which it is installed.

2.4 MANUFACTURED UNITS

A. Volume extractors: Equal to Hart & Cooley "Vectrol" Type AVLR, with the equal to Young Regulator Co. No. 429 FD end bearing and No. 443-B 3/8-inch operator; or Type VLK, with worm-driven mechanism accessible through face of diffuser or grille with an 18-inch-long removable key operator.

B. Air turning vanes: Double vane type, constructed in accordance with SMACNA HVAC DCS, from the same material as the duct.

C. Spin-in fittings in accordance with SMACNA HVAC DCS are acceptable for a round take-off connection from a rectangular duct, provided they meet the duct pressure classification.

2.5 DUCT ACCESS DOORS

A. Duct access doors for rectangular ducts:

1. Construction: Comply with SMACNA construction standards as a minimum.
2. Door and frame material:

    a. Galvanized steel duct applications: 24-gauge minimum galvanized steel.
    b. Aluminum duct applications: 20-gauge minimum aluminum.
    c. Stainless steel duct applications: 24-gauge minimum stainless steel.

3. Size:

    a. Duct dimension is 18 inches (457 mm) or more: Minimum 16 inches by 16 inches (406 mm by 406 mm).
    b. Duct dimension is less than 18 inches (457 mm): 16 inches (406 mm) by duct size.

4. Continuous piano hinge; number of cam latches to suit door size. Double-pan insulated doors, one inch (25 mm) thick with one inch (25 mm) thick minimum 3.5-pound (56 kg per cubic meter) density fiberglass insulation and compressed into the pan.
5. Perimeter gaskets sealing frame to duct and door to frame, neoprene or foam rubber.
6. As an option, provide round access doors, complete with safety holding cable, 12 inches (305 mm) diameter minimum.
7. Access doors to fire protection devices shall comply with NFPA 90A.
8. Basis of design:

    a. Square or rectangular access doors: Air Balance, Inc., Model FSA or equal by Ruskin, Inc., Airstream Products Company, Inc., or Commercial Acoustics.
    b. Round access doors: Ventfabrics "Ventlok Twist-In."

B. Duct access doors for round and oval ducts:

1. Sandwich style access door, insulated or uninsulated to match ductwork, metal material to match ductwork interior and exterior, rated for operation at pressures up to positive 20 inches w.g. (5,000 Pa) and down to negative 10 inches w.g. (2,500 Pa), threaded fasteners with rotating handles to draw inner and outer pieces of the door together.

2.6 SOUND ATTENUATORS

A. Manufactured by Dynasonic Systems, Inc., Semco, Ruskin Sound Control, Vibro-Acoustics, Commercial Acoustics Division of Metal Form Manufacturing, Aerosonics, or Price; sizes and types shown and scheduled on the drawings. Field fabrication will not be permitted.

B. Materials: The entire attenuator shall be incombustible, moisture-resistant, and odorless.

1. Outer casings: 22 gauge steel, seams lock-formed. Provide galvanized steel where connected to galvanized ductwork, and provide stainless steel elsewhere.
2. Interior baffles: 24 gauge perforated steel. Provide galvanized steel where connected to galvanized ductwork, and provide stainless steel elsewhere.
3. Acoustical filler material: Fiberglass, packed under compression to 4.5 pound density.

C. Units for duct mounting: Outer casing seams mastic-filled; casings leakproof to a pressure differential of 8 inches w.g. (2,000 Pa). Measure static pressure loss in accordance with ANSI/AMCA 210.

D. Acoustical performance for duct-mounted units: Only tests made at an independent testing laboratory will be considered, and the test data must include acoustical performance and generated noise levels at various airflow velocities. Acoustical and pressure drop performance as scheduled on the drawings.

1. Insertion loss: Measured by the "Duct to Reverberation Room" method with airflow.
2. Generated noise: Measured in accordance with ASHRAE 36B Test Method.

E. The same test sample shall have been used for both acoustic and aerodynamic measurement.

2.7 DAMPERS

A. Material:

1. Where aluminum duct is required by the specifications, provide aluminum dampers in lieu of galvanized steel.
2. Where stainless steel duct is required by the specifications, provide stainless steel dampers in lieu of galvanized steel.

B. Manual volume dampers:

1. 13 inches (330 mm) and larger in height:

a. Balanced multi-louver, opposed blade with maximum blade width of 8 inches (205 mm), rated for a 1500 feet per minute (7.6 meters per second) minimum duct velocity.
b. Bearing: Corrosion resistant, molded synthetic sleeve type bearing.
c. Control shaft: 0.375-inch (9.5-mm) square minimum.
d. Regulator: Locking type, provide with 2-inch-high (50 mm) minimum base for mounting on externally insulated duct. Where duct insulation is thicker than 2 inches (50 mm), provided a taller base coordinated with the duct insulation.
e. Basis of design:

(1) Damper: Ruskin Model MD 35.
(2) Regulator: Young Regulator Co. Model No. 443B.

2. 12 inches (305 mm) or less in height:

a. Constructed from 16-gauge metal with hemmed edges, 0.125-inch (3-mm) maximum gap between duct and damper all around.
b. Control shaft: 0.375-inch (9.5-mm) square minimum.
c. Regulator: Locking type, provide with 2-inch-high (50 mm) minimum base for mounting on externally insulated duct. Where duct insulation is thicker than 2 inches (50 mm), provided a taller base coordinated with the duct insulation.
d. End bearing: Fastens to the outside of the duct with screws and prevents air leakage by encasing the rod and bearing with a metal cover and neoprene gasket.
e. Basis of design:

(1) Regulator: Young Regulator Co. Model No. 443B.
(2) End bearing: Young Regulator Co. Model No. 429 FD.

C. Remote cable operated damper control.

1. Slot diffuser type control: Remote damper controller mounts inside the plenum of a slot diffuser. Control system shall provide up to 35 inch-pounds of push/pull torque:

a. Controller: 14-gauge galvanized-steel rack and pinion controller with positive lock graduations.
b. Cable: Tensile strength of 265,000 pounds:

(1) Inner wire: Type 302 stainless-steel wire 0.054 inches in diameter, comply with AMS 5688 J and ASTM A 313.
(2) Outer wire: 3/16 galvanized steel.

c. Mounting bracket: 18-gauge galvanized-steel with heat-treated steel self-clinching pem fastener.
d. Damper cable control: Provide external-mounted damper controller with cable and adjustable lever arm operation, suitable for commercial grade damper.
e. Basis of design: Young Regulator.

2. Concealed ceiling type control: Remote damper controller with access through a 2.5-inch hole in the ceiling concealed with a cover plate. Control system shall provide up to 35 inch-pounds of push/pull torque:

    a. Finish: Cover plate finish to match existing adjacent finish.
    b. Controller: 14-gauge galvanized-steel rack and pinion controller with positive lock graduations.
    c. Cable: Tensile strength of 265,000 pounds:

        (1) Inner wire: Type 302 stainless-steel wire 0.054 inches in diameter, comply with AMS 5688 J and ASTM-313-98.
        (2) Outer wire: 3/16 galvanized steel.

    d. Mounting cup and cover plate: 301 zinc cup mounted to ceiling framing member with 3-inch zinc plated cover to be held in by 3/4-inch stainless-steel screws.
    e. Damper cable control: Provide external-mounted damper controller with cable and adjustable lever arm operation, suitable for commercial grade damper.
    f. Basis of design: Young Regulator.

D. Counterbalanced backdraft dampers:

1. Frame: Galvanized steel channel frame with factory-applied rust-inhibitive coating.
2. Blades: 16-gauge minimum galvanized-steel, maximum width 7 inches (178 mm), steel shaft with ball bearings, interconnected with linkage. Field adjustable counterbalance.
3. Seals: Neoprene blade seals and neoprene jamb seals.
4. Maximum leakage: 20 CFM/SF (101.6 L/s per square meter).
5. Basis of design: Ruskin Type CBS7.

E. Counterbalanced airfoil backdraft dampers (for use in fan discharge):

1. Frame: Galvanized steel channel frame with factory-applied rust-inhibitive coating.
2. Blades: 18-gauge minimum galvanized-steel airfoil type, with EPDM blade seals and neoprene jamb seals, maximum width 7 inches (178 mm), steel shaft with ball bearings, interconnected with linkage. Field adjustable counterbalance.
3. Seals: EPDM blade seals and stainless steel jamb seals.
4. Maximum leakage: 20 CFM/SF (101.6 L/s per square meter).
5. Basis of design: Ruskin Type CBS8.

2.8 CONSTANT AIRFLOW REGULATORS

A. Adjustable constant airflow regulators with modulating orifices for round duct: Constructed of ABS plastic material to be flame retardant according to UL 94V-0 and safety listed and labeled for heat and visible smoke release according to UL 2043. Perform in the pressure range of 0.2 to 0.8 in. w.g. (50 to 200 Pa) with diameter sizes of 4, 5, 6, 8, and 10 inches to control airflow within 10 percent of rated flow. Field adjustable airflow.

B. Basis of design: American Aldes Model CAR-IIA or Young Regulator Company Model CVR.

2.9 FIRE DAMPERS - CURTAIN STYLE

A. Listed and labeled according to UL 555 for use in dynamic systems.

B. Type for use where a 1.5-hour fire rating is required, and Type for use where a 3-hour fire rating is required.

C. Ratings:

1. Rated for operation at 4,000 feet per minute (20.3 meters per second) and 4" w.g. (995 Pa) static pressure.
2. Fire resistance in accordance with UL 555 for no less than 1.5 hours in barriers rated for 2 hours or less, and no less than 3 hours in barriers rated for more than 2 hours.

D. Blades: Folding, with 100-percent interlocking joints to form a continuous steel curtain when closed. Provide joints with 180 degrees of free movement.

E. Sleeve: Furnish each damper complete with a galvanized steel factory sleeve of length and gauge required for satisfactory installation. Sleeves, angles, and methods of fastening shall meet requirements of manufacturer's UL-approved installation instructions.

F. Actuator: Constant-force, stainless-steel spring.

G. Fusible links: Replaceable, 165 degrees F (74 degrees C) rated.

H. Frame types:

1. Dampers in rated partitions between non-ducted transfer grilles, or dampers terminating at a ducted wall grille or register: Type A frame, installed within or behind grille or register, access by removal of grille or register.
2. Dampers connected to supply air ductwork: 100 percent free opening, Type C frame with welded-seam housing.
3. Dampers connected to return air or exhaust air ducts: 90 percent free opening, Type B frame with welded-seam housing.

I. Basis of design:

1. 1.5-hour fire rating: Ruskin DIBD2 Series.
2. 3-hour fire rating: Ruskin DIBD23 Series.

2.10 FIRE DAMPERS – MULTIBLADE STYLE

A. Listed and labeled according to UL 555 for use in dynamic systems.

B. Type for use where a 1.5-hour fire rating is required, and Type for use where a 3-hour fire rating is required.

C. Ratings:

1. Rated for operation at 4,000 feet per minute (20.3 meters per second) and 8" w.g. (995 Pa) static pressure.
2. Fire resistance in accordance with UL 555 for no less than 1.5 hours in barriers rated for 2 hours or less, and no less than 3 hours in barriers rated for more than 2 hours.

D. Blades: Double-skin airfoil-shaped blades, with a pressure loss of not more than 0.1 inches w.g. (25 Pa) in full-open position at damper-face velocity of 2,000 feet per minute (10.2 meters per second) for a 36-inch by 36-inch (914 mm x 914 mm) damper.

E. Sleeve: Furnish each damper complete with a galvanized steel factory sleeve of length and gauge required for satisfactory installation. Sleeves, angles, and methods of fastening shall meet requirements of manufacturer's UL-approved installation instructions.

F. Actuator: Constant-force, stainless-steel spring.

G. Fusible links: Replaceable, adjustable linkage, 165 degrees F (74 degrees C) rated.

H. Basis of design:

1. 1.5-hour fire rating: Ruskin DFD60 Series.
2. 3-hour fire rating: Ruskin DFD60-3 Series.

2.11 COMBINATION FIRE/SMOKE DAMPERS

A. Listed and labeled in accordance with UL 555S and UL 555.

B. Type for use where a 1.5-hour fire rating is required, and Type for use where a 3-hour fire rating is required.

C. Ratings:

1. Velocity and Pressure:

a. Rated at 4,000 feet per minute (20.3 meters per second) and 8" w.g. (1,990 Pa) static pressure at 250ºF (121ºC) for sizes up to 24-inches x 24-inches (610 mm x 610 mm).
b. Rated at 4,000 feet per minute (20.3 meters per second) and 4" w.g. (995 Pa) static pressure at 250ºF (121ºC) for sizes up to 48-inches x 24-inches (1220 mm x 610 mm).
c. Rated at 3,000 feet per minute (15.2 meters per second) and 4" w.g. (995 Pa) static pressure at 250ºF (121ºC) for sizes up to 120-inches x 36-inches (3050 mm x 914 mm) or 60-inches x 72-inches (1525 mm x 1830 mm).

2. Fire resistance in accordance with UL 555 for no less than 1.5 hours in barriers rated for 2 hours or less, and no less than 3 hours in barriers rated for more than 2 hours.
3. Leakage in accordance with UL Standard 555S no higher than Leakage Class I, 8 cfm per square foot maximum at four inches w.g., (40.6 liters per second per square meter maximum at 1 kPa).

D. Blades: Double-skin airfoil-shaped blades, with a pressure loss of not more than 0.1 inches w.g. (25 Pa) in full-open position at damper-face velocity of 2,000 feet per minute (10.2 meters per second) for a 36-inch by 36-inch (914 mm x 914 mm) damper.

E. Sleeve: Furnish each damper complete with a galvanized steel factory sleeve of length and gauge required for satisfactory installation. Sleeves, angles, and methods of fastening shall meet requirements of manufacturer's UL-approved installation instructions.

F. Actuator: Elevated temperature category B (250 degrees F (121 degrees C)) electric actuator, factory-installed on exterior of sleeve.

1. Type: Spring-return fail-closed that will close damper upon power or pressure interruption.
2. Voltage: Coordinate with available power.
3. Position Indication: Provide with internal switches and contacts to indicate whether damper is open or closed.

G. Basis of design:

1. 1.5-hour fire rating: Ruskin FSD60 Series
2. 3-hour fire rating: FSD60-3 Series.

2.12 DUCT CLAMPS

A. Duct clamps for flexible duct and flexible fabric connections: Positive locking drawbands able to conform to any shape. Fabricate from a single piece of stainless steel, with hex screw and worm gear.

B. Nonmetallic duct clamps for flexible duct connections:

1. Heavy-duty adjustable nylon strap type for 12-inch (305-mm) diameter and smaller flexible ductwork, complying with UL 181.
2. Basis of design: HellermannTyton Corporation

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Duct accessories shall be mounted or installed properly in accordance with the manufacturer's instructions and as indicated on the drawings.

3.2 INSTALLING FLEXIBLE CONNECTIONS

A. Flexible connections: Install using flexible joint fabric where duct connects to motor-driven equipment, and in other locations shown on drawings. Securely clamp flexible connection to duct and collar with duct clamps, providing 1 inch (25 mm) slack. Stitch seams with fiberglass thread.

1. Flexible connections are not required where duct connects to air-handling equipment with internally isolated fans.

3.3 INSTALLING SCREENS

A. Install bird screen in outdoor air and exhaust air connections.

B. Install bird screen at open ended duct terminations and where indicated on mechanical drawings.

3.4 INSTALLING MANUFACTURED UNITS

A. Install necessary devices to balance the air flow to produce air quantities at outlets as indicated on the drawings.

B. Install turning vanes in 90-degree square elbows.

C. Install spin-in fittings as indicated on the drawings. Mechanically fasten to duct main with screws or rivets. Where connecting to lined ductwork, provide fittings with sleeve designed for installing with liner.

3.5 INSTALLING DUCT ACCESS DOORS

A. Install duct access doors in ductwork for access to fire dampers, combination fire/smoke dampers, smoke dampers, ATC dampers, duct coils, control devices, and any other devices, equipment, or components requiring maintenance, service, or adjustment and located inside ducts or adjacent equipment.

B. Provide OSHA-approved labels on doors enclosing fire protection devices. Labels shall have lettering at least 1/2 inch (13 mm) high describing the protection device enclosed.

3.6 INSTALLING SOUND ATTENUATORS

A. Where multiple units are used, seal joints after making connections. Provide steel bands around multiple units. Install duct-mounted units with transitions where required, and pressure test and insulate with ductwork.

3.7 INSTALLING DAMPERS

A. Install dampers at locations indicated on drawings and where required to properly balance the systems and to deliver the air quantities indicated. Each damper shall have substantial operators of proper size with locking facilities.

3.8 INSTALLING FIRE DAMPERS

A. Fire dampers are an integral part of the rated barrier being penetrated. Install sleeves and dampers before beginning installation of the duct system being connected. Do not begin connecting ducts until rated assembly, including installed dampers, has been completed.

B. Install fire dampers where indicated and in accordance with the applicable requirements of the following:

1. Details on drawings.
2. NFPA requirements.
3. Local building code.
4. Manufacturer's UL-approved installation instructions.
5. SMACNA-05.

C. Install fire dampers in sleeves. Coordinate with other trades to properly frame openings so that damper and sleeve assembly can be secured in partition or floor.

1. Do not use dampers and sleeves as a lintel for supporting the wall above the damper. Provide separate steel angles on both sides of wall or floor slab to hold damper and sleeve firmly in place.
2. Sleeve thickness and retaining angle size are contingent on type of duct connection, duct size and damper manufacturer’s requirements. See SMACNA recommendations and NFPA requirements.

D. After damper installation is complete and required ductwork connected, test operation of damper by releasing holding mechanism to see that damper operates freely and properly and closes tight. Make adjustments if required and reset holding mechanism.

E. Provide concrete curbs for damper penetrations in mechanical room floors.

3.9 INSTALLING COMBINATION FIRE/SMOKE DAMPERS

A. Fire and smoke dampers are an integral part of the barrier being penetrated. Install sleeves and dampers before beginning installation of the duct system being connected. Do not begin connecting ducts until rated assembly, including installed dampers, has been completed.

B. Install fire and smoke dampers where indicated and in accordance with the applicable requirements of the following:

1. Details on drawings.

2. NFPA requirements.
3. Local building code.
4. Manufacturer's UL-approved installation instructions.
5. SMACNA-05.

C. Install fire and smoke dampers in sleeves. Coordinate with other trades to properly frame openings so that damper and sleeve assembly can be secured in partition or floor.

1. Do not use dampers and sleeves as a lintel for supporting the wall above the damper. Provide separate steel angles on both sides of wall or floor slab to hold damper and sleeve firmly in place.
2. Sleeve thickness and retaining angle size are contingent on type of duct connection, duct size and damper manufacturer’s requirements. See SMACNA recommendations and NFPA requirements.

D. Coordinate with available power. Provide transformer and wiring as required.

E. Coordinate with installation of fire alarm system for connection to damper actuation.

F. Coordinate with installation of building automation system for connection to damper position switches

G. After damper installation is complete and required ductwork connected, test operation of damper by releasing holding mechanism to see that damper operates freely and properly and closes tight. Make adjustments if required and reset holding mechanism.

H. Provide concrete curbs for damper penetrations in mechanical room floors.

3.10 INSTALLING CONTROL DAMPERS

A. Install control dampers per manufacturer’s recommendations.

B. Coordinate location of damper operator to provide clear service access for operator.

C. After damper installation is complete and required ductwork connected, test operation of damper to see that damper operates freely and properly and closes tight. Make adjustments if required.

END OF SECTION 23 33 00

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 23 33 46 - FLEXIBLE DUCTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Insulated flexible ducts.

B. Flexible duct connectors.

1.2 REFERENCES

A. UL 181: Factory-Made Air Ducts and Air Connectors.

B. NFPA 90A: Standard for the Installation of Air-Conditioning and Ventilating Systems

1.3 SUBMITTALS

A. Product data: For each type of product, include a description, characteristics, materials, composition, finishes, and performance. Include the following:

1. Insulated flexible ducts.
2. Flexible duct connectors.

PART 2 - PRODUCTS

2.1 INSULATED FLEXIBLE DUCTS

A. Insulated flexible duct: UL 181, Class 1, factory pre-insulated, complying with NFPA 90A.

1. Core: Non-metallic airtight polyester supported by galvanized steel wire helix.
2. Insulation: Fiberglass, R-6 (RSI-1.06) minimum.
3. Vapor barrier: Aluminized and reinforced.
4. Pressure Rating: 10 inches w.g. (2,500 Pa) positive and 1 inch w.g. (250 Pa) negative up to an 18 inch (457 mm) diameter.
5. Maximum Air Velocity: 4,000 feet per minute (20 meters per second)
6. Temperature Range: Minus 20 to plus 210 degrees F (Minus 29 to plus 99 degrees C).

B. Flexible duct connectors:

1. Clamps: Stainless-steel bands with cadmium-plated hex screw to tighten band with a worm-gear action, to suit duct size.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Before fabricating ductwork, make field measurements and coordinate layout of ductwork shown on the drawings with building components and work of other trades. Resolve conflicts and obtain written approval for deviations before fabrication.

B. Generally, it is intended that all horizontal ductwork be a minimum of 10 inches (255 mm) above suspended ceiling (where applicable) to allow for removal of ceiling panels and ceiling-mounted light fixtures and devices.

C. Provide insulated flexible ducts where shown on drawings:

1. Install ducts fully extended.
2. Do not bend ducts across sharp corners.
3. Lay out bends and turns with the longest practicable radius.
4. Bends of flexible ducting shall not have an inside radius less than one duct diameter.
5. Avoid contact with metal fixtures, water lines, pipes, or conduits.
6. Install flexible ducts in a direct line, without twists, or turns.
7. Lengths shall not exceed 5 feet (1.5 m).

D. Connections: Coat at least 3 inches inside the end of the flexible duct core with duct sealant, install over the rigid duct, and secure with a duct clamp. After replacing the insulation and vapor barrier, secure with another duct clamp.

E. Supporting flexible ducts:

1. Suspend flexible ducts with bands 1-1/2 inches (38 mm) wide or wider and spaced a maximum of 48 inches (1,200 mm) apart. Maximum centerline sag between supports shall not exceed 1/2 inch (13 mm) per 12 inches (300 mm).
2. Install extra supports at bends approximately one duct diameter from center line of the bend.
3. Ducts may rest on ceiling joists or truss supports. Spacing between supports shall not exceed the maximum spacing per manufacturer's written installation instructions.
4. Vertically installed ducts shall be stabilized by support straps at a maximum of 72 inches (1,800 mm) on center.

END OF SECTION 23 33 46

SECTION 23 34 00 - HVAC FANS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Exhaust, circulating, and supply fans.

B. Accessories.

1.2 RELATED SECTIONS

A. UL label, demonstration, training, and equipment installation: Section 23 05 00.

B. Motors: Section 23 05 13.

C. Equipment hangers and supports: Section 23 05 29.

D. Vibration control supports: Section 23 05 48.

1.3 REFERENCES

A. ASHRAE 90.1: Energy Standard for Sites and Buildings Except Low-rise Residential Buildings.

1.4 SUBMITTALS

A. Product data: For each type of fan, include the following:

1. Product description, rated capacities, operating characteristics, materials, finishes, and furnished specialties and accessories.
2. Certified fan curves with system operating conditions indicated. Include static pressure, brake horsepower, and static efficiency plotted against air volume.
3. Verification that products comply with ASHRAE 90.1 fan efficiency requirements.
4. Dampers, including housings, linkages, and operators.
5. Fan speed controllers.
6. Certified fan sound power ratings.

B. Product schedule: Provide a fan schedule with the following as a minimum:

1. Equipment identification tags.
2. Unit electrical characteristics.
3. Equipment model numbers, types, nominal sizes, and arrangements.
4. Operating conditions and flow rates.

5. Motor types, electrical characteristics, and accessories.
6. Furnished specialties and accessories.
7. Verification of compliance with any additional information scheduled on the drawings.

C. Shop drawings:

1. Unit shop drawings: Include the following for each type of fan:

   a. Dimensioned plans, elevations, and sections of complete assembled units with accessories.
   b. Required service clearances.
   c. Weights, loads, and support and attachment details.
   d. Details of equipment components and assemblies, and any required field assembly.
   e. Location and size of each field connection.
   f. Diagrams for power, signal, and control wiring, differentiating between manufacturer-installed and field-installed wiring.

2. Curb shop drawings.

   a. Dimensioned plans, and sections of complete assembled units.
   b. Weights, loads, and support and attachment details.
   c. Details of and any required field assembly.

D. Operation and maintenance data: Include operating and maintenance data for each fan in the project Operation and Maintenance Manual as specified in Division 01 with supplemental requirements as specified in Section 23 01 01.

1.5 QUALITY ASSURANCE

A. UL label: As specified in Section 23 05 00, Common Work Results for HVAC.

B. Fans shall meet the energy performance requirements of ASHRAE 90.1.

C. Fans shall be tested and rated in accordance with the applicable AMCA Standard Test Code and Certified Rating Program and bear AMCA Certified Air Rating Seal.

D. Make fan selections to the right of the peak static pressure point and not on any flat portion of the fan curve. Generally, fan selection shall be in the 50 to 80 percent range of wide open volume.

1.6 COORDINATION

A. Coordinate colors selected for roof-mounted fans with colors of other roof-mounted equipment.

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 and location of intended use. Deliver and store in a location directed by the Owner, or as indicated below.

1. Fan belts: One set for each belt-driven fan.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Scheduled units are the basis for design of the project. The manufacturers listed also provide units of acceptable quality. If units by any of these manufacturers should be proposed, verify that they meet requirements specified in Division 01 and the article "Product Options" in Section 23 01 01, and submit shop drawings and product data as specified in Part 1 above.

B. Exhaust, circulating, and supply fans:

1. Aerovent, a Twin City Fan Company
2. Acme Engineering and Manufacturing
3. Greenheck Fans
4. Jenco Fan
5. Loren Cook, Inc.
6. Penn Barry
7. Twin City Fans and Blowers
8. Or approved equal.

2.2 GENERAL REQUIREMENTS

A. Provide type, size, configuration, capacity, class, and current characteristics indicated on the drawings.

B. Units shall be factory-assembled, -wired, -finished, and -tested, and shipped in one piece.

C. Motors:

1. Provide motors that meet requirements in Section 23 05 13, Common Motor Requirements for HVAC Equipment.
2. Where electronically commutated motors are schedule, provide a controller with both of the following:

a. Provide with a potentiometer for adjustment of constant speed operation, field-adjustable with a screwdriver to adjust the fan speed, and low voltage input terminals to receive a control signal from the building automation system to start and stop the fan motor.

b. Provide with low voltage input terminals to receive a control signal from the building automation system to start and stop the fan motor and control the motor speed for variable speed operation.

3. Provide single-phase constant speed motors for directly driven units with solid-state variable speed control connected downstream on the load side of the disconnect switch, unless otherwise indicated on the drawings.

D. Fans shall be statically and dynamically balanced. Fans controlled by variable frequency drives shall be balanced at all operating speeds and be free of surge or vibrations due to harmonic frequencies.

E. Shaft bearings: Unless otherwise indicated, provide the following:

1. Self-aligning ball bearings.
2. Rigidly supported from the fan structural base or frame.
3. Grease lubricated.
4. Extended lubrication lines to an easily accessible location.

2.3 EXHAUST, CIRCULATING, AND SUPPLY FANS

A. In-line fan (square): Fan housings and other parts shall be aluminum or steel. Provide support brackets for mountings as shown on drawings. Directly driven units shall have motors out of air stream and shall be prewired to an external twist-lock receptacle.

1. Wheel: Backward-inclined, non-overloading, airfoil aluminum blades, inlet cones.
2. Direct drive or belt-driven as scheduled.
3. Motor and fan support:

a. Belt-driven: Motors on shall be supported on an adjustable base on the exterior of the fan casing with shaft bearings encased within the fan tube.
b. Direct-drive: Motor mounted on steel base within fan casing.
c. Moving parts shall be provided with vibration isolation.

B. Low airflow resin fan: For hydraulic oil tank venting in elevator shaft. Provide with manufacturer supplied mounted brackets and hardware. Suitable for outdoor use. Equal to Fantech model indicated on drawings.

2.4 ACCESSORIES

A. Bird screens: Specified in Section 23 33 00, Duct Accessories.

B. Provide a disconnect switch without overload protection under the weather hood of roof-mounted units, factory-wired to motor and mounted independently of the motor.

C. Identification: Each fan shall be identified with a fan number no less than 0.5 inch high, as shown in the fan schedule, on an aluminum strip riveted to hood of roof fans and on the motor side of frame for wall fans.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install equipment as indicated on the drawings. Comply with requirements in Section 23 05 00.

B. Provide bird screens for fans without ducted inlets.

3.2 EXHAUST, CIRCULATING, AND SUPPLY FANS

A. In-line fans:

1. Suspend from structure above.
2. Provide vibration isolation. Comply with requirements in Section 23 05 48.

B. Low airflow resin fan:

1. Mounted fan to steel support system with manufacturer provided support brackets and hardware. Extend steel support system from roof curb as indicated on drawings.

3.3 ACCESSORIES

A. Fans without supply duct on fan inlet shall be provided with bird screens.

3.4 ADJUSTING

A. Coordinate with air balancing to adjust fan speed to obtain the airflow and static pressure required. If necessary, provide belts, sheaves, or other parts required to complete balancing with no addition to the contract sum.

3.5 DEMONSTRATION AND TRAINING

A. Provide demonstration and training as specified in Section 23 05 00.

END OF SECTION 23 37 13

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 23 37 13 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Ceiling- and wall-mounted diffusers, registers, and grilles.

B. Floor-mounted diffusers and grilles.

1.2 RELATED SECTIONS

A. Balancing: Section 23 05 93.

B. Automatic control dampers: Section 23 09 07.

C. Fire and smoke dampers: Section 23 33 00.

D. Louvers: Division 08.

E. Filters: Section 23 41 00.

1.3 REFERENCES

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

1.4 SUBMITTALS

A. Product data: For each type of diffuser, register, and grille, include the following:

1. Product description, rated capacities, operating characteristics, materials, finishes, and furnished specialties and accessories.
2. Frame style.
3. Mounting details.
4. Available materials and finishes.
5. Throw, static pressure drop, and noise ratings

B. Product schedule: Provide a diffuser, register, and grille schedule with the following as a minimum:

1. Location
2. Quantity
3. Type
4. Size
5. Function

6. Material
7. Finish

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Grilles, registers and diffusers:

1. Hart and Cooley Inc.
2. Krueger.
3. Metalaire.
4. Nailor Industries, Inc.
5. Price Company.
6. Titus Products.
7. Or approved equal.

2.2 DIFFUSERS, REGISTERS, AND GRILLES

A. Devices of one of the named manufacturers, with performance data, characteristics, features, and accessories of the model or type specified or indicated on the drawings. Model numbers specified below are Krueger except as noted otherwise.

B. See architectural drawings for type of walls and ceilings where diffusers, grilles, and registers are required. Coordinate margin and frame of each device with the substrate in which it will be installed. Where devices are installed in suspended ceilings, assure that they will fit correctly in the type of suspension supports shown or specified.

C. Materials and finish:

1. Construction:

a. Steel where mounted in ceilings.
b. Either aluminum or steel where mounted in walls near ceiling.
c. Heavy-duty steel where mounted in walls near floor.
d. Welded or mechanically fastened cores in diffusers located in gymnasium.

2. Aluminum devices shall be all aluminum construction, including dampers, where specifications call for aluminum or stainless steel ductwork.
3. Finish:

a. White enamel unless indicated otherwise.
b. Color selected by Architect.

D. Where narrow margin grilles and registers are specified or indicated on the drawings, they shall be provided with mounting frames except where mounted on ductwork.

E. Provide stainless-steel safety cables to diffusers to prevent the face of each diffuser from falling during removal.

2.3 SUPPLY DIFFUSERS

A. Throw length is based on performance data of the scheduled or specified manufacturer and model. Select units of other manufacturers whose performance data meet the required conditions. Throw direction of square and rectangular ceiling diffusers shall be four-way unless otherwise indicated on the drawings.

B. Square and rectangular ceiling diffusers: Square, rectangular, or round neck and removable core. Each unit shall have a straightening grid. The grids shall be set at right angles to one another. Basis of design: Krueger Series SH.

1. Frame Style 23 (panel diffuser): Diffusers mounted in nominal 24 by 24-inch (600 by 600-mm) or 24 by 48-inch (600 by 1200-mm) flat steel panels as indicated on the drawings, to lay into suspended ceiling grid of acoustical ceilings.
2. Frame Style 22 (surface mount): Diffuser with flat frame to mount at underside of plaster or gypsum wallboard ceilings.

C. Round, adjustable diffuser with round neck:

1. Surface-mounted frame, 360 degree discharge with infinitely field-adjustable vane settings for discharge pattern from vertical to horizontal, combination air extractor/damper and grid with concealed adjustment, duct-mounted straightening grid (shipped loose for field installation). Provide safety cables to inner cones to prevent from falling during removal.
2. Basis of design: Krueger Series RA2.

D. Linear slot diffusers:

1. Architectural linear slot diffuser (linear flow bar): Equal to Titus Flowbar or Price, Inc. Adjusta-Slot with number of slots and size as indicated on drawings. Provide adjustable pattern controllers where indicated for ceiling mounted with directional airflow. Blades and internal surfaces exposed to view shall be painted black. For installation in gypsum ceiling, provide concealed frame style equal to Price Type 22. For installation in an accessible ceiling tile system, provide frame style equal to Price Type 25 without manufacturer plenum. Where units are suspended from structure and exposed, provide with frame style equal to Price Type 25 with frame painted black. Provide alignment tabs where multiple units are joined together, and mitered corner at 90 degrees turn.

2.4 SUPPLY GRILLES AND REGISTERS

A. For registers, provide opposed-blade dampers with linkage and adjustment through grille face with a screwdriver or Allen wrench. For plaster wall or ceiling construction, provide with plaster frames.

B. Wall-mounted near ceiling:

1. Grilles and registers, double deflection with horizontal face bars, minimum 1.25-inch (32-mm) overlap margin.
2. Basis of design:

a. Grilles: Krueger 880H (steel); 5880H (aluminum).
b. Registers: Krueger 880H-OBD (steel); 5880H-5OBD (aluminum).

C. Ceiling-mounted:

1. Registers, individually adjustable curved air deflection blades, 1-, 2-, 3-, or 4-way air pattern as indicated on the drawings, minimum 1.25-inch (32-mm) overlap margin.
2. Basis of design: Krueger 5180-OBD (aluminum); 180-OBD (steel).

D. Spiral duct mounted (SG-A)

1. Material: Aluminum.
2. Finish: white baked enamel finish.
3. Face Blade Arrangement: Horizontal vertical spaced three-quarter (3/4) inch apart.
4. Core Construction: Integral.
5. Rear-Blade Arrangement: Horizontal vertical spaced three-quarter (3/4) inch apart.
6. Mounting: Spiral-duct mounted.
7. Damper Type: Not Required.
8. Accessories: Front rear-blade gang operator.
9. Basis of design: Titus model S300.

2.5 RETURN AND EXHAUST GRILLES AND REGISTERS

A. For registers, provide opposed-blade dampers with linkage and adjustment through grille face with a screwdriver or Allen wrench. For plaster wall or ceiling construction, provide with plaster frames.

B. Ceiling-mounted and wall-mounted near ceiling: Grilles and Registers, fixed horizontal face bars set at 35 to 45 degrees deflection, minimum 1.25-inch (32-mm) margin.

1. Basis of design:

a. Grilles: Krueger S-80H (steel); S-580H (aluminum).
b. Registers: Kruger S-80H-OBD (steel); S-580H-5OBD (aluminum).

C. Wall-mounted near floor:

1. Grille and registers, heavy-duty steel construction, 14 gauge fixed horizontal face bars set at 30 to 40 degrees deflection, spaced on 0.5 to 0.7-inch (13 to 18-mm) centers, and 14 gauge vertical support bars on maximum 8-inch centers, minimum 1.25-inch (32-mm) margin.

2. Basis of design:

    a. Grilles: Krueger S-480H.
    b. Registers: Krueger S-480H-OBD.

D. Square and rectangular ceiling diffusers used for return or exhaust: Same as specified above for diffuser.

E. Filter grilles, ceiling-mounted (FRG):

1. Construction: Steel, hinged grille face, fixed horizontal bars set at 35 to 45 degrees deflection.
2. Filter access fasteners:

    a. Quick-turn fasteners.

3. Filter rack depth:

    a. 1-inch (25-mm).

4. Frame style:

    a. Frame F23 for installation laying into suspended ceiling grid:

        (1) 24 by 24-inch (600 by 600-mm).

    b. Surface-mounted frame for installation in plaster or gypsum wallboard ceilings.

5. Disposable flat panel filters for regular service:

    a. MERV 8/8A.

6. Basis of design: Krueger Model 580H 5FF.

F. Filter grilles, wall-mounted near floor:

1. Heavy duty steel construction, hinged grille face with 14 gauge fixed horizontal bars set at 30 to 40 degrees deflection, spaced on 0.5 to 0.7-inch (13 to 18-mm) centers, and 14 gauge vertical support bars on maximum 8-inch (203 mm) centers.
2. Tamperproof filter access fasteners.
3. Filter rack depth:

    a. 1-inch (25-mm).

4. Frame style: Minimum 1.25-inch (32-mm) margin for surface mounting.
5. Disposable flat panel filters for regular service:

    a. MERV 8/8A.

6. Basis of design: Krueger Model S-480H.

2.6 TRANSFER GRILLES

A. Ceiling-mounted and wall-mounted near ceiling: S80H (steel) or S-580H (aluminum), fixed horizontal face bars set at 35 to 45 degrees deflection, minimum 1.25-inch margin.

B. Wall-mounted near floor: S-480-H (steel), heavy duty, 14 gauge fixed horizontal bars set at 30 to 40 degrees deflection, spaced on 0.5- to 0.7-inch (13 to 18-mm) centers, and 14 gauge vertical support bars on maximum 8-inch (205-mm) centers, minimum, (32-mm) margin.

PART 3 - EXECUTION

3.1 INSTALLING GRILLES, REGISTERS AND DIFFUSERS

A. Securely attach grilles, registers, and diffusers in place. Do not install the grilles and registers until duct interiors have been painted as specified in Section 23 05 00, Common Work Results for HVAC.

B. Install all air control devices complete with the accessories specified, securely attached in position. Make operating devices accessible.

C. Adjust diffuser straightening grids to provide uniform air distribution above diffuser face.

D. Adjust supply register deflectors to provide uniform air distribution to the areas served.

E. Provide filters for filter return grilles as specified in Section 23 41 00.

END OF SECTION 23 37 13

SECTION 23 41 00 - PARTICULATE AIR FILTRATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Disposable filters.

B. Filter gauges.

C. Filter housings.

1.2 RELATED SECTIONS

A. UL label, demonstration, training, and equipment installation: Section 23 05 00.

B. Motors: Section 23 05 13.

C. Filter grilles: Section 23 37 13.

D. Air-handling units:

1. Air-handling units with coils: Section 23 73 22.

E. Variable refrigerant flow HVAC systems: Section 23 81 29

1.3 REFERENCES

A. ASHRAE 52.2: Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size, including Appendix J for MERV ‘A’ testing

B. AHRI 850: Commercial and Industrial Air Filter Equipment.

C. IEST-RP-CC034.2: HEPA and ULPA Filter Leak Tests.

D. References for packaged bag-in bag-out filtration systems:

1. ASME N510: Testing of Nuclear Air Treatment Systems.
2. ASME NQA-1: Quality Assurance Requirements for Nuclear Facility Applications.

E. References for fan-filter units with HEPA filters:

1. ASTM D1308: Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
2. ASTM D4752: Standard Practice for Measuring MEK Resistance of Ethyl Silicate (Inorganic) Zinc-Rich Primers by Solvent Rub.

1.4 DEFINITIONS

A. MERV: Minimum Efficiency Reporting Value as determined by ASHRAE 52.2 and Appendix J.

B. Temporary service: Operation of equipment during the construction period, before air balancing.

C. Regular Service: Operation of equipment during air balancing and normal use during occupancy.

1.5 SUBMITTALS

A. Product data: For each type of product, include a description, characteristics, materials, composition, finishes, and performance. Include the following:

1. Filters:

a. Include filter ratings, rated flow capacity, and fire classification.
b. Submit a single manufacturer for filters. Submittals that include multiple filter manufacturers are not acceptable.

2. Filter gauges.
3. Filter housings.

B. Product schedule:

1. Provide a schedule of locations of filters, identifying equipment and filter types and sizes, including pre-filters and final filters.

C. Operation and maintenance data:

1. Include a copy of the filter schedule.

1.6 QUALITY ASSURANCE

A. Source limitation: Provide all filters for regular service from a single manufacturer.

B. Test filters by methods described in ASHRAE 52.2 Appendix J.

C. Comply with AHRI 850.

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 and location of intended use. Deliver and store in a location directed by the Owner, or as indicated below.

1. Three sets of permanent filters for every item of equipment requiring filters, as follows:

a. One set of filters for regular service, installed before air balancing.
b. Remaining sets of filters for regular service, provided as extra materials for future use.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis-of-design products: Subject to compliance with requirements, provide specified or scheduled products, or comparable product by one of the following:

1. Filters and filter-holding systems:

a. AAF International.
b. Airguard; Clarcor Air Filtration Products
c. Camfil Farr
d. Filtration Group
e. Flanders Filters, Inc.
f. Or approved equal.

2. Filter Gauges:

a. Dwyer Instruments, Inc.
b. H.O. Trerice Co.
c. Miljoco Corporation
d. Weksler Instruments
e. Or approved equal.

2.2 FILTERS, GENERAL

A. Coordinate with approved manufacturers of the various approved air-handling units and equipment for filter size and thickness required.

B. Thickness: Generally, large air-handling units shall have filters 2 inches and more thick. Smaller units such as fan-coil units may be limited to filters 2 inches thick.

C. Filter face areas: As scheduled, or equivalent to one square foot for each 300 cfm.

D. Size and thickness: Size and thickness required for each application

2.3 DISPOSABLE FILTERS

A. Disposable filters, MERV 8/8A:

1. Pleated media, 1-inch (25-mm), 2-inch (50-mm), or 4-inch (100-mm) depth, disposable.

2. UL 900: Class 2.
3. Efficiency:

    a. ASHRAE 52.2: MERV 8.
    b. ASHRAE 52.2 Appendix J: MERV8A.

4. Medium: Non-woven, reinforced synthetic fabric, pleated.
5. Medium support grid: Welded wire bonded to medium. Medium shall not oscillate nor pull away from support grid.
6. Enclosing frame: High-wet-strength beverage board, with diagonal supports bonded to media pleats. Filter media continuously bonded to frame so that no air leaks around edges.
7. Initial resistance:

    a. 1-inch (25-mm): 0.23 inches w.g. (0.08 kPa) at 350 feet per min. (1.8 meters per sec.).
    b. 2-inch (50-mm): 0.31 inches w.g. (0.08 kPa) at 500 feet per min. (2.5 meters per sec.).
    c. 4-inch (100-mm): 0.27 inches w.g. (0.08 kPa) at 500 feet per min. (2.5 meters per sec.).

8. Recommended maximum final resistance: 1 inch w.g. (0.25 kPa).
9. Guaranteed structural integrity with a pressure drop of up to 2 inches w.g. (0.5 kPa).
10. Basis of design: Camfil Farr “Farr 30/30”.

B. Disposable filters, MERV 13/13A:

1. Pleated media, 4-inch (100-mm) depth, disposable.
2. UL 900: Class 2.
3. Efficiency:

    a. ASHRAE 52.2 MERV 13.
    b. ASHRAE 52.2 Appendix J: MERV13A.

4. Medium: Fine pleated glass media bonded to a beverage board holding frame.
5. Enclosing frame: High-wet-strength beverage board, with diagonal supports bonded to media pleats. Filter media continuously bonded to frame so that no air leaks around edges.
6. Initial resistance: 0.5 inches w.g. (0.12 kPa) at 500 feet per minute (2.5 meters per second).
7. Recommended maximum final resistance: 1 inch w.g. (0.25 kPa).
8. Guaranteed structural integrity with a pressure drop of up to 5 inches w.g. (1.24 kPa).
9. Basis of design: Camfil Farr “Opti-Pac”.

2.4 FILTER GAUGE

A. Filter gauge:

1. Range 0 to 3 inches w.g. (0 to 0.75 kPa), with divisions of 0.10 inch (0.025 kPa).

2. Accessory package: To adapt the "Magnehelic" gauge for use as a filter gauge. Package includes aluminum surface-mounting bracket with screws, two 5-foot lengths of 0.25-inch aluminum tubing, two static pressure tips, and two molded plastic vent valves, with integral compression fittings on both tips and valves.
3. Basis of design: Dwyer "Magnehelic", Series 2000.

2.5 FILTER HOUSING

A. Construction: 16-gauge galvanized steel, braced with corner posts of Z channels, equipped with extruded aluminum tracks designed to accommodate filter panels.

B. Provide insulated double wall construction where connected ductwork requires insulation.

C. Provide access doors to permit filter replacement from either side. Provide with neoprene gaskets around each access door.

D. Depth and Capacity:

1. 13-inch (330-mm) depth, accommodating a 2-inch (50-mm) pre-filter and a 2-inch (50-mm) or 4-inch (100-mm) final filter.

E. Basis of design: Camfil Farr Glide-Pack.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. See schedules on drawings and equipment specification sections for filtration requirements.

B. Where throwaway filters are indicated for regular service, provide MERV 6 filters as a minimum.

C. Provide custom filter thicknesses and dimensions to match equipment requirements.

3.2 TEMPORARY FILTERS

A. Before startup of each item of equipment requiring a filter, install filters for temporary service.

1. Provide MERV 8/8A filters for temporary service for equipment with a single filter and a rack for disposable filters.
2. For equipment with pre-filter and final filter, and racks for disposable filters, provide specified pre-filters or MERV 8/8A filters for temporary service, whichever has a higher MERV rating.
3. For equipment without a rack for disposable filters (such as equipment with a permanent washable filter), provide MERV 8 filter roll material to protect and cover return air openings.

B. Provide temporary filter changes required in Division 01 for Indoor Air Quality Management. Dispose of used filters.

C. Immediately prior to air balancing, remove temporary filters, wash any permanent washable filters, and install filters required for regular service.

3.3 INSTALLING FILTER GAUGE

A. Mount across filter section in accordance with manufacturer's instructions.

3.4 INSTALLING FILTER HOUSINGS

A. Install in conformance with SMACNA HVAC Duct Construction Standards.

B. Attach securely, following manufacturer's installation instructions.

END OF SECTION 23 41 00

SECTION 23 63 13 - AIR-COOLED REFRIGERANT CONDENSING UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Air-cooled condensing units designed for installation outdoors.

1.2 RELATED SECTIONS

A. Refrigeration equipment service, warranty, and maintenance: Section 23 01 00.

B. UL label, demonstration, training, and equipment installation: Section 23 05 00.

C. Motors: Section 23 05 13.

D. Equipment supports: Section 23 05 29.

E. Vibration control supports: Section 23 05 48.

F. Refrigeration piping: Section 23 23 00.

G. Associated equipment:

1. Air-handling units with coils: Section 23 73 22.

1.3 REFERENCES

A. ASHRAE 15: Safety Standard for Refrigeration Systems.

B. ASHRAE 90.1: Energy Standard for Sites and Buildings Except Low-rise Residential Buildings.

1.4 PERFORMANCE REQUIREMENTS

A. Design of the HVAC system, including associated work of other design disciplines and trades, is based on scheduled and specified equipment. If a different item of equipment should be proposed, as permitted under the article "Acceptable Manufacturers," ascertain that it will:

1. Perform to the scheduled and specified capacities.
2. Make no additional demands on other systems such as electricity.
3. Meet or exceed all specified requirements.

1.5 SUBMITTALS

A. Product data: For each type of air-cooled condensing unit, include the following:

1. Product description, rated capacities, operating characteristics, materials, finishes, and furnished specialties and accessories.
2. Refrigerant charge quantity and type.
3. Verification of compliance with ASHRAE 90.1.
4. Verification of compliance with CEE efficiency requirements.

B. Product schedule: Provide an air-cooled condensing unit schedule with the following as a minimum:

1. Equipment identification tags.
2. Unit electrical characteristics.
3. Equipment model numbers, types, nominal sizes, and arrangements.
4. Operating conditions and flow rates.
5. Operating capacities at operating conditions and flow rates.
6. Furnished specialties and accessories.
7. Verification of compliance with any additional information scheduled on the drawings.

C. Shop drawings:

1. Unit shop drawings: Include the following for each air-cooled condensing unit:

a. Dimensioned plans, elevations, and sections of complete assembled units with accessories.
b. Required service clearances.
c. Weights, loads, and support and attachment details.
d. Details of equipment components and assemblies.
e. Details of and any required field wiring or field assembly.
f. Location and size of each field connection.
g. Diagrams for power, signal, and control wiring.

2. Refrigeration system shop drawings:

a. Provide design of refrigeration piping prepared by manufacturer of the refrigeration compressor. Show oil traps and accessories specified in Section 23 23 00, Refrigerant Piping, as well as those required by the manufacturer.
b. Provide a condensing unit capacity curve showing that direct expansion coil capacity balances with the corresponding condensing unit.

D. Coordination drawings: Unit shown on drawings is based on the dimensions of the design basis unit specified in Part 2 below. If another acceptable manufacturer's unit should be proposed, ascertain that it will fit in the available space. Include, with shop drawings of the unit, scale drawings similar to the contract drawings, including plans and sections showing any changes in wiring, arrangement, or access made necessary to accommodate the unit proposed.

E. Warranty: Refrigeration equipment and compressor warranties required in Section 23 01 00, executed to the Owner.

F. Operation and maintenance data: Include operating and maintenance data for each condensing unit in the project Operation and Maintenance Manual as specified in Division 01 with supplemental requirements as specified in Section 23 01 01.

1.6 QUALITY ASSURANCE

A. UL label: As specified in Section 23 05 00, Common Work Results for HVAC.

B. Comply with ASHRAE 15 for equipment design, construction, leak testing, and installation.

C. Air-cooled condensing units shall meet the energy performance requirements of ASHRAE 90.1.

D. COMAR 14.26.03: Packaged equipment with over 20 tons of cooling capacity shall meet the Tier 2 requirements for minimum efficiencies for unitary commercial air conditioners or heat pump units of the Consortium for Energy Efficiency (CEE), in effect on 1 January 2002.

1.7 WARRANTY

A. Provide refrigeration equipment and compressor warranties required in Section 23 01 00.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis-of-design product: Subject to compliance with requirements, provide the specified or scheduled Trane Co. product, or comparable product by one of the following:

1. AAON
2. Addison
3. Or approved equal.

2.2 GENERAL REQUIREMENTS

A. Provide type, size, configuration, capacity, and current characteristics indicated on the drawings.

B. Provide motors that meet requirements in Section 23 05 13, Common Motor Requirements for HVAC Equipment.

C. Refrigerant:

1. R-32 or R-454B.
2. Ship with a shipping charge of refrigerant or nitrogen and seal.

3. Provide a full charge of refrigerant and oil in the field.
4. See Section 23 23 00 for refrigerant piping work.

2.3 HEAT PUMP AIR-COOLED CONDENSING UNITS

A. Common requirements:

1. Factory-assembled and factory–tested.
2. Pressure tested.
3. Designed for use with the specified refrigerant.
4. AHRI certified.
5. Unit shall have the size, capacity and current characteristics indicated on the drawings.
6. Unit shall meet scheduled performance requirements when matched with the associated evaporator coil.
7. Comply with regulatory requirements for efficiency.
8. With controls provided, unit shall operate in cooling mode at capacity shown on drawings when ambient air (air entering condenser) is within the range from 115 degrees F (46 degrees C) down to the low ambient temperature shown on drawings.
9. With controls provided, unit shall operate in heating mode at capacity shown on drawings with ambient air down to the low ambient temperature shown on drawings.

B. Casing:

1. Weatherproof for outdoor installation, galvanized steel.
2. Finish: Baked enamel.
3. Openings for power and refrigerant connections.
4. Removable panels allowing access for servicing.
5. Access door for controls.
6. Hail guard protection for all condenser coils.
7. Tool lock on all access doors.

C. Condenser coil:

1. Fins: aluminum.
2. Tubes: seamless aluminum or copper tubes.
3. Circuited for sub-cooling.

D. Condenser fan: Provide safety guard for each fan.

1. Propeller: Statically and dynamically balanced.
2. Motor:

    a. TEFC or TEAO.
    b. Permanent split-capacitor unless otherwise indicated.
    c. Variable speed electronically commutated motor where scheduled.

3. Motor and fan support: Mounted on resilient supports.

E. Compressor and refrigeration circuits:

1. Provide the minimum number of compressors as scheduled.
2. Provide scroll compressors.
3. Provide with on-off capacity control where no other type of control is indicated.
4. Provide variable speed compressors with brushless permanent magnet motors where scheduled.
5. Fully hermetic design with external vibration isolators.
6. Centrifugal or positive displacement oil pump.
7. Crankcase heater.
8. Hot gas muffler.
9. Pressure relief valve.
10. Suction line accumulator.
11. Filter dryer.
12. Service valves and connection fittings for refrigerant piping.
13. Isolation solenoid valves and refrigerant pump down cycle for condensing units 20-tons tons and larger in capacity.
14. Reversing valve.
15. Where hot gas reheat is schedule, provide a hot gas reheat control valve and valve actuation controls.
16. For units scheduled with low ambient cooling operation, provide cooling operation down to 0 degrees F (-17.8 degrees C). For all other units, provide cooling lockout thermostat to prevent operation below 55 degrees F (13 degrees C).
17. Low ambient heating operation:

    a. Provide low ambient heat pump heating and defrost cycle.

18. Provide a minimum of two compressors and two independent refrigeration circuits in condensing units with a capacity larger than 10-tons. Tandem compressor arrangements serving a single condensing unit refrigeration circuit are not acceptable.
19. Provide a minimum of two compressors and two independent refrigeration circuits in condensing units serving equipment with multiple independent refrigeration circuits. Tandem compressor arrangements serving a single condensing unit refrigeration circuit are not acceptable.
20. Tandem compressor arrangements serving a single condensing unit refrigeration circuit are only acceptable for condensing units with a capacity 10-tons and smaller serving equipment with a single refrigeration circuit.

F. Power

1. Provide single-point power connection.
2. Provide phase loss protection for three-phase equipment.

G. Controls:

1. Factory-wired.
2. Control circuit transformer.
3. Condenser fan cycle control.
4. Compressor capacity control compatible with compressor style (where applicable).

5. Compressor anti-short-cycle protection.
6. Discharge line thermostat.
7. Refrigerant high-pressure and low-pressure switches.
8. Compressor overload devices.
9. Compressor contactors.
10. Compressor electrical circuit overload protection.
11. Unit supplier shall cooperate with automatic temperature control subcontractor to implement the control sequence shown on the drawings and required by the manufacturer.
12. Reversing valve controls.
13. Defrost cycle.
14. Control cabinet with hinged access door for condensing units 20-tons tons and larger in capacity.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment as indicated on the drawings. Comply with requirements in Section 23 0500.

B. Support:

1. Units mounted at grade: Mount on structural foundation. See drawings for details.

C. Vibration isolation:

1. Units mounted at grade: Provide neoprene waffle pad vibration isolation. Comply with requirements of Section 23 05 48.

D. Vent relief valves to atmosphere with steel pipe or copper tubing in accordance with applicable codes.

E. Install hot-gas loading system on compressor where scheduled.

3.2 REFRIGERATION SYSTEM START-UP AND SERVICE

A. Provide refrigeration system start-up by a factory-trained service and maintenance agency. Comply with requirements in Section 23 01 00.

B. Provide refrigeration system service during the project correction period by a factory-trained service and maintenance agency. Comply with requirements in Section 23 01 00.

3.3 DEMONSTRATION AND TRAINING

A. Provide demonstration and training as specified in Section 23 05 00.

END OF SECTION 23 63 13

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 23 73 22 – AIR-HANDLING UNITS WITH COILS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Modular air-handling units installed indoors.

1.2 RELATED SECTIONS

A. UL label, demonstration, training, and equipment installation: Section 23 05 00.

B. Motors: Section 23 05 13.

C. Filters: Section 23 41 00.

D. Condensing units: Section 23 63 13.

E. Disconnect switches: Division 26.

F. Variable frequency drives: Division 26.

1.3 REFERENCES

A. AHRI 260: Sound Rating of Ducted Air Moving and Conditioning Equipment.

B. AHRI 410: Forced-Circulation Air-Cooling and Air-Heating Coils.

C. AHRI 430: Central-Station Air-Handling Units.

D. AHRI 1060: Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment

E. ANSI/AMCA Standard 204: Balance Quality and Vibration Levels for Fans

F. ANSI/AMCA Standard 500-D: Laboratory Methods of Testing Dampers for Rating.

G. ANSI B9.1: Safety Code for Mechanical Refrigeration.

H. ANSI/AFBMA Standard 9: Load Ratings And Fatigue Life For Ball Bearings.

I. ASHRAE 33: Methods of Testing Forced-Circulation Air-Cooling and Air-Heating Coils

J. ASHRAE 62.1: Ventilation for Acceptable Indoor Air Quality.

K. ASHRAE 84: Method of Testing Air-to-Air Heat/Energy Exchangers

L. ASHRAE 90.1: Energy Standard for Buildings Except Low-Rise Residential Buildings.

M. ASTM A123: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

N. ASTM B117: Standard Practice for Operating Salt Spray Apparatus

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

P. NFPA 90A: Standard for the Installation of Air-Conditioning and Ventilating Systems.

1.4 QUALITY ASSURANCE

A. Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.

B. Unit and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration.

C. Unit Seasonal Energy Efficiency Ratio (SEER) shall be equal to or greater that prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.

D. Unit shall be safety certified by ETL and be ETL US and ETL Canada listed. Unit nameplate shall include the ETL label.

1.5 PERFORMANCE REQUIREMENTS

A. Design of the HVAC system, including associated work of other design disciplines and trades, is based on scheduled and specified equipment. If a different item of equipment should be proposed, as permitted in the article "Acceptable Manufacturers" below, ascertain that it will:

1. Perform to the scheduled and specified capacities.
2. Make no additional demands on other systems such as heating water systems, and chilled water systems, or power distribution systems.
3. Meet or exceed all specified requirements.

1.6 SUBMITTALS

A. Product data:

1. As required in the article "Quality Assurance" below.
2. For air-handling unit complete with all equipment, options, and accessories, showing compliance with specification.

B. Unit shown on drawings is based on the dimensions of the design basis unit specified in Part 2 below. If another acceptable manufacturer's unit should be proposed, ascertain that it will fit in the available space.

1. "Fit in the available space" means that space allows clearances required for service and for overhaul or removal of components.
2. Include, with shop drawings of the unit, scale drawings similar to the contract drawings, including plans, elevations, sections, and diagrams, showing any changes in wiring, arrangement, or access necessary to accommodate the proposed unit.
3. Include shop drawings and product data sufficient to show compliance with the article "Performance Requirements" above.

C. Shop drawings shall show complete dimensions and configuration of complete assembled unit with accessories, including dimension and configuration, as required to coordinate with the building’s structure, framing, and bracing.

1. For units with direct-expansion coils, include design of refrigeration piping prepared by manufacturer of the refrigeration compressor. Show oil traps and accessories specified in Section 23 23 00, Refrigerant Piping, as well as those required by the manufacturer.
2. Wiring diagrams: Power, signal, and control wiring.

D. Submit fan curves for each air-handling unit, with operating points indicated.

E. Submit the base rail height for each unit, and show coordination with supplemental supports and required height for affiliated traps.

F. If fan belt guards or inlet screens are not available as a factory option, submit a letter indicating that the guards or screens are not available, and that the air-handling unit complies with OSHA and VOSHA requirements via protection by the air-handling unit casing.

G. Certifications:

1. Fan energy performance. Submit product data that certifies fan energy consumption is in compliance with ASHRAE 90.1 requirements.

1.7 QUALITY ASSURANCE

A. UL label: As specified in Section 23 05 00, Common Work Results for HVAC.

B. Sound performance data shall be provided using AHRI Standard 260 test methods.

C. Coil performance data shall be certified in accordance with AHRI 410.

D. Air-handling performance data shall be certified in accordance with AHRI 430.

E. Air-handling unit surfaces in contact with airstream shall comply with ASHRAE 62.1.

F. Air-handling units shall meet the energy performance requirements of ASHRAE 90.1.

G. Air-handling unit design and fabrication shall comply with NFPA 90A.

H. Fan selections shall be made to the right of the peak static pressure point of the fan curve and not on any flat portion of the fan curve. Generally, fan selection shall be in the 50 to 80 percent range of wide-open volume.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Unit shall be on a wooden pallet with skeleton crating prior to shipment to prevent damage during transport and thereafter while in storage awaiting installation.

B. Unit shall be plastic shrink-wrapped prior to shipment to prevent damage during transport and thereafter while in storage awaiting installation.

C. Follow Installation, Operation and Maintenance manual instructions for rigging, moving, and unloading the unit at its final location.

D. Unit shall be handled carefully to avoid damage to components, enclosures and finish.

E. Unit shall be stored in a clean, dry place protected from weather and construction traffic in accordance with Installation, Operation and Maintenance manual instructions.

1.9 WARRANTY

A. Manufacturer shall provide a limited “parts only” warranty for a period of 12 months from the date of equipment start up or 18 months from the date of original equipment shipment from the factory, whichever is less. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided manufacturer’s written instructions for installation, operation, and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts and air filters.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Products shall be provided by the following manufacturers:

1. AAON
2. Substitute equipment may be considered for approval that includes at a minimum:

a. R-454B or R32 refrigerant
b. VFD driven direct drive backward curved plenum supply fans
c. Double wall cabinet construction
d. Insulation with a minimum R-value of 6.25
e. Double-sloped stainless steel drain pans

f. Hinged access doors with lockable handles
g. LED service lights in the control panel
h. Designed, engineered, and manufactured in the United States of America
i. All other provisions of the specifications must be satisfactorily addressed

2.2 AIR HANDLING UNITS

A. General Description

1. Indoor air handling units shall include filters, supply fans, and the following:

   a. DX evaporator coil
   b. Hot-gas reheat coil
   c. Electric heaters
   d. Exhaust fans & energy recovery wheel
   e. Unit controls

2. Unit shall have a draw-through supply fan configuration and discharge air vertically.
3. Unit shall be shipped in four sections and factory tested including leak testing of the coils and run testing of the supply fans and factory wired system.
4. Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.
5. Unit components shall be labeled, including pipe stub outs, refrigeration system components and electrical and controls components.
6. Installation, Operation and Maintenance manual shall be supplied within the unit.
7. Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment’s hinged access door.
8. Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment’s hinged access door.

B. Construction

1. All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.
2. Unit insulation shall have a minimum thermal resistance R-value of 6.25. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D1929-11 for a minimum flash ignition temperature of 610°F. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, reduces heat transfer through the panel and prevents exterior condensation on the panel.
3. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.
4. Access doors shall be flush mounted to cabinetry.
5. Unit shall include a 5-inch forklift base.

6. Units shall include double-sloped 304 stainless steel drain pan. Drain pan connection shall be on the right hand side of unit with a 1" MPT fitting.
7. Cooling coil shall be mechanically supported above the drain pan by multiple supports that allow drain pan cleaning and coil removal.
8. Unit shall include factory wired control panel compartment LED service lights.

C. Electrical

1. Unit shall be provided with an internal control panel with separated low and high voltage control wiring. Access to internal control panel shall be through service access door with piano hinges and lockable quarter turn handle.
2. Unit shall be provided with standard power block for connecting power to the unit.
3. Unit shall include a factory installed 24V control circuit transformer.
4. Unit shall have a 5kAIC SCCR.
5. Unit shall include high and low voltage quick connects for easy wiring at installation.
6. Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more than 10% out of balance on voltage, the voltage is more than 10% under design voltage or on phase reversal.
7. Unit shall be provided with remote safety shutdown terminals for wiring to a field installed smoke detector, firestat, or building safety automatic shutdown system.

D. Supply Fans

1. Unit shall include direct drive, unhoused, backward curved, plenum supply fans.
2. Blower and motor assembly shall be dynamically balanced.
3. Motor shall be an IE5 efficient permanent magnet totally enclosed motor.
4. Blower and motor assembly shall be mounted on rubber isolators.
5. Supply fan shall include a piezometer ring on the inlet cone for connection to a field provided measurement device.
6. ECM driven supply fan speed shall be controlled with the factory installed AAON controller.
7. Access to supply fan shall be through an access door with piano pin hinges and lockable quarter turn handles, and then through a bolted removable control panel.

E. Exhaust Fans

1. Unit shall include direct drive, unhoused, backward curved, plenum supply fans.
2. Blower and motor assembly shall be dynamically balanced.
3. Motor shall be a high efficiency electronically commutated motor (ECM).
4. Blower and motor assembly shall be mounted on rubber isolators.
5. Exhaust fan shall include a piezometer ring on the inlet cone for connection to a field provided measurement device.
6. ECM driven exhaust fan speed shall be controlled with the factory installed AAON controller.
7. Access to exhaust fan shall be through an access door with piano pin hinges and lockable quarter turn handles, and then through a bolted removable control panel.

F. Cooling Coil

1. Access to cooling coil shall be through hinged access door with lockable quarter turn handles.
2. Access to reheat coil shall be through hinged access door with lockable quarter turn handles.
3. Evaporator Coil

    a. Coil shall be designed for use with R-410A refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and aluminum end casings. Fin design shall be sine wave rippled.
    b. Coil shall have two circuits and interlaced circuitry.
    c. Coil shall be 6 row high capacity and 12 fins per inch.
    d. Coil shall be hydrogen leak tested.
    e. Coil shall be furnished with factory installed thermostatic expansion valves. The sensing bulbs shall be field installed on the suction line immediately outside the cabinet.
    f. Refer to the drawings for coil hand external piping connections (left and right are both required per drawing). Liquid and suction connections shall be sweat connection. Coil connections shall be labeled, extend beyond the unit casing, and be factory sealed on both the interior and exterior of the unit casing to minimize air leakage.

G. Refrigeration System

1. Air handling unit and matching condensing unit shall be capable of operation as an R-410A split system heat pump.
2. Each refrigeration circuit shall be equipped with thermostatic expansion valve type refrigerant flow control.
3. Modulating hot gas reheat shall be provided on the refrigeration circuit. Air handling unit shall be provided with hot gas reheat coil, a check valve on the liquid line, and a check valve on the hot gas reheat line. The matching condensing unit must include modulating 3-way reheat valve, liquid line receiver, electronic controller, supply air temperature sensor and a dehumidification control signal terminal. This allows the system to have a dehumidification mode of operation and includes supply air temperature control to prevent supply air temperature swings and overcooling of the space. Reheat line connections shall be labeled, extend beyond the unit casing and be located near the suction and liquid line connections for ease of field connection. Connections shall be factory sealed on both the interior and exterior of the unit casing to minimize air leakage.
4. Modulating hot gas reheat shall be provided on the lead refrigeration circuit. Air handling unit shall be provided with hot gas reheat coil, a check valve on the liquid line, and a check valve on the hot gas reheat line. The matching condensing unit must include modulating 3-way reheat valve, liquid line receiver, electronic controller, supply air temperature sensor and a dehumidification control signal terminal. This allows the system to have a dehumidification mode of operation and includes supply air temperature control to prevent supply air temperature swings and overcooling of the space. Reheat line connections shall be labeled, extend beyond the unit casing and be located near the suction and liquid line connections for ease of field connection. Connections shall be factory sealed on both the interior and exterior of the unit casing to minimize air leakage.

5. Unit shall be configured as heat pump. Refrigeration circuit shall be equipped with a thermal expansion with an external check valve on the indoor coil.
6. Reversing valve, outdoor coil thermal expansion valve, bi-flow filter drier, and liquid line receiver shall be factory installed in the matching AAON condensing unit.

H. Electric Heating

1. Unit shall include an electric heater consisting of electric heating coils, fuses, contactors, and a high temperature limit switch, with capacities as shown on the plans.
2. Electric heating access shall be through service access door with piano hinges and lockable quarter turn handle.
3. Electric heating coils shall be located in the reheat position downstream of the supply fan.
4. Electric heater shall have full modulation capacity controlled by an SCR (Silicon Controlled Rectifier). Controller shall provide the heating control signal to control the amount of heating.

I. Filters

1. Unit filter access shall be through service access door with piano hinges and quarter turn button fasteners.
2. Unit shall include 4 inch thick, pleated panel filters with a MERV rating of 13, upstream of the cooling coil. Unit shall also include2 inch thick, pleated panel pre filters with MERV rating of 8, upstream of the 4 inch standard filters.

J. Energy Recovery

1. Unit shall contain an energy recovery cabinet with back outside air opening, back exhaust air opening, top return air opening, and top supply air opening.
2. Unit shall include on/off outside air and on/off exhaust air damper assemblies constructed of extruded aluminum, hollow core, airfoil blades with rubber edge and end seals. Damper blades shall be gear driven and designed to have no more than 20 cfm of leakage per sq ft. at 4 in. w.g. air pressure differential across the damper. Low leakage dampers shall be Class 2 AMCA certified, in accordance with AMCA Standard 511.
3. Outside air damper shall open with a 24VDC supply fan enable signal, and the supply fan shall not be enabled until after the outside air damper is fully opened.
4. The exhaust air damper shall open with a 24VDC exhaust fan enable signal, and the exhaust fan shall not be enabled until after the exhaust air damper is fully opened.
5. Unit shall include 2 inch thick, pleated panel outside air filters with MERV rating of 8, upstream of the wheel.
6. Unit shall contain a factory mounted and tested energy recovery wheel. The energy recovery wheel shall be mounted in a rigid frame containing the wheel drive motor, drive belt, wheel seals and bearings.
7. Wheel frame shall slide out for service and removal from the cabinet.
8. The energy recovery component shall incorporate a rotary wheel in an insulated cassette frame complete with seals, drive motor and drive belt.
9. Wheels shall be wound continuously with one flat and one structured layer in an ideal parallel plate geometry providing laminar flow. The layers shall be effectively captured in stainless steel wheel frames or aluminum and stainless steel segment frames that provide a rigid and self-supporting matrix.

10. Wheels shall be provided with removable energy transfer matrix. Wheel frame construction shall be a welded hub, spoke and rim assembly of stainless, plated and/or coated steel and shall be self-supporting without matrix segments in place. Segments shall be removable without the use of tools to facilitate maintenance and cleaning. Wheel bearings shall be selected to provide an L-10 life in excess of 400,000 hours. Rim shall be continuous rolled stainless steel and the wheel shall be connected to the shaft by means of taper locks.
11. All diameter and perimeter seals shall be provided as part of the cassette assembly and shall be factory set. Drive belts of stretch urethane shall be provided for wheel rim drive without the need for external tensioners or adjustment.
12. The energy recovery cassette shall be an Underwriters Laboratories Recognized Component for electrical and fire safety. The wheel drive motor shall be an Underwriters LaboratoryRecognized Component and shall be mounted in the cassette frame and supplied with a service connector or junction box. Thermal performance shall be certified by the manufacturer in accordance with ASHRAE Standard 84, Method of Testing Air-to-Air Heat Exchangers and AHRI Standard 1060, Rating Air-to-Air Energy Recovery Ventilation Equipment. Cassettes shall be listed in the AHRI Certified Products.
13. Energy recovery wheel cassette shall carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory. The first 12 months from the date of equipment startup, or 18 months from the date of original equipment shipment from the factory, whichever is less, shall be covered under the standard AAON limited parts warranty. The remaining period of the warranty shall be covered by Airxchange. The 5 year warranty applies to all parts and components of the cassette, with the exception of the motor, which shall carry an 18 month warranty. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided the Airxchange written instructions for installation, operation and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts. Refer to the Airxchange Energy Recovery Cassette Limited Warranty Certificate.
14. Total energy recovery wheels shall be coated with silica gel desiccant permanently bonded by a process without the use of binders or adhesives, which may degrade desiccant performance. The substrate shall be lightweight polymer and shall not degrade nor require additional coatings for application in marine or coastal environments. Coated segment sshall be washable with detergent or alkaline coil cleaner and water. Desiccant shall not dissolve nor deliquesce in the presence of water or high humidity.
15. Unit shall include energy recovery wheel rotation detection sensors and a set of normally open and normally closed contracts for field indication of wheel rotation.
16. Unit shall include energy recovery wheel defrost control to periodically stop the wheel rotation, which allows the warm exhaust air to defrost the wheel.
17. Unit shall include a clogged filter switch that senses pressure drop across the outside air filters and energy recovery wheel.
18. Unit shall include factory installed magnehelic gauge measuring the pressure drop across the outside air filters and energy recovery wheel.
19. Energy recovery wheel access shall be through service access door with piano hinges and quarter turn button fasteners.
20. Outside air dampers, exhaust air dampers, and energy recovery wheel control panel access shall be through service access doors with piano hinges and lockable quarter turn handles.

K. Controls

1. Unit shall be provided with a proof of airflow switch. When airflow is not detected, the supply fans will shut down.
2. Unit shall be provided with an internal control panel with separated low and high voltage control wiring.
3. Access to internal control panel shall be through an access door with piano hinges and lockable quarter turn handles.
4. Factory Installed and Factory Provided Controller

    a. Unit controller shall be capable of controlling all features and options of the unit. Controller shall be factory installed in the unit controls compartment and factory tested.
    b. Controller shall be capable of standalone operation with unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling available without dependence on a building management system.
    c. Controller shall have an onboard clock and calendar functions that allow for occupancy scheduling.
    d. Controller shall include non-volatile memory to retain all programmed values without the use of a battery, in the event of a power failure.
    e. Constant Volume Controller

        (1) Unit shall modulate cooling with constant airflow to meet ventilation outside air loads. Cooling capacity shall modulate based on supply air temperature.
        (2) Hot gas bypass shall be required on the lead refrigeration circuits of systems without variable capacity compressors.
        (3) Unit shall modulate heating with constant airflow to meet ventilation outside air loads. Heating capacity shall modulate based on supply air temperature.

    f. Unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling shall be accomplished with connection to interface module with LCD screen and input keypad, interface module with touch screen, or with connection to PC with free configuration software. Controller shall be capable of connection with other factory installed and factory provided unit controllers with individual unit configuration, setpoint adjustment, sensor status viewing, and occupancy scheduling available from a single unit. Connection between unit controllers shall be with a modular cable. Controller shall be capable of communicating and integrating with a BACnet network.

PART 3 - EXECUTION

3.1 ACCEPTABLE INSTALLER

A. The manufacturer shall provide a local representative at the job site to supervise the assembly and to assure the units are assembled to meet manufacturer's recommendations.

3.2 INSTALLATION, OPERATION AND MAINTENANCE

A. Installation, Operation and Maintenance manual shall be supplied with the unit.

B. Install units as indicated on the drawings. Comply with requirements in Section 23 05 00.

C. Support:

1. Interior units: Support via one of the following methods as shown on the drawings:

a. Provide a concrete equipment foundation (housekeeping pad) and mount equipment on that foundation. Comply with requirements in Section 23 05 29.

D. Where required, disassemble and reassemble air-handling unit sections to fit through doors and openings. Reassembly shall be supervised by a local manufacturer's representative.

E. Provide filters in accordance with Section 23 41 00.

F. Installing contractor shall install unit, including field installed components, in accordance with Installation, Operation and Maintenance manual instructions.

3.3 ADJUSTING

A. Coordinate with air balancing to adjust fan speed to obtain the airflow and static pressure required. If necessary, provide belts, sheaves, or other parts required to complete balancing with no addition to the contract sum.

3.4 DEMONSTRATION AND TRAINING

A. Provide demonstration and training as specified in Section 23 05 00.

B. Start up and maintenance requirements shall be complied with to ensure safe and correct operation of the unit.

END OF SECTION 23 73 22

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 23 81 29 - VARIABLE-REFRIGERANT-FLOW HVAC SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Interior units: Combination of ceiling mounted cassette type, console units, or fan-coil units.

B. Branch controller boxes.

C. Exterior units (condensing units): Air cooled.

D. System controls.

1.2 RELATED SECTIONS

A. Refrigeration system startup and service, and compressor warranty: Section 23 01 00.

B. UL label, demonstration, training, and equipment installation: Section 23 05 00.

C. Motors: Section 23 05 13.

D. Equipment hangers and supports: Section 23 05 29.

E. Vibration control supports: Section 23 05 48.

F. Control system wiring: Section 23 09 02.

G. Refrigerant piping: Section 23 23 00.

H. Filters: Section 23 41 00.

I. Disconnect switches: Division 26.

1.3 REFERENCES

A. AHRI 1230: Performance Rating of Variable Refrigerant Flow (VRF) Multi-split Air-conditioning and Heat Pump Equipment.

B. ASHRAE 15: Safety Standard for Refrigeration Systems.

C. ASHRAE 90.1: Energy Standard for Sites and Buildings Except Low-rise Residential Buildings.

1.4 PERFORMANCE REQUIREMENTS

A. Design of the HVAC system, including associated work of other design disciplines and trades, is based on scheduled and specified equipment. If a different item of equipment should be proposed, as permitted under the article "Acceptable Manufacturers" below, ascertain that it will:

1. Perform to the scheduled and specified capacities.
2. Make no additional demands on other systems such as electricity.
3. Meet or exceed all specified requirements.

1.5 SUBMITTALS

A. Product data:

1. Equipment: For each VRF system interior unit, branch controller box, and exterior unit, include the following:

   a. Product description, rated capacities, operating characteristics, materials, finishes, and furnished specialties and accessories.
   b. Refrigerant system charge quantity and type.
   c. Verification of compliance with ASHRAE 90.1.

2. Control system: Include information to illustrate compliance with the specifications.

B. Product schedule: Provide a VRF system component schedule with the following as a minimum:

1. Equipment identification tags.
2. Equipment model numbers, types, nominal sizes, and arrangements.
3. Unit electrical characteristics.
4. Operating conditions.
5. Operating capacities at operating conditions, accounting for any deration required by refrigerant piping length.
6. Furnished specialties and accessories.
7. Verification of compliance with any additional information scheduled on the drawings.

C. Shop drawings:

1. Equipment shop drawings: Include the following for each interior unit, branch controller box, and exterior unit:

   a. Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection.
   b. Wiring diagrams: For power, signal, and control systems, differentiating between factory- and field-installed wiring.
   c. Include refrigerant charge quantity for each system relative to scheduled basis of design system.

d. Include calculated connection ratio, in compliance with scheduled connection ratio.
e. Include calculations showing that system travel distance for refrigerant piping and controls cabling are within horizontal and vertical travel distances set by manufacturer. Provide a comparison table for each system installed.

2. Refrigeration system shop drawings:

a. Provide design of refrigeration piping system prepared by manufacturer of the refrigeration compressor. Show oil traps and accessories specified in Section 23 23 00, Refrigerant Piping, as well as those required by the manufacturer.
b. Include diagrams and details of refrigerant piping and tubing showing installation requirements for manufacturer-furnished divided flow fittings.
c. Include design calculations with corresponding diagram of refrigerant piping and tubing sizing for each system installed.
d. Include isolation valve locations.
e. Provide ASHRAE 15 compliance calculations and shop drawings showing that the system does not require mechanical ventilation. Calculations will be based on a non-institutional occupancy (a premise or that portion of a premise from which, because they are disabled, debilitated, or confined, occupants cannot readily leave without the assistance of others, including hospitals, nursing homes, asylums, and spaces containing locked cells). Documentation will include the following based on actual equipment locations and pipe sizes, as well as scheduled equipment and building geometry information:

(1) Refrigerant detection devices, including sensitivity and speed.
(2) Automatic refrigerant isolation valve locations, including speed of closure.
(3) Indication of terminal units that provide air circulation in the event of refrigerant detection.
(4) The EDVC for each area served by the system.
(5) The actual amount of refrigerant charge that may enter an area served based on the system and the detection and control system operation.
(6) Documentation of compliance.

D. Samples: Color chips, showing manufacturer's complete line of finishes.

E. Installer qualifications.

F. Warranties:

1. Refrigeration equipment and compressor warranties required in Section 23 01 00, executed to the Owner.
2. Additional warranties required by this specification section, executed to the Owner.

G. Operation and maintenance data: Include operating and maintenance data for each of the following in the project Operation and Maintenance Manual as specified in Division 01 with supplemental requirements as specified in Section 23 01 01.

1. Indoor units.

2. Exterior units.
3. Branch controller boxes.
4. System controls.

1.6 QUALITY ASSURANCE

A. UL label: As specified in Section 23 05 00, Common Work Results for HVAC.

B. Comply with ASHRAE 15 for equipment design, construction, leak testing, and installation.

C. Systems shall meet the energy performance requirements of ASHRAE 90.1.

D. Certify unit capacity in compliance with AHRI 1230.

E. Installer shall be certified by the system manufacturer as having successfully completed prerequisite training, administered by manufacturer, for proper installation of systems, including but not limited to, equipment, piping, controls, and accessories indicated and furnished for installation. Installer shall have experience providing a minimum of five installations of similar size, completed and in operation for more than two years, with references.

1.7 SYSTEM STARTUP

A. System startup shall be performed by a technician certified by the supplied equipment manufacturer. Startup technician shall be present during performance verification testing and shall be present and assist in training and instruction required in Section 23 05 00.

1.8 WARRANTY

A. Provide refrigeration equipment and compressor warranties required in Section 23 01 00.

B. In addition to the general project warranty, and warranties required in Section 23 01 00, provide a manufacturer’s special project warranty:

1. Provide a manufacturer’s ten-year extended warranty for material to replace terminal units, branch controllers, and condensing units.

1.9 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 and location of intended use. Deliver and store in a location directed by the Owner, or as indicated below.

1. For each interior unit with a washable filter, furnish one extra washable filter per unit.
2. For each interior unit with disposable filters, furnish extra filters as specified in Section 23 41 00.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis-of-design product: Subject to compliance with requirements, provide the scheduled product, or comparable product by one of the following:

1. Daikin
2. Mitsubishi
3. LG
4. Trane
5. York
6. Or approved equal.

2.2 GENERAL REQUIREMENTS

A. Provide type, size, configuration, capacity, and current characteristics indicated on the drawings.

B. Units shall be factory-assembled, -piped, -wired, -finished, and -tested, and shipped in one piece.

C. Provide motors that meet requirements in Section 23 05 13, Common Motor Requirements for HVAC Equipment.

D. Provide each unit with factory-installed means of disconnect in compliance with NFPA 70 (NEC) and applicable local codes. Where the equipment nameplate refers to a fuse or a maximum fuse size, provide a fused disconnect switch. In the event a factory installed disconnect is not available, or a fused disconnect switch is required but is not available from the manufacturer, provide an approved means of disconnect for field mounting.

E. Refrigerant:

1. R-32 or R-454B.
2. Ship with a shipping charge of refrigerant or nitrogen and seal.
3. Provide a full charge of refrigerant and oil in the field.
4. See Section 23 23 00 for refrigerant piping work.

F. Test, rate, and certify system performance in accordance with AHRI 1230.

2.3 INTERIOR UNITS

A. All interior units shall include the following features:

1. Electronic modulating expansion valve.
2. Fan assembly:

a. Wheel: Centrifugal, statically and dynamically balanced.

b. Direct drive.
c. Fan motor and speed control:

(1) Electronically commutated motor.
(2) Two or more speeds, or variable speed.
(3) Integral motor protection against voltage fluctuations.

3. Condensate drain pan: Non-ferrous.
4. Coil: Copper tubes expanded into aluminum fins, aluminum or stainless steel casing, factory leak tested.
5. Controller: Factory installed configurable digital controller for unit control and network communication with other indoor and exterior units and branch controller boxes, self-diagnostics, auto-restart, fused time delay, test run switch, and terminal connections for a condensate overflow signal.
6. Electrical: Single-point power connection and integral controls and integral control transformer.

B. Ceiling Cassette fan-coil units shall include the following additional features.

1. Cabinet: Constructed with sound absorbing foamed polystyrene and polyethylene insulation, removable panel for internal access.
2. Thermistors: Return air thermistor, coil liquid thermistor, and coil gas thermistor.
3. Supply air discharge: 4-way airflow via motorized louvers, integrated into ceiling air panel grille with capability to change to 3-way and 2-way airflow to accommodate various field installations as described on the drawings.
4. Return air: Flow through the middle of ceiling air panel grille.
5. Filters:

a. Coordinate piping and electrical connections so they do not interfere with filter access.
b. Filters for nominal 2 foot x 2 foot units: Washable resin filter.
c. Filters for nominal 3 foot x 3 foot units:

(1) Washable resin filter.

6. Condensate drain pump: Integral and powered from fan-coil unit.
7. Condensate safety shut off and alarm.
8. Fresh air intake kit.

C. Wall-Mounted fan-coil units shall include the following additional features.

1. Cabinet: Constructed with sound absorbing foamed polystyrene and polyethylene insulation, removable panel for internal access.
2. Thermistors: Return air thermistor, coil liquid thermistor, and coil gas thermistor.
3. Supply air discharge: Via motorized louver.
4. Return air: Flow through removable front grille.
5. Filter: Washable resin filter.
6. Condensate drain pump: Provide manufacturer's field-installed condensate pump accessory and condensate overflow sensor where indicated.

D. Horizontal, concealed, ducted fan-coil units shall include the following additional features.

1. Cabinet: Painted steel, constructed with 1-inch (25 mm) sound absorbing foil-faced insulation, removable panels or hinged doors for internal access.
2. Thermistors: Return air thermistor, coil liquid thermistor, and coil gas thermistor.
3. Ducted supply air and return air connections.
4. Filters for slim low-static units: Washable resin filter.
5. Filters for medium static and high static models:

    a. Filter return grilles. Refer to drawings.

6. Condensate safety shut off and alarm.
7. Condensate drain pump: Provide field-installed condensate pump where indicated.

2.4 BRANCH CONTROLLER BOX

A. Branch controller box: Factory assembled and tested unit designed for field interconnection of multiple indoor units to a single refrigeration circuit, and providing the ability for heating operation of indoor units served by one branch controller box simultaneous with cooling operation of indoor units served by another branch controller box.

1. Cabinet: Galvanized steel, insulated to prevent condensation, with removable or hinged panels for internal access.
2. Provide ball isolation valves on all piping upstream of the branch controller box so the branch controller box can be isolated without system interruption. Where branch controller boxes are not factory furnished with isolation valves, furnish ball isolation valves for field installation as part of refrigerant piping work.
3. Provide ball isolation valves on all supply and return lines to the indoor units from each branch controller box to the indoor units so the branch controller box and terminal units can be isolated without system interruption. Where branch controller boxes are not factory furnished with isolation valves, furnish ball isolation valves for field installation as part of refrigerant piping work.
4. Electrical: Single-point power connection and integral controls and integral control transformer.
5. Internal piping: Factory tested copper tubes with brazed joints, insulated to prevent condensation.
6. Controller: Factory installed configurable digital controller for unit control and network communication with indoor and exterior units, self-diagnostics, and fuse protection.
7. Control valves: Each refrigerant branch circuit shall have refrigerant control valves to control refrigerant flow.
8. Spare circuits: Each branch controller box shall include at least two branch circuit ports for future use.
9. Drain Pan: If required by manufacturer's design, provide unit with non-ferrous drain pan with bottom sloped to a low point drain connection.

2.5 EXTERIOR UNIT (CONDENSING UNIT)

A. Factory-piped, factory-wired, and factory-tested.

B. Designed for field interconnection of multiple indoor units to a single condensing unit, and providing the ability for heating operation of indoor units served by one branch controller box simultaneous with cooling operation of indoor units served by another branch controller box and heat recovery. Unit contains compressors, electronic expansion valves, solenoid valves, control valves, refrigerant piping, capillaries, filters, shut off valves for each piping connection, refrigerant condensing equipment, oil separators and oil management equipment, service ports, liquid receivers, refrigerant accumulator, and controls. Modular design to allow side-by-side installation with minimum spacing.

C. Cabinet:

1. Galvanized steel panels.
2. Finish: Baked enamel.
3. Removable panels or hinged doors for internal access.

D. Electrical: Single point connection to power unit and integral controls and integral control transformer and control circuit fuses.

E. Internal piping: Factory tested copper tubes with brazed joints, insulated to prevent condensation.

F. Compressors:

1. Variable-speed direct-drive scroll compressors with inverter drive, controlled to maintain refrigerant suction and condensing pressures while varying refrigerant flow to satisfy system cooling and heating loads. Provide spring vibration control.
2. Oil recovery system to ensure safe and proper lubrication over entire operating range.
3. Crankcase heaters with integral control.

G. Air-cooled type condensing unit:

1. Condenser coil: Copper tubes expanded into aluminum or copper fins with aluminum or stainless steel casing. Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.
2. Fan assembly: Provide corrosion resistant fan guards.

    a. Propeller: Vertical discharge, fabricated from non-ferrous components or ferrous components with corrosion protection finish.
    b. Motors: TEFC or TEAO, electronically commutated motors.
    c. Direct drive.
    d. Fan and motor support: Provide vibration control.

3. Provide night setback fan speed control capability.
4. Provide a field selectable discharge pressure setting to accommodate ducted discharge applications.

5. Capable of heating operation at -13 degrees F (-25 degrees C) ambient temperature without additional low ambient controls or an auxiliary heat source.
6. The systems shall continue to provide heat to indoor units in heating operation while in the defrost mode.

H. Controls:

1. Controller: Factory installed configurable digital controller for unit control and network communication with indoor units and branch controller boxes.
2. Self-diagnostics.
3. Automatic restart after a power failure without losing programmed settings.
4. Refrigerant sub-cooling control to ensure the liquid refrigerant does not flash when it is being supplied to indoor units.
5. Controls shall provide continued operation in the event of compressor failure.
6. Controls shall provide control multiple compressors to equalize run time.
7. Safety features:

    a. Refrigerant high pressure sensor and switch.
    b. Refrigerant low pressure sensor.
    c. Fusible plug pressure relief or pressure relief valve for refrigerant pressure relief.
    d. Overload relay.
    e. Inverter overload protection.
    f. Inverter overcurrent protection.
    g. Thermal overload protection for compressor motors.
    h. Anti-short cycle timer.

2.6 SYSTEM CONTROLS

A. Provide the entire system with required controls, designed and installed by the equipment manufacturer to provide a complete working system.

B. Wired controllers for indoor units: Provide each indoor unit with a wall-mounted remote controller provided by the unit manufacturer, hard-wired to and powered by the associated indoor unit.
1. Auto timeout LCD touch screen.
2. Temperature and relative humidity sensing.
3. Temperature and relative humidity display.
4. Settings stored in nonvolatile memory to ensure that settings are not lost if power is lost. Battery backup for date and time only.
5. Capable of controlling multiple indoor units as group.
6. Control functions:

    a. On/off control.
    b. Hold: Hold operation settings until hold is released.
    c. Operation mode selection: Cool, heat, auto, dehumidification, fan only, and setback.
    d. Temperature set point adjustment with separate set points for cooling, heating, and setback.

e. Relative humidity set-point adjustment.
f. Fan speed setting.
g. Airflow direction setting.
h. Scheduling: Seven-day programmable operating schedule with ability to adjust on/off, operating mode, and temperature set point multiple times per day.
i. Occupancy detection.
j. Service notification display.
k. Service test troubleshooting support.
l. Error code notification display.
m. User and service password capability.

C. Safety controls: Provide refrigerant detection, automatic starting of fans, refrigerant isolation valves, and other components required to provide a system that complies with ASHRAE 15 requirements without the use of mechanical ventilation.

D. Central system controllers: Provide a central system controller for each VRF system for monitoring and control of all indoor and exterior units associated with the system. Locate central system controller as indicated on the drawings. Include multiple interconnected controllers as required.

1. LCD touch screen.
2. Provide with BACnet interface for building automation system.
3. Settings stored in nonvolatile memory to ensure that settings are not lost if power is lost.
4. Capable of displaying site floor plan as the background for visual navigation. Indoor unit icons with operational status can be placed on the floor layout
5. Multiple RJ-45 ports for direct connection to a local PC and an Ethernet network switch.
6. Web accessible through standard web browser software.
7. Adjust for daylight savings time automatically.
8. Control functions:

a. Information displayed on individual controllers shall also be available for display through central controller.
b. Controls operation mode of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Operation modes available through central controller shall match those operation modes of controllers for indoor units.
c. Controls set points of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.
d. Define set point range limitation of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.
e. Fan speed control.
f. Airflow direction control.
g. Schedule operation of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Provide weekly scheduling with at least 40 exception days for specific dates or floating dates.
h. Service notification display.
i. Error code notification display.
j. Interlock on/off control and monitoring for third party equipment.

PART 3 - EXECUTION

3.1 INDOOR UNIT INSTALLATION

A. Install units as indicated on the drawings. Comply with requirements in Section 23 05 00.

B. Support:

1. Ceiling cassettes: Suspend from structure above.
2. Horizontal concealed ducted fan-coil units: Suspend from structure above.
3. Wall-Mounted fan-coil units: Support via attachment to wall.
4. Vertical air-handling units:

a. Provide a concrete equipment foundation where shown on the drawings.
b. Support via one of the following methods as shown on the drawings:

(1) Support via a structural frame mounted on the surface below.
(2) Support on a return plenum.

C. Vibration isolation.

1. Ceiling cassettes: Provide vibration isolation using neoprene washers or grommets at threaded rod connections to the unit or using neoprene vibration isolation hangers.
2. Horizontal concealed ducted fan-coil units: Provide vibration isolation using neoprene washers or grommets at threaded rod connections to the unit or using neoprene vibration isolation hangers.
3. Vertical air-handling units: Provide neoprene waffle pad vibration isolation. Comply with requirements of Section 23 05 48.

D. Connect refrigerant piping.

E. In rooms with ceilings, conceal piping and tubing, controls, and electrical power serving units above ceilings.

F. In rooms without ceilings, arrange piping and tubing, controls, and electrical power serving units to provide a neat and finished appearance.

G. For floor-mounted units that are exposed, conceal piping and tubing, controls, and electrical power serving units within walls.

H. For wall-mounted units installed in occupied area, provide line set covers equal to Aerco Inc. “Slim-Duct–MD”, Rectorseal “Slimduct”, or Diversitech “Speedichannel” in a color to match indoor terminal unit. Installation shall conceal all exposed refrigerant line sets and condensate drain piping.

1. Line set covers are not required for units serving utility spaces, such as elevator machine rooms, storage rooms, and electrical rooms.

I. Provide required field-Installed condensate pumps and wire overflow contacts to indoor unit controllers.

J. Field provide filter housing for ducted units (where not factory provided) to accommodate side or bottom filter replacement access without removing ductwork and without the need for tools.

K. Filters:

1. For units with disposable filters, provide filters as specified in Section 23 41 00.
2. For units with washable filters, provide temporary protection and wash filters as specified in Section 23 41 00.

3.2 BRANCH CONTROLLER BOX INSTALLATION

A. Provide branch controller boxes and sub-controller boxes as indicated on the drawings and recommended by the manufacturer for a fully functional system.

B. Suspend from structure above.

C. Connect refrigerant piping. Provide joint adapter and branch joints as required.

D. Basis of design units do not require condensate connections. If units provided require condensate connections, provide concealed air conditioning condensate piping from branch controller boxes to a code compliant discharge location approved by the Architect.

3.3 EXTERIOR UNIT (CONDENSING UNIT) INSTALLATION

A. Support:

1. Air-cooled condensing units mounted at grade: Mount on structural foundation. See drawings for details.

B. Provide vibration isolation.

3.4 SYSTEM CONTROLS INSTALLATION

A. Provide the entire system with required controls, designed and installed by the equipment manufacturer to provide a complete working system.

B. Provide site floor plan graphics for visual navigation.

C. Coordinate with the Owner to establish system passwords.

D. Coordinate with the Owner to provide a network connection for the control system.

E. Provide a connection to and coordinate integration with the building automation system.

F. Provide wiring in compliance with the requirements of the Division 23 Section "Control System Wiring."

G. At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

3.5 REFRIGERATION SYSTEM START-UP AND SERVICE

A. Provide refrigeration system start-up by a factory-trained service and maintenance agency. Comply with requirements in Section 23 01 00.

B. Provide refrigeration system service during the project correction period by a factory-trained service and maintenance agency. Comply with requirements in Section 23 01 00.

3.6 DEMONSTRATION AND TRAINING

A. Provide demonstration and training as specified in Section 23 05 00.

END OF SECTION 23 81 29

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 23 82 38 - ELECTRIC RESISTANCE TERMINAL UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Electric ceiling or wall heaters.

1.2 RELATED SECTIONS

A. UL label, demonstration, training, and equipment installation: Section 23 05 00.

B. Motors: Section 23 05 13.

C. Filters: Section 23 41 00.

D. Disconnect switches: Division 26.

1.3 SUBMITTALS

A. Product Data: For each type of electric resistance terminal unit, include the following:

1. Product description, rated capacities, operating characteristics, materials, finishes, and furnished specialties and accessories.

B. Product schedule: Provide an electric resistance terminal unit schedule with the following as a minimum:

1. Equipment identification tags.
2. Equipment model numbers, types, nominal sizes, and arrangements.
3. Unit electrical characteristics.
4. Operating conditions and flow rates.
5. Operating capacities at operating conditions and flow rates.
6. Motor types and electrical characteristics.
7. Furnished specialties and accessories.
8. Verification of compliance with any additional information scheduled on the drawings.

C. Shop drawings: Include the following for each type of electric resistance terminal unit:

1. Dimensioned plans, elevations, and sections of complete assembled units with accessories.
2. Required service clearances.
3. Weights, loads, and support and attachment details.
4. Details of equipment components and assemblies.
5. Details of and any required field wiring or field assembly.
6. Location and size of each field connection.
7. Diagrams for power, signal, and control wiring.

D. Coordination drawings: Unit shown on drawings is based on the dimensions of the design basis unit specified in Part 2 below. If another acceptable manufacturer's unit should be proposed, ascertain that it will fit in the available space. Include, if necessary, scale drawings similar to the contract drawings, including plans, elevations, sections, and diagrams, showing any changes in wiring, arrangement, or access necessary to accommodate the proposed unit. Show complete dimensions of complete assembled unit with accessories.

E. Samples: Manufacturer's complete line of color chips.

F. Operation and maintenance data: Include operating and maintenance data for each electric resistance terminal unit in the project Operation and Maintenance Manual as specified in Division 01 with supplemental requirements as specified in Section 23 01 01.

1.4 QUALITY ASSURANCE

A. UL label: As specified in Section 23 05 00, Common Work Results for HVAC.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis-of-design product: Subject to compliance with requirements, provide the scheduled units or comparable models of one of the following:

1. Electric ceiling or wall heaters.

a. Berko Electric Heating
b. General Electric Co.
c. Markel Products, Inc.
d. Qmark
e. Vulcan Radiator Corp.
f. Or approved equal.

2.2 GENERAL REQUIREMENTS

A. Provide type, size, configuration, capacity, and current characteristics indicated on the drawings.

B. Units shall be factory-assembled, -wired, -finished, and -tested, and shipped in one piece.

C. Provide motors that meet requirements in Section 23 05 13, Common Motor Requirements for HVAC Equipment.

D. Provide each unit with factory-installed means of disconnect in compliance with NFPA 70 (NEC) and applicable local codes. In the event a factory installed disconnect is not available, provide an approved means of disconnect for field mounting.

2.3 ELECTRIC CEILING OR WALL HEATERS

A. Type, capacity, and current characteristics are indicated on the drawings.

B. Enclosure:

1. Heavy gauge steel back box for recessed rough in.
2. Heavy gauge steel surface mounting frame to connect the back box to the installation surface.
3. Heavy gauge steel frame to hold parts of the heater, mount to back box, and hold the grille.
4. Front panel: Grille constructed of minimum 20 gauge steel and designed for a downflow pattern. Provide with a plug button to replace the thermostat knob and render the unit tamper-resistant where required.

C. Mounting: Recessed, ceiling-mounted or wall-mounted.

D. Finish: Phosphatized and finished with baked enamel.

E. Fan and Motor:

1. Impeller: Aluminum.
2. Motor: TEFC.
3. Direct drive.

F. Heating element: Nickel-chrome wire within a steel sheath to which plate fins are copper brazed.

G. Controls:

1. Integral single pole snap-action thermostat.
2. Bi-metalic snap-action fan control.
3. Automatically reset thermal overheat protection.
4. Provide on-off disconnect switch mounted on the back box.

H. Basis of design: QMark EFF.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate with other trades to ensure that recess or bracing in walls is constructed in locations and with dimensions required for installation of recessed or surface-mounted units.

3.2 INSTALLATION, GENERAL

A. Install units as indicated on the drawings. Comply with requirements in Section 23 05 00.

B. Install manufacturer's access fitting for access to electrical connections, controls, and other fittings.

3.3 ADJUSTING

A. For ducted cabinet unit heaters, coordinate with air balancing subcontractor to adjust fan speed to obtain the airflow and static pressure required. If necessary, provide parts required to complete balancing.

3.4 DEMONSTRATION AND TRAINING

A. Provide demonstration and training as specified in Section 23 05 00.

END OF SECTION 23 82 38

SECTION 26 01 01 - ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. General provisions and requirements for electrical work.

1.2 RELATED SECTIONS

A. Requirements of this section generally supplement requirements of Division 01.

B. Construction waste management: Division 01.

C. Commissioning requirements: Division 01.

1.3 REFERENCES

A. NFPA 10: Portable Fire Extinguishers.

B. NFPA 241: Safeguarding Construction, Alteration, and Demolition Operations.

1.4 SYSTEM DESCRIPTION

A. The full set of Contract Documents applies to work of Division 26.

B. Visit the site and study aspects of the project and working conditions, as required by General and Supplementary Conditions, Bidding and Contracting Requirements, Drawings, and Specifications. Verify field dimensions.

C. The work covered in technical sections includes the furnishing of labor, equipment and materials, and the performance of operations pertinent to the work described.

D. Except as required otherwise in Division 01, promptly obtain and pay for necessary signatures and paperwork, permits, fees and inspections required for work of this division by authorities having jurisdiction, including any utility connection or extension charge. No payment will be made until a copy of the permit is forwarded to the Owner.

E. Electrical work of this project includes, as a brief general description, the following:

1. Provide a new electrical service to the property.
2. Provide a complete electrical system for the building to support all installed equipment and functions. Project includes lighting, receptacles, equipment connections and safety disconnects, electrical distribution and building system grounding.

F. See Division 01 for requirements related to Owner's occupancy of the premises, limits on use of site, time restrictions on work, limits on utility outages or shutdowns, and phasing (sequencing) and scheduling.

1.5 PRODUCT OPTIONS

A. Except as modified by provisions of Bidding and Contracting Requirements and Division 01, these options apply to Division 26 specifications.

B. General: Where Contractor is permitted to use a product other than the specified item and model named as the basis of design, Contractor is responsible for coordination and additional costs as specified in article "Substitutions" below for substitutions.

C. Products specified by reference standards or by description only: Any product meeting those standards or description.

D. Products specified by naming one or more manufacturers, or model name or catalog reference number: Products specified establish a standard of quality, options to be included, and performance, and shall not be construed as limiting competition. Contractor may use products of any manufacturer, which meet the specifications.

E. Products specified by naming one manufacturer and particular product, with no provision for other options: No options or substitutions allowed.

1.6 SUBSTITUTIONS

A. Substitutions will be considered only as permitted or required by the Bidding and Contracting Requirements and Division 01. Except as modified by those requirements, the requirements below apply to Division 26 specifications.

B. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

C. Document each request with complete data substantiating compliance of proposed substitution with contract documents.

D. A request constitutes a representation that the Bidder or Contractor:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
2. Will provide the same warranty for the substitution as for the specified product.
3. Will coordinate installation and make changes to other work which may be required for the work to be complete with no additional cost to Owner.
4. Waives claims for additional costs or time extension which may subsequently become apparent.
5. Will reimburse Owner for review or redesign services associated with re-approval by authorities.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

F. Substitution submittal procedure is specified in Bidding and Contracting Requirements and Division 01.

1.7 MATERIALS AND EQUIPMENT

A. Materials and equipment shall be new and the best of their respective kinds, suitable for the conditions and duties imposed on them by the project, and of representative manufacturer. The description, characteristics and requirements of the materials to be used shall be in accordance with the specifications.

B. Equipment, construction and installation must meet requirements of local, state and federal governing codes.

C. Singular number: In cases where material, a device, or part of the equipment is referred to in the singular number in the specifications, it is intended that such reference shall apply to as many items of material, devices, or parts of the equipment as are required to complete the installation as shown on the drawings or required for proper operation of the system.

D. Terms have the following meanings:

1. Furnish: Supply item
2. Install: Mount and connect item
3. Provide: Furnish and install

E. Materials and equipment shall be installed and completed in a first class and workmanlike manner and in accordance with the best modern methods, practice and manufacturers' instructions. Any work which shall not present an orderly and neat or workmanlike appearance shall be removed and replaced with satisfactory work when so directed in writing by the Architect.

F. The specifications and drawings are intended to define the minimum requirements, as to quality of materials, construction, finish and overall workmanship.

G. General Conditions describe the correlation and intent of the Contract Documents. In case of discrepancies between the specifications and drawings, the specifications should be followed as to the general methods and principles and the drawings followed as to sizes, capacities and specifics for corresponding parts. If sizes are omitted, the Architect will determine sizes to be utilized.

H. In cases of doubt, uncertainty, or conflict as to the true meaning of the specifications or drawings, it is the responsibility of the Contractor to notify the Architect of said uncertainty, doubt, or conflict and obtain a decision as to the intent prior to initiating any work which may be affected by this decision.

1.8 COORDINATION

A. Should a situation develop during construction to prevent the proper installation of any equipment or item where shown on the drawings, call the situation to the attention of the Architect and await a written decision.

B. Plan and coordinate work to proceed in an orderly and continuous manner without undue delay, and in conformance with the project schedule. Submit samples, shop drawings, schedules, insurance policies and certificates, and the like in time to avoid delays in actual construction. Coordinate electrical work so that work of each trade is completed before other construction begins which would obstruct it.

C. Coordinate trades to ensure that proper clearances between work of the various trades allow access to items which require operation and maintenance.

D. Coordinate location and elevation of conduit, light fixtures, equipment, and appurtenances in such a manner that the finished installation is as indicated on drawings. In the event difficulties are encountered which prevent this, it is the Contractor's responsibility to bring this to the attention of the Architect prior to initiation of work. Correct improperly coordinated installation at no additional cost.

E. The Contractors' assistants shall include a competent electrical foreman, who shall be on the premises at all times to check, layout, coordinate and superintend the installation of work. The foreman shall establish basic requirements relative to the work before starting, and be responsible for the accuracy thereof.

1.9 SUBMITTALS

A. Manufacturers' and subcontractors' lists:

1. As specified in Division 01, submit a complete list of proposed manufacturers for equipment, materials and subcontractors used for the work of this division. Lists shall follow the sequence of the specifications. No considerations will be given for partial or incomplete lists. After review of lists, submit shop drawings and product data.

B. Shop drawings and product data:

1. Submit in accordance with the requirements of Division 01 or as established at the preconstruction conference, the required number of copies of Shop Drawings and Product Data for every item of equipment. Shop drawings or product data will not be considered until Manufacturers' Lists have been approved. Shop drawings and product data shall be submitted, as required by the General Conditions, with sufficient time for checking, return to Contractor, and resubmission as required before Contractor shall install any item.

2. Each item submitted shall be properly labeled, indicating the specific service for which the equipment or material is to be used, section and paragraph number of specification or drawing number to which it applies, Contractor's name and project name and number. Data submitted shall be specific and shall include product data and printed information in sufficient detail and scope to verify compliance with requirements of the contract documents. Clearly identify each item within the data. Data of a general nature will not be accepted. Each sheet must clearly show the project name and number.
3. The review of a shop drawing or product data shall not be considered as a guarantee of the measurements or building conditions or that the shop drawings or product data have been checked to see that item submitted properly fits the building conditions. This review shall not relieve the Contractor of the responsibility for furnishing material or performing work as required by the contract documents, for correctness of dimensions and quantities, or for proper coordination of details and interfaces among trades.
4. Exclusively electrical items furnished as items associated with mechanical items but not specifically described in the mechanical item submission, shall be submitted as a separate submittal but shall be clearly marked as associated with the mechanical item by identified specification paragraph.
5. Product data sheets shall be 8.5-inches by 11-inches cut sheets for operating and maintenance manual.

C. Submit results of every test required under any section in this division.

D. After the work is completed, submit required certificates of approval from approved inspection agencies and authorities having jurisdiction over work of this division. Certificates of approval must be received by the Architect prior to final acceptance of the work.

1.10 CONTRACT CLOSEOUT SUBMITTALS

A. Project record documents:

1. Maintain on site one set of the following record documents; record actual revisions to the work of this division:

    a. Contract Drawings.
    b. Specifications.
    c. Addenda.
    d. Change Orders and other Modifications to the Contract.
    e. Reviewed shop drawings, product data, and samples.

2. Maintain record documents separate from documents used for construction.
3. Record information concurrent with construction progress.
4. Specifications: Legibly mark and record in each section a description of actual products installed, including the following:

    a. Manufacturer's name and product model and number.
    b. Product options, substitutions, or alternates utilized.
    c. Changes made by addenda and modifications.

5. Record documents and shop drawings: Legibly mark each item to record actual construction, including:

    a. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
    b. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the work.
    c. Field changes of dimension and detail.
    d. Details not on original Contract Drawings.

6. Submit documents as specified in Division 01.

B. Operation and maintenance data:

1. Submit data prior to final inspection as specified in Division 01. In addition to requirements specified in Division 01, submit operating and maintenance manuals for the work of this division as specified below.
2. Prepare covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS," and title of project.
3. Internally subdivide the contents with permanent page dividers, logically organized as described below:
4. Contents: Prepare a Table of Contents, with each product or system description identified.
5. Part 1: Directory, listing names, addresses, and telephone numbers of electrical engineers; contractor; electrical subcontractors; and major electrical equipment suppliers.
6. Part 2: Operation and maintenance instructions, arranged by specification section. For each category, identify names, addresses, and telephone numbers of subcontractors and suppliers. Identify the following:

    a. Significant design criteria.
    b. List of equipment.
    c. Parts list for each component, including recommended spare parts list.
    d. Operating instructions.
    e. Maintenance instructions for equipment and systems.
    f. Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.

7. Part 3: Project documents and certificates, including the following:

    a. Shop drawings and product data.
    b. Photocopies of certificates.
    c. Photocopies of warranties, guarantees, and bonds.
    d. Test reports: Copies of the results of tests required under sections of specifications.
    e. Photocopies of each panelboard circuit directory or directories for each panelboard provided, including panel name, panel location, panel ratings, spare circuit breakers and spaces for additional circuit breakers.

8. Submit data in final form 15 days prior to final inspection. This data will be returned after final inspection, with Engineer comments. Revise content of documents as required prior to final submittal.
9. Submit within ten days after final inspection.
10. Submit operation and maintenance data in electronic format.

1.11 REGULATORY REQUIREMENTS

A. When these specifications call for materials or construction of a better quality or larger sizes than required by the following codes and standards, the provisions of the specifications shall take precedence.

B. Provide, without extra charge, any additional materials and labor which may be required for compliance with these codes and standards even though the work is not mentioned in these specifications or shown on the contract drawings.

C. Perform the work of this division in strict accordance with the following authorities. The latest revision of these codes accepted by the authority having jurisdiction as of the date of the contract documents shall apply.

1. The electrical, building, fire, and safety codes of the state and county or city in which the work is being performed.
2. The National Electric Code, NFPA 70 (NEC).
3. The National Fire Protection Association Code (NFPA).
4. International Building Code (IBC).
5. International Energy Conservation, Fire, and Electrical Codes (ICC).

1.12 REFERENCE STANDARDS

A. Perform the work of this division using the standards of the following organizations, as referred to in technical sections, as a minimum requirement for construction and testing. Unless specified otherwise in Bidding and Contract Documents or Division 01, the latest revision current as of the date of the contract documents shall apply.

1. American National Standards Institute (ANSI)
2. American Society for Testing and Materials (ASTM)
3. International Code Council (ICC)
4. Institute of Electrical and Electronics Engineers (IEEE)
5. National Electrical Code (NEC) (NFPA 70)
6. National Electrical Manufacturer’s Association (NEMA)
7. National Fire Protection Association (NFPA)
8. The Occupational Safety and Health Act (OSHA)
9. Underwriters Laboratory Inc. (UL)
10. American Association of State Highway and Transportation Officials (AASHTO)
11. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE)
12. Maryland Occupational Safety and Health Act (MOSHA)
13. Illuminating Engineering Society of North America (IESNA)

1.13 TEMPORARY STORAGE

A. Maintain upon premises, where directed, a storage area, and be responsible for contents within these areas. Provide security measures necessary for this area.

B. Area shall be maintained and shall be returned to original condition at the completion of the project.

C. Store electrical construction materials such as wire, raceways and boxes, devices, and equipment in buildings, enclosed trailers, or portable enclosed warehouses.

1. Materials and products subject to damage from moisture: Store in dry locations. If necessary, protect with protective wraps or covers.
2. Plastics and other materials and products subject to damage from heat or cold: Store at manufacturer's recommended temperatures.
3. Plastics and other materials and products subject to damage from sunlight: Protect from sunlight.

D. Electrical equipment such as motor controllers, panelboards and circuit breakers stored before installation and installed during construction: Provide clean, dry locations at manufacturer's recommended temperatures, and cover or wrap if required to protect from incidental damage.

1.14 PROTECTION

A. Each trade and subcontractor is responsible for preventing damage and soiling of work performed by other trades or subcontractors. Each trade and subcontractor is responsible for providing temporary protection of its own work.

1. Protect work from spills, splatters, drippings, adhesives, bitumens, mortars, paints, plasters, and damage from welding or burning.
2. Protect finished work from damage, defacement, staining, or scratching.
3. Protect finishes from cleaning agents, or grinding and finishing equipment.
4. Protect adjacent and finished work from damage, using tape, masking, covers or coatings and protective enclosures.
5. Coordinate installations and temporarily remove items to avoid damage from finishing work.

B. Repair damage or soiling to the complete satisfaction of the Architect; replace any materials or work damaged to such an extent that they cannot be restored to their original condition, at no addition to the Contract sum.

C. Protect work stored in place and supplies stored in the building.

1. Store materials and products, subject to damage from moisture, in dry locations. If necessary, protect in wraps or covers.
2. Store plastics, other materials, and products subject to damage from heat or cold at manufacturer's recommended temperatures.

D. Protect electrical materials and products from weather events and accidents of construction.

E. Use of sidewalk or roadway areas outside of the property lines shall be with permission and approval of the local authorities having jurisdiction.

1.15 FIRE PROTECTION

A. As a minimum, provide hand-carried, portable, UL-rated extinguishers with each work crew working inside the building.

B. Select extinguishers in accordance with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

1.16 SECURITY REQUIREMENTS

A. Refer to division 01 for project security requirements.

1.17 PROJECT CONDITIONS

A. Drawings showing utilities in concealed locations are based on the best information available but are not represented as being precisely correct. Work of the contract includes digging, cutting, drilling, using nondestructive methods, and other methods of locating concealed utilities in the field, as well as patching and repairing as specified in “Cutting and Patching” below.

B. If, in the course of the work, workers encounter a material they suspect to present some hazard:

1. Promptly notify the Owner and Architect in writing.
2. Do not perform any work which would disturb the suspected material until written instructions have been received.

1.18 WARRANTY

A. Work and equipment provided as work of this division shall be fully warranted under the general project warranty. In addition, provide added special warranties as specified in individual sections.

B. During the correction period, the Contractor shall begin correcting any work found to be not in accordance with the requirements of the Contract Documents within 4-hours of receiving written notice from the Owner. Provide detailed schedule for completion of work within 24-hours of receiving written notice from the Owner and revise schedule based on any Owner comments generated. Except as otherwise required in General Conditions and Division 01, the correction period is one year after the date of substantial completion of the work. Work requiring correction shall promptly be repaired or completely replaced at no addition to the Contract Sum.

1. Service reports for warranty work shall be provided to the Owner.

C. When use of the permanent equipment has been permitted for temporary services during construction of the building, the warranty and correction periods shall nevertheless begin at the time of substantial completion, unless another date of acceptance has been agreed to by the Owner.

D. Special warranties are warranties required by individual specification sections, incidental product warranties, manufacturers' standard warranties, installer or subcontractor service agreements, and other individual warranties in addition to the general project warranty.

E. Provide copies of warranties as required for Operation and Maintenance Manual specified above, and by Division 01.

F. For items of work delayed beyond date of substantial completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

1.19 COMMISSIONING

A. This project includes commissioning under the direction of a Commissioning Agent (CxA). Contractor's and subcontractors' responsibilities are described in Division 01.

B. Cooperate with the CxA to accomplish the requirements of the Commissioning Plan during the construction and correction periods.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

B. Cut walls, floors, partitions, roofs, and other appurtenances for the passage or accommodation of conduits. Close superfluous openings and remove debris caused by work of this division.

C. No cutting of any structure or finish shall be done until the condition requiring such cutting has been examined and approved by the Architect.

D. New or existing surfaces disturbed as a result of such cutting or otherwise damaged shall be restored to match original work and materials used for any patching or mending shall conform to the class of materials originally installed.

E. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

3.2 TEMPORARY FACILITIES

A. Temporary water facilities, electricity, telephone, toilet facilities, and temporary heat, shall be provided as specified in Division 01.

3.3 PROGRESS MEETINGS

A. Progress meetings shall be held as specified in Division 01, and also when and if the Contractor or Architect finds them necessary or advantageous to progress of work.

B. Contractor, those subcontractors and those material suppliers concerned with current progress or with the scheduling of future progress, Architect and Owner shall each be represented at these meetings by persons familiar with the details of work and authorized to conclude matters relating to work progress.

3.4 COMMISSIONING

A. Comply with requirements of ‘Commissioning” in Part 1 above.

END OF SECTION 26 01 01

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements applicable to work of more than one section of Division 26.

B. Basic materials and equipment required for electrical work.

C. Date sensitive equipment.

D. Operating instructions.

E. Testing wiring systems.

1.2 RELATED SECTIONS

A. Project and special warranties: Division 01 and Section 26 01 01.

B. Operation and Maintenance Manuals: Division 01 and Section 26 01 01.

C. Painting: Division 09.

D. Construction waste management: Division 01.

E. Commissioning requirements: Division 01.

1.3 DEFINITIONS

A. Project correction period: A period after Substantial Completion of the work during which the Contractor shall correct every part of the work found to be not in accordance with the requirements of the contract documents, promptly after receipt of written notice.

B. Qualified testing agency: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

1.4 DESIGN REQUIREMENTS

A. The drawings and system performances have been designed on the basis of using the particular manufacturers' products specified and scheduled on the drawings.

B. Products of other manufacturers that are listed under the article "Acceptable Manufacturers," or permitted as "equal," are permitted provided:

1. Product shall meet the specifications.
2. Contractor shall make, without addition to the contract sum, all adjustments for deviations so that the final installation is complete and functions as the design basis product is intended.

C. Do not propose products with dimensions or other characteristics different from the design basis product that make their use impractical or cause functional fit, access, or connection problems.

1.5 SUBMITTALS

A. Test reports: Show that tests specified in Part 3 below demonstrate the specified results.

1.6 QUALITY ASSURANCE

A. Provide materials and perform work in accordance with the electrical, building, fire, and safety codes and regulations of the state, county, or city in which the work is performed.

B. Electrical control panels, equipment, materials, and devices provided or installed as work of Division 26 shall bear UL label, or, if UL label is not available, the item shall be tested and labeled by a qualified testing agency, acceptable to authorities having jurisdiction, and in accordance with NFPA 70. Provide testing, if required, without addition to the contract sum.

C. VOC content: Field-applied adhesives and sealants, limits per South Coast Air Quality Management District (SCAQMD), Rule No. 1168.

D. Products shall contain no urea-formaldehyde content.

1.7 COMMISSIONING

A. This project includes commissioning under the direction of a Commissioning Agent (CxA). Contractors' and subcontractors' responsibilities are described in Division 01.

PART 2 - PRODUCTS

2.1 GENERAL

A. Techniques, testing, and operating instructions specified in this section apply to products specified in other sections of Division 26.

B. Equipment that uses or processes date and time data in order to perform its function shall be warranted by the manufacturer to properly function and correctly use or process all time-related data for all dates and times which occur during a reasonable life expectancy of the equipment.

2.2 MATERIALS

A. Electrical equipment backing panels: Plywood, DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated in accordance with AWPA C27, in thickness indicated, not less than 0.5 inch (13 mm) nominal.

1. One side finished.

B. Wood-preservative-treated lumber: Treated by pressure process, AWPA C2, with chemicals acceptable to authorities having jurisdiction, and marked with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

1. Application: Treat items indicated on the drawings, and the following:

a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, or waterproofing.
b. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
c. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
d. Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.
e. Wood floor plates that are installed over concrete slabs-on-grade.

C. Aircraft cable: 0.25-inch (6-mm) steel wire rope, galvanized, construction 7 by 19 strands, minimum 7000 pounds (31138 N) breaking strength.

2.3 DATE-SENSITIVE EQUIPMENT

A. Date-sensitive equipment: Systems, equipment, or components which use or process date and time data to perform their functions.

B. Each item of date-sensitive equipment used in the project shall be warranted by the manufacturer to properly function and correctly use or process all time-related data for all dates and times which occur during a reasonable life expectancy of the equipment.

PART 3 - EXECUTION

3.1 GENERAL

A. Manufacturers' instructions: Except as modified by drawings or specifications, install products and equipment in accordance with manufacturers' instructions and recommendations applicable to the project conditions.

1. Immediately notify Architect if a difference or discrepancy is found between manufacturers' instructions and the drawings or specifications.

B. The contract drawings are diagrammatic, and do not indicate all fittings or offsets in conduit or all pull boxes, access panels, or other specialties required. Provide required fittings, offsets, access panels, and specialties to coordinate the work.

C. No conduit shall be run below the head of a window or door.

D. Equipment and conduits installed in areas without a suspended ceiling shall be as tight to structure as possible, but at least above a height of 6'-8", unless otherwise noted.

E. Items which require access for operation or maintenance shall be easily accessible. Do not cut or form hand holes for operation or maintenance of appliances through walls or ceilings.

3.2 INSTALLATION OF PRODUCTS AND EQUIPMENT

A. Install conduit exposed to view parallel with the lines of the building and as close to walls, columns, and ceilings as may be practical, maintaining adequate clearance for access at parts requiring servicing.

B. Install conduit a sufficient distance from other work to permit a clearance of not less than 0.5 inches (13 mm) between its finished covering and adjacent work.

C. Pull boxes and other appurtenances which require operation or maintenance shall be easily accessible. Do not cut or form handholes for operation or maintenance of appliances through walls or ceilings.

D. Install plywood backing panels with finished face exposed.

3.3 OPERATING INSTRUCTIONS (DEMONSTRATION)

A. Furnish the necessary technicians, skilled workers, and helpers to overview the electrical systems and equipment of the entire project for one 8-hour day.

B. Where specified in technical sections, provide longer periods required for specialized equipment.

C. Instruct the Owner or designated personnel in operation, maintenance, lubrication, and adjustment of systems and equipment.

1. Instructions by manufacturer's technical representative for each type of equipment shall include the performance of the recommended preventive maintenance procedures for that equipment.

D. The Operating and Maintenance Manual shall be available at the time of the instructions for use by instructors and Owner personnel.

E. Schedule the general and specialized instruction periods for a time agreed upon by the Owner and Architect.

3.4 TESTS

A. During the progress of the work and after completion, test the branch circuits and distribution system, and the low-voltage alarm and signal systems.

B. Results of the tests shall show that the wiring meets the requirements of this specification. Should any test indicate defect in materials or workmanship, immediately repair, or replace with new, the faulty installation, and retest the affected portions of the work.

C. Furnish equipment and instruments necessary for testing.

D. Tests shall demonstrate the following:

1. Lighting, power, and control circuits are continuous and free from short circuits.
2. Circuits are free from unspecified grounds.
3. The resistance to ground of each non-grounded circuit is not less than one megohm.
4. Circuits are properly connected in accordance with the applicable wiring diagrams.
5. Circuits are operable. Demonstration shall include functioning of each control not less than ten times, and continuous operation of each lighting and power circuit for not less than 0.5 hours.

E. Test circuit breakers larger than 100 amps at full voltage.

F. Make voltage built-up tests with a voltage sufficient to determine that no short circuits exist.

G. Immediately repair defects and retest until systems are operating correctly.

H. Submit test reports.

END OF SECTION 26 05 00

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 05 07 - FIRESTOPPING FOR ELECTRICAL WORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Through-penetration firestopping in fire-rated construction.

B. Through-penetration smoke-stopping in smoke partitions.

1.2 RELATED SECTIONS

A. Conduit: Section 26 05 33.

1.3 REFERENCES

A. Underwriters Laboratories

1. UL Fire Resistance Directory
2. UL 1479: Through Penetration Firestops.

B. American Society for Testing and Materials Standards:

1. ASTM E 814: Standard Test Method for Fire Tests of Through-Penetration Firestops.

1.4 DEFINITIONS

A. Assembly: Particular arrangement of materials specific to given type of construction described in referenced documents.

B. Barriers: Time-rated fire walls, smoke barrier walls, time-rated ceiling/floor assemblies and structural floors.

C. Firestopping: Methods and materials applied in penetrations and unprotected openings to limit spread of heat, fire, gasses and smoke.

D. Penetration: Opening or foreign materials passing through or into barrier or structural floor such that full thickness of rated materials is not obtained.

E. Sleeve: Metal fabrication or pipe section extending through thickness of barrier and used to permanently guard penetration. Sleeves are described as part of penetrating system in other sections and may or may not be required.

F. System: Specific products and applications, classified and numbered by the rating agency to close specific barrier penetrations.

1.5 SYSTEM DESCRIPTION

A. Design requirements:

1. Fire-rated construction: Maintain barrier and structural floor fire resistant ratings including resistance to cold smoke at all penetrations.
2. Smoke barrier construction: Maintain barrier and structural floor resistance to cold smoke at all penetrations.

1.6 SUBMITTALS

A. Product data: Manufacturer's specifications and technical data including the following:

1. Detailed specification of construction and fabrication.
2. Manufacturer's installation instructions.

B. Shop drawings: Submit firestop assemblies and devices for all openings and through penetrations in fire-rated construction. Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, plus the following specific requirements.

1. Details of each proposed assembly identifying intended products and applicable rating agency classification.
2. Manufacturer or manufacturer's representative shall provide qualified engineering judgments and drawings relating to conditions where rated assemblies do not exist.

C. Quality control submittals:

1. Statement of qualifications.

D. Certifications: Letters or forms showing acceptance by local authorities for systems without acceptance by a rating agency.

1.7 QUALITY ASSURANCE

A. Products and assemblies shall be tested and labeled by an independent, nationally recognized testing and labeling authority.

B. Installer's qualification: Firm experienced in installation or application of systems similar in complexity to those required for this project, plus the following:

1. Acceptable to or licensed by manufacturer, state, or local authority where applicable.
2. At least 2 years' experience with systems.
3. Successfully completed at least 5 projects of comparable scale, using these systems.

C. Local and state regulatory requirements: Obtain acceptance for proposed assemblies not conforming to specific rating agency classifications or rated assemblies.

D. Materials shall have been tested to provide fire rating at least equal to that of the construction in which they are to be installed.

E. VOC content: Field-applied adhesives and sealants, limits per South Coast Air Quality Management District (SCAQMD), Rule No. 1168.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Packing and shipping:

1. Deliver products in original unopened packaging with legible manufacturer's identification.
2. Coordinate delivery with scheduled installation date, allow minimum storage at site.

B. Storage and protection: Store materials in a clean, dry, ventilated location. Protect from soiling, abuse, moisture and freezing when required. Follow manufacturer's instructions.

1.9 PROJECT CONDITIONS

A. Existing conditions:

1. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
2. Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.

B. Environmental requirements:

1. Furnish adequate ventilation if using solvent.
2. Furnish forced-air ventilation during installation if required by manufacturer.
3. Keep flammable materials away from sparks or flame.
4. Provide masking and drop cloths to prevent contamination of adjacent surfaces by firestopping materials.
5. Comply with manufacturing recommendations for temperature and humidity conditions before, during and after installation of firestopping.

1.10 WARRANTY

A. General project warranty and correction period, as required in general conditions and Division 01, requires repair or replacement of materials or systems which fail in joint adhesion, co-adhesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Acceptable manufacturers and products: Those listed in the UL Fire Resistance Directory for the UL System involved, or rated for the application by Warnock Hersey or by another acceptable rating agency.

2.2 THROUGH-PENETRATION FIRESTOPPING OF FIRE-RATED CONSTRUCTION

A. Systems or devices listed and labeled by a rating agency, and conforming to the construction type, penetrant type, annular space requirements and fire rating involved in each separate instance. The system shall be symmetrical for wall applications. Systems or devices shall be asbestos-free.

1. Additional requirements: Firestopping shall withstand the passage of cold smoke either as an inherent property of the system, or by the use of a separate product included as a part of the rated system or device, and designed to perform this function.
2. Additional requirements: Firestopping sealants shall be red in color to facilitate field verification of firestopping application.

2.3 MEMBRANE PENETRATIONS OF FIRE-RATED CONSTRUCTION

A. Systems for devices using UL listed electrical boxes within a fire-rated wall, listed and labeled by a rating agency, and conforming to the construction type, penetrant type, annular space requirements and fire rating involved in each separate instance. Systems shall be asbestos-free.

1. Additional requirements: Firestopping shall withstand the passage of cold smoke either as an inherent property of the system, or using a separate product included as a part of the rated system or device, and designed to perform this function.
2. Additional requirements: Firestopping sealants shall be red in color to facilitate field verification of firestopping application.

2.4 SMOKE-STOPPING AT SMOKE PARTITIONS

A. Through-penetration smoke-stopping: Any system complying with the requirements for through-penetration firestopping in fire-rated construction is acceptable, provided that the system includes the specified smoke seal or will provide a smoke seal. The length of time of the fire resistance may be disregarded.

2.5 ACCESSORIES

A. Fill, void or cavity materials and forming materials: Classified for firestopping use, or included in a rated firestopping assembly, by a rating agency.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify barrier penetrations are properly sized and in suitable condition for application of materials.
2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean surfaces to be in contact with penetration seal materials, of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire resistance.

3.3 INSTALLATION

A. Provide firestop devices or assemblies for every opening and penetration in floors or fire-rated construction.

B. Install penetration seal materials in accordance with printed instructions of the rating agency and in accordance with manufacturer’s instruction.

C. Ensure an effective smoke barrier in each sealed penetration. Install smoke stopping as specified for firestopping.

D. Protect materials from damage on surfaces subject to traffic.

E. Where large openings are created in walls or floors to permit installation of conduits, cables, or other items, close unused portions of opening with firestopping material tested for the application.

3.4 FIELD QUALITY CONTROL

A. Examine penetration seals to ensure proper installation before concealing or enclosing them.

B. Keep areas of work accessible until inspection and acceptance by applicable authorities.

C. Before substantial completion, patch and repair firestopping cut or penetrated by other construction work.

3.5 ADJUSTING AND CLEANING

A. Clean up spills of liquid components.

B. Neatly cut and trim materials as required.

C. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

END OF SECTION 26 05 07

SECTION 26 05 19 - WIRES AND CABLES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wires and cables rated 600 volts and less.

B. Type MC and Type MC luminary cables as permitted in Part 3.

C. Type AC-HCF and Type NM cables are not permitted.

1.2 RELATED SECTIONS

A. Underground ducts and utility structures: Section 26 05 44.

B. Conduits: Section 26 05 33.

C. Lighting controls: Section 26 09 23.

D. Lighting: Section 26 51 00.

E. Access Control and Security Systems: Division 28.

1.3 REFERENCES

A. ANSI/NEMA WC 70: Power Cables rated 2000 Volts or Less for Distribution of Electrical Energy.

B. ASTM B3: Standard Specification for Soft or Annealed Copper Wire.

C. ASTM B8: Standard Specification for Concentric-Lay-Stranded Copper Conductors.

D. UL 44: Standard for Thermoset-Insulated Wires and Cables.

E. UL 83: Standard for Thermoplastic-Insulated Wires and Cables.

F. Additional UL Standards as indicated.

1.4 SUBMITTALS

A. Product data:

1. Each type of wire and cable, including accessories.

2. Include copies of UL certifications showing compliance with requirements in "Quality Assurance" below.

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. Products and installation shall comply with NFPA 70 and other applicable national, state, and local electrical codes.

1.6 DELIVERY, STORAGE, AND HANDLING

A. General requirements: Deliver, store, and handle wire and cable in accordance with the manufacturer's instructions.

1. Wire and cable shall be packaged in a manner that protects them during ordinary handling and shipping. Ship from manufacturer with ends temporarily sealed against moisture.
2. Protect wire and cable during storage (both onsite and offsite).

    a. Store in a clean and dry location. Elevate from surfaces where water can accumulate, and cover cable rolls to protect against weather.

3. Handle wire and cable as recommended by the manufacturer. Do not pull from the center or periphery of the cable reel.
4. Damaged wire and cable shall be removed from the project site.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE (600 volts maximum)

A. Conductors: UL listed and NEMA WC 70 compliant; Copper, 98 percent conductivity, suitable for 600-volt duty; rated 90-degree Celsius temperature for wet/dry applications; solid bare annealed copper for No. 10 and smaller complying with ASTM B 3, and stranded for No. 8 and larger complying with ASTM B 8.

B. Conductor insulation:

1. Type THHN / THWN-2: Comply with UL 83; PVC insulation, nylon jacket.
2. Type XHHW-2: Comply with UL 44; stranded conductors XLPE insulation.

C. Conductor identification: Markings along outer braid denoting conductor size, voltage classification, type of insulation, and manufacturer's trade name, and color code. Identification shall extend to branch circuits and outlets. Use the color coding system tabulated below throughout the building's network of feeders and circuits, unless otherwise required by the authority having jurisdiction.

1. Colors on conductors No. 10 and smaller, or No. 6 and smaller for grounded and grounding conductors: Solid colored insulation.
2. Colors on conductors No. 8 and larger, or No. 4 and larger grounded and grounding conductors: Colored tape wrapped a minimum of 6 inches on either end of conductor.

COLOR CODE (600 volts maximum)				
VOLTAGE	NEUTRAL	PHASE		
		A	B	C
120 volts, 2-wire	White	Black, Red, or Blue depending on phase		
208/120 volts wye, 3-phase, 4-wire	White	Black	Red	Blue

D. Wires used solely for grounding purposes shall be green, where insulated. Insulated equipment ground conductors for isolated ground type receptacle circuits shall be green with a yellow strip.

E. Control wiring shall be coded with colors different from those used to designate phase wires.

2.2 WIRING ACCESSORIES

A. Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service where installed.

B. Twist-on wire connectors (dry locations):

1. Color-keyed.
2. Basis of design: Ideal Industries, Inc., Wingnut®, 3M Company "Scotchlok", or King Innovation.

C. Twist-on wire connectors (damp and wet locations):

1. Connectors shall be listed under UL 486D.
2. Basis of design: Ideal Industries, Inc., UnderGround®, models 60, 64, or 66 as appropriate; King Innovation DryConn®; or 3M Company.

D. Compression connectors:

1. Color-keyed.
2. Basis of design: 3M Company "Scotchlok"™ compressor connectors, "10000" series for copper conductors or Thomas & Betts (Blackburn) or Ilsco.

E. Compression connectors (damp and wet locations):

1. Protect connectors with a waterproof system, UL-listed for direct burial and 600 volts.

2. Basis of design: 3M Company 8420 series, Thomas & Betts Model DBSK82, or IIsco.

F. Compression taps:

1. Series CT-2 tap with CT-2C cover, or Series 54710 color-keyed compression taps,
2. Basis of design: Burndy Corporation "Versitap" or OZ/Gedney.

G. Power distribution blocks:

1. Basis of design: Hubbell Burndy “U-Blok.”

H. Multi-tap connectors, clear insulated:

1. Basis of design: Burndy Corporation "UNITAP" or Ilsco "Cleartap".

2.3 UNDERGROUND CONDUCTORS

A. Underground cable, Type THHN / THWN-2: Single-conductor, underground cable.

1. Cable: UL 83 listed; NEMA WC 70 construction; 600-volt, single-conductor. Solid copper No. 10 and smaller, stranded copper No. 8 and larger; and with PVC and nylon jacket insulation.

2.4 PLENUM CABLES

A. Plenum cable:

1. Insulated with material that is UL classified for low flame and smoke-spread characteristics, for use in plenum areas without conduit in accordance with the requirements of NFPA 70.
2. Communications cable: Type MPP or CMP in accordance with NFPA 70.
3. Insulator basis of design: Dupont “Teflon FEP”.

2.5 METAL-CLAD CABLE, TYPE MC

A. Cable: UL 83 and UL 1569 listed; 600-volt, single- or multi-circuit Type MC Cable, multi-conductor with ground conductor; aluminum or steel interlocked armor.

B. Conductors: Solid copper No. 10 and smaller, and stranded copper No. 8 and larger; conforming to ASTM B 3 or B 8.

C. Conductor Insulation: Type THHN/THWN insulated single conductors including ground conductor.

D. Fittings:

1. UL 514B listed, steel or malleable iron fittings.

2. Basis of design: KonKore/Atkore International.

2.6 METAL-CLAD CABLE, TYPE MC LUMINARY CABLE

A. Cable: UL 66, UL 83, UL 1569, and UL 2556 listed; 600-volt, single- or multi-circuit Type MC luminary cable; multi-conductor with power conductors, control conductors, and ground conductor; aluminum or steel interlocked armor.

1. Power conductors: Solid copper, Type THHN insulation, No. 10 and No. 12 AWG.
2. Control conductors: Solid copper, Type TFN insulation, twisted pair No. 16 AWG.

B. Fittings:

1. UL 514B listed, steel or malleable iron fittings.
2. Basis of design: KonKore/Atkore International.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Provide wire and cable indicated in accordance with national, state, and local electrical codes.

B. Conceal wire and cable in new construction and in locations with finished walls, ceilings, and floors unless otherwise noted on drawings.

C. Wire and cable serving systems over 100 volts shall be installed in raceways, except where otherwise noted on drawings.

D. Wire and cable serving systems rated below 100 volts shall be installed in raceways, except where otherwise noted in individual specification sections. Refer to paragraph “INSTALLING CABLE RATED BELOW 100 VOLTS” below for additional information.

3.2 INSTALLING INTERIOR WIRING

A. Sizes: Minimum sizes shall be as follows, unless a larger size is indicated on the drawings.

1. 120-volt branch circuits:

a. Homerun from first outlet to panel: No. 12 when run is 50 feet or less; No. 10 when run is between 50 feet and 100 feet; No. 8 when run is more than 100 feet.
b. First outlet to other outlets: No. 12.

2. Exit light and emergency lighting circuits: No. 12. Do not install in raceways, outlet boxes, or other locations with non-emergency wiring systems.

3. Other systems (over 100 volts): Minimum No. 12 unless specified or shown on drawings to be smaller.

Wiring methods and locations: Wires and cables shall be installed based on the following requirements, unless otherwise noted.

1. Feeders, exposed: Type THHN / THWN-2, single conductors in raceway.
2. Feeders, concealed in ceilings, walls, partitions, and crawlspaces: Type THHN / THWN-2, single conductors in raceway.
3. Feeders, concealed in concrete and below slab-on-grade: Type THHN / THWN-2, single conductors in raceway.
4. Feeders, underground: Type THHN / THWN-2, single conductors in raceway.
5. Branch circuits, concealed in ceilings, walls, and partitions:

    a. Unless otherwise indicated, utilize Type THHN / THWN-2, single conductors in raceway.
    b. Metal-clad cable, Type MC cable and MC luminary cable - Refer to section "INSTALLING MC CABLE" below for acceptable locations.

6. Branch circuits, exposed: Type THHN / THWN-2, single conductors in raceway.
7. Branch circuits, concealed in concrete and below slab-on-grade: Type THHN / THWN-2, single conductors in raceway.
8. Branch circuits, underground: Type XHHW-2, single conductors in raceway.
9. All other applications: Provide Type THHN / THWN-2, single conductors in raceway or wire and cable type as indicated.

B. Splicing shall be done in outlet boxes and junction boxes and not in conduit.

1. Conductors No. 8 and larger: Terminated, spliced and taped, wherever practical, with compression connectors or solderless connectors. Use tools recommended by the manufacturer.
2. Splices in conductors No. 10 and smaller, including lighting fixtures: Made with wire connectors.
3. Taps in conductors No. 6 and larger: Made with compression taps or power distribution blocks.

C. Wiring in high ambient temperature areas shall be of types required by NFPA 70 including fixture channels and on rooftops.

D. Wires shall be neatly shaped in panels, wireways, boxes, and appurtenances.

3.3 COORDINATION WITH DEVICES AND EQUIPMENT

A. Where conductor size or parallel conductors shown on drawings connect to terminals on devices or equipment which is not sized for the connection:

1. Provide a junction box as near the equipment as possible, but no more than 10 feet (3 m) away. Obtain approval of location before installing.

2. Provide conductor(s) sized to the ampacity of the equipment, from equipment to junction box.
3. In the junction box, splice the conductors from the equipment to the conductors of sizes, or parallel conductors, shown on the drawings.

3.4 INSTALLING EXTERIOR WIRING

A. Sizes: Minimum sizes shall be as follows, unless a larger size is indicated on the drawings.

1. 600-volt branch circuits: Copper, No. 10 minimum.
2. Exterior lighting circuits: Copper, No. 10 minimum.

B. Wiring methods and locations: Wires and cables shall be installed based on the following requirements, unless otherwise noted.

1. Feeders and branch circuits, exposed: Type XHHW-2, single conductors in raceway.
2. Feeders and branch circuits, underground: Type THHN / THWN-2, single conductors in raceway.
3. Service entrance: Type THHN / THWN-2, single conductors in raceway.

C. Splicing shall be done in outlet boxes and junction boxes and not in conduit. Treat these boxes as wet locations.

1. Conductors No. 8 and larger: Terminated, spliced and taped, wherever practical, with compression connectors. Use tools recommended by the manufacturer.
2. Splices in conductors No. 10 and smaller, including lighting fixtures: Made with wire connectors.
3. Taps in conductors No. 6 and larger: Made with compression taps or power distribution blocks.

3.5 INSTALLING CABLE RATED BELOW 100 VOLTS

A. Install in raceway, unless otherwise indicated in individual specification sections.

B. Where individual specification sections allow cable to be installed either in raceway or on J-hooks, install as follows:

1. Wiring method:

a. Wiring in walls, in concrete floors, above inaccessible ceilings, where exposed in finished spaces, exposed on walls, and wherever it may not be accessible or may be subject to physical damage: Install cables in raceway.
b. Wiring exposed in ceilings of unfinished spaces: Install cables in raceway or on J-hooks.
c. Wiring concealed above accessible suspended ceilings: Install cables on J-hooks.
d. Wiring in ceiling spaces of communications equipment rooms: Install cables on J-hooks.

e. Wiring within enclosures, consoles, cabinets, desks, and counters: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and/or distribution spools.

2. Conceal raceway and cables, except in unfinished spaces, and in open ceiling spaces.
3. Cable not in raceways:

   a. Do not install in hangers used for pipes, electric conduits, or ceiling hangers, nor support it in any way by attachments to pipes, conduits, or ceiling hangers.
   b. Install without damaging conductors, shield, or jacket. Cables shall not run through structural members or be in contact with pipes, ducts, or other potentially damaging items.
   c. Install away from potential EMI sources, including electrical power lines and equipment.
   d. Install parallel and perpendicular to surfaces or exposed structural members and follow surface contours where possible.

4. Cable support with J-hooks:

   a. Install J-hooks at intervals not exceeding 60 inches.
   b. Secure cables on J-hooks with hook-and-loop fastener (e.g., VELCRO® Brand) cable straps. No plastic cable ties. Avoid cinching cables.
   c. Provide separate J-hooks for each low-voltage system.

5. Each cable run shall contain an ‘S’ loop or other means to accommodate expansion or contraction.
6. Where ceiling plenums are used for passage of air by heating and air conditioning system, use UL listed plenum cable.

C. For cable installed in conduit, comply with requirements for raceways and boxes specified in Section 26 05 33, Conduits, and Section 26 05 34, Boxes.

1. Provide separate conduit systems for each low-voltage system.
2. Pull cables without exceeding cable manufacturer's recommended pulling tensions.

   a. Pull cables simultaneously if more than one is being installed in same raceway.
   b. Use pulling compound or lubricant, if necessary. Use compounds that will not damage conductor or insulation.
   c. Use pulling means, including fish tape, cable, rope, and basket-weave wire or cable grips, that will not damage cables or raceway.

D. Avoid installing near hot utilities, which might adversely affect system performance or result in damage to the cable. If cable must be placed close to such utilities, keep it separate and protect with insulation.

E. Cable bends shall have a radius not less than the value recommended by the cable manufacturer.

F. Tag cables connected to electronic equipment, to show function and the location of other end. Securely fasten labels to the cable.

3.6 INSTALLING MC CABLE

A. Install in compliance with NFPA 70.

1. Bend radius shall not be less than 7 times the external diameter of the cable.
2. Securely fasten in place at intervals of not more than six feet, with suitable clamps or fasteners of approved type.
3. Maintain at least 6-inch clearance between MC cables and other piping systems.
4. Do not fasten MC cable to conduits, pipes, or ducts.
5. Support individual MC cables hung from roof structure or structural ceiling by independently supported hangers using No. 10 wire.
6. Support groups of MC cable run in parallel on trapeze hangers suspended from 0.5-inch hanger rods, held in place with MC cable clamps or fasteners.
7. Installing hangers for MC cable shall be similar to installing conduit hangers.
8. Support MC cable on each side of a bend and not more than 1 foot from an enclosure where an MC cable is terminated.

B. Sizes: Cables larger than No. 8 shall not be permitted.

C. Locations: Type MC cable may be used for branch circuits in the following locations and conditions, unless otherwise indicated:

1. Concealed in accessible ceiling spaces or within casework.
2. Light fixture whips from junction box in accessible ceiling to recess-mounted lighting fixtures. Whips shall not exceed 12 feet in length.
3. Within drywall partitions / metal stud wall construction: Between wiring devices and from wiring device to a junction box in accessible ceiling within each room.
4. Do not use between ceiling junction boxes and homeruns back to panelboard. Homeruns shall be wire in raceway.
5. Do not install in masonry partitions or masonry walls.

D. Connect cable with wiring accessories specified above.

E. MC cable run to switches shall have a neutral conductor. This conductor is not indicated on the drawings.

F. Provide junction box in accessible ceiling space of each space and terminate MC cables in space at box.

G. Install in lengths no longer than 12 feet, terminating at junction box or outlet box at each end.

3.7 INSTALLING MC LUMINARY CABLE

A. Install in compliance with NFPA 70.

B. Locations: Type MC luminary cable may be used only above ceilings for LED lighting fixtures with dimmable drivers controlled by a Class 2, low-voltage 0-10VDC controller; connections between the controller and lighting fixtures within a space.

C. Connect cable with wiring accessories specified above.

D. Cable larger than No. 10 shall not be permitted.

E. Maximum length: 12 feet.

END OF SECTION 26 05 19

SECTION 26 05 21 - WIRING CONNECTIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Power and control wiring for equipment.

1.2 RELATED SECTIONS

A. Equipment: Installed items requiring electricity, specified in other sections or shown on drawings.

B. Motors:

1. Motors requirements for plumbing equipment: Section 22 05 13.
2. Motors requirements for HVAC equipment: Section 23 05 13.

C. Control systems wiring: Section 23 09 02.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Conduits, wires and cables, devices, and accessories as specified in other sections.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide power wiring from the motor starters to each motor and its manual controlling device. Interlock and control wiring related to the automatic temperature control system shall be provided under Section 23 09 02, Control Systems Wiring.

1. Make flexible or liquid tight connections as specified in Section 26 05 33, Conduits.

B. Except where provided with equipment, furnish and install manual pushbutton stations and pilot lights, with wiring. Where stations and pilot lights are grouped at central locations, mount them under a common faceplate.

C. Rough in and connect to equipment furnished under other sections and equipment furnished by Owner. Make connections as indicated on drawings with exact locations and details determined by approved shop drawings of the equipment.

1. Under equipment sections, equipment will be set in position and the electrical devices and components furnished loose. Assemble, install, and wire under this section.
2. Accomplish rough-in from walls with flush outlet boxes and from floors by means of conduit couplings finishing flush with finished floor.

D. Certain equipment, as indicated, will be furnished with control panels and auxiliary control components. Mount the panels, furnish and install source wiring and disconnects, and completely connect controls and motors.

E. Provide source wiring, connections, and disconnects for mechanical heating, ventilating, and air-conditioning (HVAC) equipment specified in Division 23. Refer to sections of Division 23 for equipment and controls.

1. Provide weathertight enclosures for disconnects for outdoor equipment.
2. Mount starters where required, and provide proper size overload protection.
3. Where capacitors are required for power factor correction as specified in 23 05 13, Common Motor Requirements for HVAC Equipment, connect the capacitors.

F. Roof exhaust fans will be equipped with factory-wired disconnects located adjacent to the motor under the ventilator hoods as specified in Section 23 34 00, HVAC Fans. Exhaust fans shall be controlled by various means as indicated on drawings.

1. For fans shown to be manually controlled, furnish and install a manual motor starting switch with pilot light, located where indicated.
2. Where necessary for larger and three-phase motors, provide magnetic starters.
3. Where fans are provided with electrically operated dampers, provide wiring and relays for single-phase damper operators on three-phase motors.

G. Cabinet unit heaters will be equipped with a manual motor starting switch with overload protection, located within the cabinet. Provide source wiring to line side of this switch. Automatic control of these units will be as described in Control Sequences.

H. Provide wiring to submersible pump in well.

I. Where a Division 23 section requires installation of equipment under supervision of equipment manufacturer's representative, coordinate electrical installation to cooperate with representative's requirements.

J. Provide power sources for Owner-furnished equipment.

K. Provide power and control wiring for fire protection system pumps, controllers, alarm panels and alarm bell. Mount bells and silence switches where indicated. Provide plastic nameplates under bell and switch.

L. Provide power and control wiring for emergency generator, controllers, remote control panels and remote alarm bell. Mount remote bell and silence switch where indicated. Provide plastic nameplates under bell and switch.

M. Provide wiring where required to time clocks provided as specified in automatic temperature controls sections.

END OF SECTION 26 05 21

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 05 26 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Grounding and bonding electrical systems and equipment.

B. Ground system test.

1.2 REFERENCES

A. ANSI/TIA/EIA J-STD-607

B. IEEE STD 142

C. NFPA 70

D. ASTM F467 and F468

E. UL 467

1.3 DEFINITIONS

A. Area served by a separately-derived system: The area within the building that contains any part of a circuit of the system.

B. IBT: Intersystem Bonding Termination Grounding Busbar.

C. TGB: Telecommunications Grounding Busbar.

1.4 SUBMITTALS

A. Product data: Ground rods and connections.

B. Certifications: System test.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Ground conductor, unless specifically noted otherwise, shall be copper, 98 percent conductivity, solid for No. 10 AWG and smaller and stranded for No. 8 AWG and larger.

1. Isolated equipment grounding conductors shall have green insulation with a yellow stripe, or shall be identified as specified in Part 3.

B. Grounding busbar: Predrilled rectangular bars of electro-tin plated copper, 0.25 inches thick, 12 inches long, unless otherwise indicated on drawings, with 0.3125-inch or 0.4375-inch diameter holes horizontally spaced 1 to 1.125 inches apart.

1. Intersystem bonding termination grounding busbar (IBT) shall be 4 inches wide, with four rows of holes. Telecommunications main grounding busbar shall comply with ANSI/TIA/EIE J-STD-607.
2. Other grounding busbars shall be 2 inches wide with two rows of holes. Each telecommunications ground busbar (TGB) shall comply with ANSI/TIA/EIA J-STD-607.
3. Stand-off insulators for busbar shall be flame-resistant fiberglass-reinforced thermoset polyester, UL recognized per UL Standard 891.

C. Ground rods:

1. Copper bonded steel, 0.75-inch diameter by 10 feet long, one end pointed and the other end tinned,
2. Basis of design: Erico International Corporation.

D. Mechanical type ground connectors:

1. Connectors:

a. IEEE 837 and UL 467 compliant, listed for use for specific types, sizes, and combinations of conductors and connected items.
b. Basis of design: FCI Burndy G Series.

2. Nuts, bolts, and washers: Silicon bronze alloy type B per ASTM F467 and F468.

E. Exothermic type ground connections:

1. Exothermic welding systems.
2. Basis of design: “Cadweld,” manufactured by Erico International Corporation.

F. Lugs:

1. Lugs shall be two- or four-hole.
2. Basis of design: Burndy Hylug series.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Provide the complete grounding of conduit systems, electrical equipment, conductor and equipment enclosures, motors, transformers, and neutral conductors in accordance with applicable codes. Grounded phase and neutral conductors shall be continuously identified. Continuity of metal raceways shall be insured by double locknuts.

B. Furnish and install main grounds for secondary electrical service to cold water main in accordance with NEC requirement. In addition to the cold water ground, provide ground rods as indicated or as required by NEC and applicable codes.

C. Grounding busbar: Busbars shall stand off the wall a minimum of 2 inches. Mount 6 inches above finished floor unless otherwise indicated. Insulate the busbar from its supports.

1. Conductors connecting busbar to other busbars, and to the grounding electrode system shall be attached to busbar with exothermic welds.
2. Connect other conductors to busbar using lugs.

D. Install copper grounding jumpers of 3/0 copper cable around each main water valve in the building. Install copper grounding jumpers around conduit expansion fittings. Jumpers shall be of adequate current carrying capacity corresponding to size of conduit.

E. Ground system connections which are beneath the floor and in a concealed or inaccessible location shall be brazed or welded. Brazing and welding shall be “CADWELD.”

F. Bonding separately-derived systems:

1. Each metal water piping system, not used as the electrical system’s grounding electrode, in the area served by the electrical system shall be bonded to the electrical system’s neutral by a system bonding jumper.
2. If exposed structural metal is not used as the grounding electrode for the system, bond exposed structural metal in the area served by the electrical system to the system’s neutral by a system bonding jumper.
3. If a metal water piping system in the area served by the electrical system is bonded to exposed structural metal by a NEC-compliant bonding jumper, then only one of the two (piping or structure metal) need to be bonded to the electrical system’s neutral.

G. Test wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 26 05 44, Underground Ducts and Utility Structures , and shall be at least 12 inches deep, with cover.

1. Test wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

H. Bonding straps and jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.

2. Bonding to equipment mounted on vibration isolation hangers and supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connections for outdoor locations; if a disconnect-type connection is required, use a bolted clamp secured with a minimum of two bolts and lock washers.

I. Ufer ground (concrete-encased grounding electrode): Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.

1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

3.2 EQUIPMENT GROUNDING AND BONDING

A. Provide insulated equipment grounding conductors with feeders and branch circuits.

B. Air-duct equipment circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Water heater, heat tracing, and anti-frost heating cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

D. Isolated grounding receptacle circuits shall be provided with an additional equipment grounding conductor insulated from the normal equipment grounding conductor.

1. Provide an isolated equipment grounding conductor for connection to the isolated ground type receptacle's grounding terminal. The isolated equipment grounding conductor shall be in addition to the system equipment grounding conductor used to bond the outlet box to the grounding system.
2. Multiple isolated ground type receptacles on a single circuit may use a common insulated equipment ground conductor for connection to the grounding terminals.
3. Terminate the circuit's insulated equipment grounding conductor in the circuit's originating panelboard on an insulated equipment ground bar (insulated from the panel's normal equipment ground bar and panel enclosure).
4. Provide an insulated equipment grounding conductor from the panel's insulated equipment ground bar to the originating system's (service or separately derived system) neutral terminal. This conductor shall follow the route of the panel feeder through any intervening distribution equipment to the originating system.
5. Insulating equipment grounding conductors that do not have insulation as described in Part 2 shall be marked (where visible to normal inspection) with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

E. Signal and communication equipment: In addition to grounding and bonding required by NFPA 70, provide grounding systems complying with requirements in ANSI/TIA/EIA J-STD-607-A.

1. Telephone and data equipment may share a common grounding system.

a. Provide a No. 4 AWG minimum conductor from the IBT to a TGB, located in the telecommunications closet.

2. For other communication equipment, such as fire alarm, intercom, CATV, and security panels, when located in a room other than where the IBT or TGB is, provide a grounding busbar in the same room as the equipment. Bond the grounding busbar to the IBT or TGB with a No. 4 AWG minimum conductor.

3.3 IDENTIFICATION

A. Comply with requirements in Section 26 05 53, Identification for Electrical Systems , for instruction signs. The label or its text shall be green.

B. Install labels at the ends of telecommunications bonding conductors and the grounding electrode conductor where exposed

1. Label text: “If this connector or cable is loose or must be removed for any reason, please call the building telecommunications manager.”

3.4 GROUNDING SYSTEM TEST

A. Ensure that grounding system is continuous and that resistance to earth is not more than 10 ohms.

B. Test each ground rod for resistance to earth before making connections to rod; tie grounding system together and test for resistance to earth.

1. Make resistance measurements in dry weather, not earlier than 48 hours after rainfall.

C. Submit written results of each test including location of rods as well as resistance and soil conditions at time measurements were made.

END OF SECTION 26 05 26

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 05 28 - EQUIPMENT FOUNDATIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Equipment foundations (housekeeping pads).

B. Outdoor equipment foundations.

1.2 RELATED SECTIONS

A. Service entrance: Section 26 05 41.

1.3 SUBMITTALS

A. Product data: Concrete mix, grout, reinforcement, and accessories.

B. Certifications: Test report showing strength of concrete.

PART 2 - PRODUCTS

2.1 CONCRETE

A. Concrete:

1. Indoor: 3,000 psi (20.7 MPa) compressive strength at 28 days.
2. Outdoor: 4,500 psi (31.0 MPa) compressive strength at 28 days.

2.2 GROUT

A. Non-shrink grout: Premixed, consisting of non-metallic aggregate, cement, water-reducing and plasticizing agents; capable of developing minimum compressive strength of 7,000 psi in 28 days.

1. Five Star Products, Inc. “Five-Star Grout”
2. L&M Construction Chemicals, Inc. “Crystex”
3. Sonneborn “Sonogrout”

2.3 METAL REINFORCEMENT

A. Reinforcing bars: Deformed steel bars in accordance with ASTM A615, Grade 60, clean and free from loose rust, scale, or other coatings that will reduce bond.

B. Welded wire fabric reinforcing: ASTM A 185 No. 6 steel wire spot-welded at intersections and of size 6 by 6 inch mesh.

C. Metal accessories: Include spacers, chairs, bolsters, ties, and other devices necessary for properly placing, spacing, supporting and fastening reinforcement in place.

PART 3 - EXECUTION

3.1 INSTALLING EQUIPMENT FOUNDATIONS (HOUSEKEEPING PADS)

A. Provide 4-inch high concrete foundations (housekeeping pads) for floor-mounted equipment unless otherwise noted. Furnish foundations, bolts, sleeves, and appurtenances and install as recommended by equipment manufacturer. Anchor the concrete foundations by dowels inserted into the floor slab. Provide welded wire fabric reinforcement.

B. Unless otherwise specified, install concrete work in accordance with the requirements of Division 03.

C. Equipment shall be properly aligned. Level and grout equipment where necessary. Support conduit independently of equipment and so as not to cause a strain or thrust.

D. Coordinate exact locations and configurations of equipment, foundations, and supports with the approved shop drawings of the equipment.

3.2 INSTALLING OUTDOOR EQUIPMENT FOUNDATIONS

A. Provide equipment foundations of size and thickness indicated.

B. Place reinforcement accurately in position shown, securely fasten, and support to prevent displacement before or during pouring. Clean, bend, place, and splice reinforcement in accordance with approved shop drawings. Lap ends and sides of mesh reinforcement in slabs not less than one mesh.

1. Coverage of main reinforcing shall be as follows: Slabs, 0.75 inch (19 mm); concrete poured against earth, 3 inches (75 mm); other locations, 2 inches (50 mm).

C. Properly align, level, and grout equipment.

END OF SECTION 26 05 28

SECTION 26 05 33 - CONDUITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Conduit, raceways, and accessories, aboveground and underground where not in concrete-encased ductbanks.

1.2 RELATED SECTIONS

A. Trenching: Division 31.

B. Firestopping: Section 26 05 07.

C. Boxes: Section 26 05 34.

D. Exterior underground concrete-encased ductbank and handholes: Section 26 05 44.

E. Painting: Division 09.

1.3 DEFINITIONS

A. Conduit: Conduit, raceway, or tubing.

B. EMT: Electrical metallic tubing.

C. FMC: Flexible metal conduit.

D. IMC: Intermediate metal conduit.

E. LFMC: Liquid-tight flexible metal conduit.

F. PVC: Polyvinyl chloride.

G. RGS: Rigid galvanized steel.

1.4 SUBMITTALS

A. Product data:

1. Each type of conduit and raceway included in the work, and related fittings.
2. Sleeves and sleeve seals.
3. Accessory materials.
4. Hangers and fasteners.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with requirements, the following listed manufacturers provide products of acceptable quality:

1. Steel conduit and tubing:

a. AFC Cable Systems, Inc. (FMC and LFMC)
b. Allied Tube & Conduit; a Tyco International Ltd-Co.
c. O-Z/Gedney, Unit of General Signal.
d. Wheatland Tube Co.
e. Or approved equal.

2. Steel conduit fittings:

a. Appleton Electric Co.
b. Cooper Crouse-Hinds.
c. Hubbell, Inc.; Killark Electric Manufacturing Co.
d. O-Z/Gedney; Unit of General Signal.
e. Spring City Electrical Manufacturing Co.
f. Thomas & Betts Corporation.
g. Wheatland Tube Co.
h. Or approved equal.

3. Nonmetallic conduit, tubing and fittings:

a. Allied Tube & Conduit; a Tyco International Ltd. Co.
b. Arnco Corp.
c. Beck Manufacturing.
d. CANTEX Inc.
e. Certainteed Corp.; Pipe and Plastics Group.
f. Lamson & Sessions; Carlon Electrical Products.
g. Or approved equal.

4. Wireways and fittings:

a. Hoffman Engineering Co.
b. Lamson & Sessions, Carlon Electrical Products.
c. Schneider Electric; Square D products.
d. Or approved equal.

5. Conduit hangers and supports:

a. Thomas & Betts “Kindorf”.
b. Tyco Power-Strut.
c. Unistrut Diversified Products.

d. Or approved equal.

6. Fasteners:

a. Caddy Fasteners by Erico Products Inc.
b. ITW Ramset “Red Head”.
c. Wej-It Fastening Systems.
d. Or approved equal.

2.2 CONDUIT AND FITTINGS

A. Galvanized steel conduit: Hot-dip galvanized with threads galvanized after cutting:

1. Intermediate steel conduit (IMC) conforming to UL 1242 and ANSI C80.6.

B. Steel conduit fittings: Cast malleable iron fittings with smooth finish and full threaded hubs. Include steel or malleable iron locknuts, bushings, and other fittings.

1. Insulating bushings: Basis of design: Thomas & Betts Series 22.
2. Hub fittings with recessed sealing ring and nylon insulated throat: Basis of design: Thomas & Betts Series 370.
3. Fittings for exposed locations: Conduit outlet bodies, cast iron or cast aluminum, zinc or cadmium plated.

C. Electrical metallic tubing (EMT): Hot-dip galvanized or sherardized thin-wall steel conduit conforming to UL 797 and ANSI C80.3.

D. Connectors and couplings for EMT: Concrete- or rain-tight, compression type, made of zinc- or chromium-plated steel. Connectors shall have nylon insulating throats.

1. Compression connector: Basis of design: Thomas & Betts No. 5223.
2. Compression coupling: Basis of design: Thomas & Betts No. 5220.

E. Flexible metal conduit (Type FMC): Made of sheet metal strip, interlocked construction, conforming to UL 1.

F. Liquidtight flexible metal conduit (Type LFMC) shall conform to UL 360.

G. Connectors for flexible metal conduit:

1. Angle wedge with nylon insulated throat.
2. Basis of design: Thomas & Betts “Tite-Bite” connector Series 3110 and 3130.

H. Liquidtight type connectors:

1. UL 14814A. Fittings: With nylon insulated throat.
2. Basis of design: Thomas & Betts Series 5331.

I. Plastic conduit: Polyvinyl chloride (PVC) Schedule 40, rated for use with 90-degree conductors, for exposed, underground, and encased applications, complying with NEMA Specification TC-2 and UL 651.

J. PVC conduit fittings, solvents and adhesives:

1. Fittings: Complying with NEMA TC 3 and UL 514.
2. Solvents and adhesives: As recommended by conduit manufacturer.

K. Wireways: Steel wireway with hinged cover, complying with UL 870 Standard for Wireways, Auxiliary Gutters, and Associated Fittings.

1. Cover: Front accessible opening along complete length of wireway.
2. Finish: Gray polyester powder finish inside and out.
3. Basis of design: Square D "Square-Duct" or Pentair/Hoffman "Angled Trough".

L. Fittings for wireways: Made with removable covers to permit installation of a complete system with access to wires throughout the system, UL listed with wireways. Connections: Threaded screws at every connector.

M. Weatherproof expansion fittings:

1. With bonding jumpers.
2. Basis of design: O-Z/Gedney Types AX and TX.

2.3 SLEEVES FOR RACEWAYS

A. Steel pipe sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

1. Sleeves for exterior walls: Anchor flange welded to perimeter.

B. Sleeves for rectangular openings: Galvanized sheet steel of length to suit application. Minimum thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches: 0.052 inches.
2. For sleeve cross-section rectangle perimeter equal to or more than 50 inches and one or more sides equal to or more than 16 inches: 0.138 inches.

C. Coordinate sleeve selection and application with selection and application of firestopping specified in Section 26 05 07.

2.4 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annual space between sleeve and conduit.

1. Sealing elements: EPDM or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure plates: Reinforced nylon polymer. Include two for each sealing element.
3. Connecting bolts and nuts: Stainless-steel of length required to secure plates to sealing elements. Include one for each sealing element.

2.5 ACCESSORY MATERIALS

A. Pull rope: Polypropylene, minimum 0.1875 inches thick, tensile strength 800 pounds, work load 130 pounds.

B. Caps and plugs: Basis of design: Thomas & Betts Series 1470.

C. Lubricant:

1. UL approved.
2. Basis of design: Ideal Industries, Inc. “Yellow 77”.

D. Bituminous protective coating: Coal tar based, self-priming on steel, applied in a wet film thickness at least 22.0 mils (559 microns) per coat.

E. Rust inhibitive paint:

1. Alkyd based, white, black, or bronzetone; applied in a wet film thickness of at least 2.9 mils.
2. Basis of design: Benjamin Moore Super Spec HP D.T.M. Alkyd Low Lustre P23.

2.6 CONDUIT HANGERS

A. Adjustable hangers: Basis of design: Kindorf C-711 lay-in hanger or C-710 Clevis hanger.

B. Trapeze hangers:

1. Constructed of channels with notched steel straps.
2. Steel strap basis of design: Kindorf C-105.

C. Channels:

1. Steel, 1.5 inches wide with 7/8-inch continuous slot, gauges, and weights.
2. Basis of design: Kindorf B-900 series, hot-dipped galvanized finish.

D. Beam clamps:

1. Adjustable type for connecting hanger rod to steel beam.
2. Basis of design: Kindorf E-160 or U-569.

E. Hangers for conduit 1 inch and smaller, through or below bar joists: “Hang-on” hangers attached to joists with Minerallac scissor clips or two-piece stud clips.

F. Finish: For hangers, assemblies, plate washers, rods, locknuts, channels, bolts, and appurtenances:

1. Zinc plated.
2. Hot-dip galvanized, where required for weather-exposed or damp locations.

2.7 FASTENERS

A. General: Select fasteners such that load applied does not exceed one-fourth of manufacturer's load capacity in 3500 psi concrete.

B. Fasteners to concrete: Self-drilling type expansion anchors, or machine bolt drop-in anchors for drilled holes. Fasteners to concrete ceilings shall be vibration- and shock-resistant.

C. Fasteners to drywall or cavity wall: Toggle bolts, hollow-wall drive anchors, or nylon anchors as required.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Provide complete, separate, and independent raceway system for each of the various wiring systems including, but not limited to, the following:

1. Lighting
2. Power
3. Exit Lighting*
4. Emergency Lighting System*
5. Fire Alarm System
6. Low Voltage Control System
7. Control Wiring
8. Voice and Data Systems
9. Sound System
10. Television System
11. Security Systems

*These wiring systems may be installed in common raceways.

B. Wire raceway systems completely, except where otherwise indicated, as shown on drawings and as required for satisfactory operation of each system.

C. Where wireways are required or used to facilitate the installation, size them to accommodate conductors, in accordance with NFPA 70.

D. Types and locations of conduits are scheduled at the end of the section.

E. Do not install conductors or pull rope during installation of conduit.

F. Where conduit is connected to a cabinet, junction box, pull box, or auxiliary gutter, protect the conductors with an insulating bushing. Provide locknuts both inside and outside the enclosure. Where conduit is stubbed up to above ceilings for future wiring, close ends with bushings.

G. Bituminous protective coating:

1. Coat exposed threads on steel conduits in concrete slabs at couplings and fittings, after joints are made up.
2. Coat metallic conduits below grade not in concrete, and where emerging from below grade or slabs, 4 inches above and below grade or slab.

H. Rust-inhibitive paint:

1. Exposed threads of exterior conduit.
2. Unfinished metal components.

I. Make turns in conduit runs with manufactured elbows or using machines or tools designed to bend conduit. Turns shall be not less than the various radii permitted by NFPA 70.

J. Sizes:

1. Do not use conduit smaller than 0.75 inches, except where otherwise indicated.
2. Feeder conduits shall be as large as indicated, or as required by NFPA 70 (whichever is larger). Do not install more than one feeder in a single conduit.
3. Conduit sizes shown on drawings are based on Type THHN/THWN-2 wire.

K. Make vertical runs plumb and horizontal runs level and parallel with building walls and partitions.

L. Ground conduits as required by NFPA 70.

M. Where conduits pass through building expansion joints, and wherever relative movement could occur between adjacent slabs, equip with weatherproof expansion fittings and bonding jumpers.

N. Where conduits through roof cannot be installed inside equipment or pipe curbs, flash them in accordance with the SMACNA Architectural Manual.

1. Coordinate flashing details and materials with manufacturer and installer of roofing system.

O. Run conduits concealed in new construction except where connecting to surface-mounted cabinets and equipment, and in electrical and mechanical equipment spaces. Install conduit above suspended ceilings and within walls and partitions.

P. Install conduits in slab on grade where indicated on the drawings and where connecting to floor boxes. Conduits installed in slab on grade shall be above the vapor barrier. Maximum conduit size shall be 1.25 inches. Slab shall be depressed as required to maintain a minimum of 2 inches of concrete above the conduit. Conduit shall be secured in position to prevent damage or movement during the concrete pour.

Q. From each flush-mounted lighting or power panelboard, provide at least four 0.75-inch empty conduits, to terminate in furred ceiling space above. On floors above ground floor, provide two additional 0.75-inch conduits terminating in furred ceiling space below. Cap these conduits.

R. Immediately after each run of conduit is completed, test it for clearance, smooth the joints, and close at each end with caps or plugs to prevent entrance of moisture or debris.

S. Conduit installed outdoors or at indoor locations exposed to continuous or intermittent moisture shall provide a liquid-tight seal. Use steel or malleable iron hub fittings. Coat exposed threads with bituminous protective coating.

T. Install no conduit in these locations:

1. Setting beds for terrazzo or tile.
2. Concrete toppings, unless specifically approved by Structural Engineer.

U. Conduit in concrete decks above grade: Not permitted.

V. Where conduit is stubbed up through concrete slab, exterior walls, or bearing walls, provide galvanized steel conduit elbows.

W. Install insulated bushings on ends of conduit stubs and sleeves.

3.2 INSTALLING PULL BOXES, JUNCTION BOXES, OUTLET BOXES

A. Install as specified in Section 26 05 34, Boxes.

B. Install pull or junction boxes in long runs of conduits or where necessary to reduce the number of bends in a run.

1. Select inconspicuous locations. Do not install until locations have been approved by the Architect.
2. Install boxes flush with wall or ceiling surfaces, with flat covers. Where removable ceiling units are used, locate boxes above ceilings.

C. Verify door swings with door frame installed before locating switch outlets. Locate switch outlets on the strike side of the door frame.

3.3 INSTALLING FLEXIBLE CONDUIT

A. Installation shall comply with NFPA 70.

1. Minimum length: 2 feet.
2. Maximum length: 6 feet.

B. Make immediate connections to transformers, recessed lighting fixtures, speakers, and other equipment in suspended ceilings with flexible metal conduit. Include sufficient slack to permit removal of fixture or equipment.

C. Make immediate connections to motors with liquid-tight flexible metal conduit. Include sufficient slack to reduce the effects of vibration.

D. In wet locations, install liquid-tight type, in such a manner that liquid tends to run off the surface and not drain toward the fittings.

E. Where fittings are brought into an enclosure with a knockout, install a gasket assembly consisting of an O ring and retainer on the outside.

3.4 INSTALLING PULL ROPE AND CONDUCTORS

A. After conduit is installed, fish pull rope. After completion of the work of this project, pull rope shall remain in conduits identified as to be left empty. For each empty conduit, pull rope shall be of the same size, strength, and material as the ropes used to pull cables and conductors through similar conduits. Provide minimum 6 inches of pull rope at each end.

B. Do not use a pull rope that has a tensile strength of more than one of the conductors of a two-wire circuit, more than two of the conductors of a three-wire circuit, or more than three of the conductors of a four-wire circuit.

C. Do not pull conductors into the conduits until the system is entirely completed and wet building materials are dry.

D. Use only a lubricant approved for use with conductor materials and pull rope materials.

3.5 INSTALLING SLEEVES

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Section 26 05 07.

B. 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.

C. 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.

D. Cut sleeves to length for mounting flush with both surfaces of walls.

E. Extend sleeves installed in floors 2 inches above finished floor level.

F. Size pipe sleeves to provide 0.25-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed.

G. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

H. Interior penetrations of non-fire-rated walls and floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint.

I. Fire-rated-assembly penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Section 26 05 07.

J. Roof-penetration sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

K. Exterior-wall penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 INSTALLING CONDUIT HANGERS

A. Single runs of overhead conduits 1.25-inch size and larger shall be supported by adjustable hangers, using 0.375-inch rods for conduits up to 2-inch size and 0.5-inch rods for conduits larger than 2 inches.

B. Support groups of conduits run in parallel on trapeze hangers suspended from 0.5-inch hanger rods.

C. Space hangers not over 5 feet apart for non-metallic conduits, and not over 10 feet apart for metal conduits. Support conduits within 3 feet of each outlet, junction or pull box.

D. Below bar joist construction, support hangers from a length of structural channel, welded to the top chords of at least two joists.

E. Where large numbers of conduits are grouped together, stagger individual hangers so as not to concentrate the load on a few joists.

F. Where hanger rods are attached to structural beams, use adjustable beam clamps.

G. Below precast plank construction, hanger rods shall pass through the precast planks and be secured on top side with nut, locknut and plate washer. Plate washers shall be at least 4 inches square and 0.125 inches thick. Top of hanger assembly shall be concealed in the concrete fill which will be placed over the planks.

H. Attach hanger rods to concrete with expansion bolts and anchors.

3.8 INSTALLING UNDERGROUND CONDUIT, GENERAL

A. Depth:

1. Buried under building slabs: Top of conduit no less than 12 inches below the vapor barrier. Seal around conduits where they penetrate the vapor barrier.
2. Outside building: Top of conduit no less than 24 inches below finish grade.

B. Slope: At least 3 inches in 100 feet away from buildings and toward manholes or other drainage points.

C. Cleaning: At the completion of each run, in each conduit, first run a testing mandrel not less than 12 inches long with diameter 0.25 inches less than the inside diameter of the conduit; then draw through a stiff-bristled brush until particles are removed. Immediately install conduit plugs.

D. Except at conduit risers, make changes in direction of runs, either vertical or horizontal, by long sweep bends. Bend may be made up of one or more curved or straight sections or combinations. Use manufactured bends with a minimum radius of 36 inches.

E. Where underground nonmetallic conduit runs penetrate floor slabs, exterior walls, or bearing walls, use galvanized steel conduit elbows. Coat metallic elbows with bituminous protective coating.

3.9 INSTALLING UNDERGROUND CONDUIT WITHOUT CONCRETE ENCASEMENT

A. Run conduit in straight lines except as necessary.

B. Trenches: At least 3-inch clearance on each side of the conduit.

C. Warning tape: Install in backfill approximately 12 inches below grade.

D. Under existing roads and paved areas not to be disturbed, jack rigid steel conduit into place.

3.10 SCHEDULE OF LOCATIONS

A. RGS or IMC with screw joint couplings:

1. Wiring to exterior equipment.
2. Conduits in concrete slabs except where noted to be PVC.
3. First five feet of conduit extending outside building.

4. Elbows penetrating floor slabs, exterior walls, or bearing walls.
5. Conduits in mechanical rooms.

B. EMT: Sizes 4 inches and smaller except as noted above.

C. FMC and LFMC: Where noted elsewhere in this section.

D. PVC with solvent cement joints:

1. For exterior circuits, direct buried, except first five feet from building.
2. Where noted under concrete slab, concrete encased, except elbows penetrating floor slabs, exterior walls, or bearing walls shall be galvanized steel conduit.
3. Where noted under building concrete slab, concrete encased or direct buried.
4. Where noted in concrete slabs.
5. For concrete-encased ductbanks.

END OF SECTION 26 05 33

SECTION 26 05 34 - BOXES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Boxes with covers.

B. Poke-thru service fittings.

C. Wall and Floor boxes for power and communications.

1.2 RELATED SECTIONS

A. Conduits: Section 26 05 33.

B. Access doors: Division 08.

C. Wiring devices: Sections 26 09 23 and 26 27 26.

D. Outlet boxes where required for special systems: Provided by the equipment manufacturers of the various systems.

1.3 SUBMITTALS

A. Product data: Each type of box and poke-thru service fitting included in the project.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with requirements, the following listed manufacturers provide products of acceptable quality:

1. Boxes:

a. ABB/Iberville/Nutek/Steel City/Carlon
b. Emerson/Appleton Group
c. nVent/Hoffman
d. Hubbell/RACO
e. Or approved equal.

2. Wall and floor boxes and poke-thru service fittings for power and communications:

   a. FSR, Inc.
   b. Hubbell/Hubbell Wiring Device-Kellems
   c. Legrand/Wiremold
   d. Or approved equal.

2.2 MATERIALS

A. Outlet, switch, and junction boxes:

1. Sheet metal: NEMA OS 1, sherardized or galvanized stamped.
2. Cast-metal, where required for weather-exposed or exposed locations: NEMA FB 1, ferrous alloy or aluminum, Type FD, with gasketed cover.

2.3 BOXES FOR WALLS, PARTITIONS, AND CEILINGS

A. Outlet boxes in concrete construction: Octagonal, two-piece type, of sufficient depth to keep conduits not closer than 1 inch to surface.

B. Toggle / snap switch and receptacle wall boxes in masonry partitions and walls: Square cornered tile wall boxes 3.5 inches deep, or 4-inch square boxes with raised tile wall device covers. The device covers shall be of extra depths required to suit the block or brick construction in which they are placed.

C. Toggle / snap switch and receptacle wall boxes in metal stud partitions: 4-inch square by 1.5-inch minimum deep boxes with 0.75-inch raised tile wall device covers finishing flush with finished wall surface.

D. Lighting controls station wall boxes in metal stud partitions: 4-inch square by 2.25-inch minimum deep boxes with 0.75-inch raised tile wall device covers finishing flush with finished wall surface.

E. Wall- and partition-mounted boxes for low-voltage systems: Same as specified above for toggle / snap switches and receptacles, except 3.25-inch minimum deep boxes and two 2-inch knockouts.

F. Wall- and partition-mounted boxes for audio/visual systems: Wall box service fittings as specified below.

2.4 JUNCTION AND PULL BOXES

A. Junction and pull boxes in feeder conduit runs: Galvanized, of size required for conduit arrangement and not less than the size required by NFPA 70, and furnished with screwed covers.

B. Junction boxes and pull boxes for branch circuits: Sheet metal, NEMA OS 1, sherardized or galvanized stamped.

C. Junction and pull boxes in exterior locations: NEMA Type 3R .

2.5 FLOOR BOXES

A. Floor boxes for power and communications:

1. UL listed, complete in-floor multi-service box consisting of floor box housing, flush removable cover, device plates, receptacles, and conduit provisions as detailed on drawings, suitable for each location.
2. Basis of design: Wiremold EFB-OG Evolution Series with epoxy coating for on-grade installations.

2.6 POKE-THRU SERVICE FITTINGS FOR POWER AND COMMUNICATIONS

A. UL listed and UL fire classified to maintain the integrity of up to 2-hour fire rated floor structures, complete in-floor multi-service assembly consisting of round enclosure housing with flush style cover, device plates, receptacles, and conduit provisions as detailed on the drawings, suitable for each location.

1. Basis of design: Wiremold Evolution Series.

2.7 WALL SERVICE FITTINGS FOR POWER AND COMMUNICATIONS

A. Wall box service fitting for masonry partitions and walls: UL listed, complete multi-service box consisting of housing, finished cover, devices plates, receptacles, and conduit provisions as detailed on the drawings, suitable for installation in 8-inch concrete masonry unit block walls.

1. Basis of design: FSR PWB-CMU8 Masonry Project Wall Box.

B. Wall box service fitting in metal stud partitions: UL listed, complete multi-service box consisting of housing, finished cover, devices plates, receptacles, and conduit provisions as detailed on the drawings, suitable for each location.

1. Basis of design: Wiremold Evolution Series Wall Box EFSB4

PART 3 - EXECUTION

3.1 INSTALLATION

A. Boxes in metal stud walls or partitions shall be securely supported by metal channels spanning between two studs and attached to same.

B. Provide box at each outlet, switch, and appurtenance. Each box shall be of a type suitable for the duty intended and shall be installed in accordance with the manufacturer’s instructions.

1. Where conduit is weather-exposed or exposed, provide cast-steel or cast-aluminum boxes.
2. Boxes installed above grade on the exterior of the building shall have a NEMA Type 4X stainless steel enclosure.

C. Coordinate locations of boxes with installation of conduit as specified in Section 26 05 33.

D. Do not install boxes back-to-back (through the wall) in partitions.

E. Firmly secure the boxes in place, plumb, level, and with front of device cover even with finished wall surface.

F. Outlet boxes used for supporting lighting fixtures: Furnish with malleable iron fixture studs of "No-Bolt" type, secured by locknut. Provide structural channel supports for boxes occurring in ceilings. Outlets in ceilings directly on bottom of joists shall be supported independent of ceiling construction. Outlets in suspended ceilings shall not be supported from ceiling construction. Special supports for boxes shall be as directed and approved by the Engineer.

G. Where service fittings will not permit ganging of boxes for floor outlets, outlets shall be as close as practical.

H. Coordinate finish of floor box and poke-thru service fitting covers with Architect.

I. Provide poke-thru service fittings where indicated.

1. Install more than 2 feet apart, and not to exceed an average of one every 65 square feet.
2. Core drill holes, sized per manufacturer's requirements.

J. Provide a single cover plate where two or more devices are grouped together in one box.

K. Verify door swings with door frame installed before locating switch outlets.

L. Outlet boxes in fire-rated assembly:

1. Clearance between boxes and wallboard shall not exceed 0.125 inches.
2. Surface area of individual outlet box does not exceed 16 square inches.
3. Entire surface area of boxes shall not exceed 100 square inches per 100 square feet of wall surface.
4. Wherever possible, boxes shall be at a minimum spaced 24 inches between boxes when on opposite sides of the wall.
5. Where the required surface area and spacing criteria cannot be met, provide firestopping for membrane penetrations. Refer to requirements in 26 05 07, Firestopping for Electrical Work.

3.2 IDENTIFICATION

A. Identification on outside covers of pull and junction boxes in ceiling space or exposed on walls: Paint with colored enamel or mark with permanent waterproof black marker, or both, as specified.

1. Fire alarm system: Red.
2. Other special systems: Mark with system type, such as Data, Security or audiovisual systems.
3. Power and lighting: Panelboard designation and circuit number(s).

END OF SECTION 26 05 34

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 05 41 - SERVICE ENTRANCE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Service entrance for electric service, 208 V, 3 phase, 4 wires.

B. Service entrance for communication services.

1.2 RELATED SECTIONS

A. Temporary power for construction: Division 01.

B. Trenching: Division 31.

C. Electrical handholes and underground ductbank: Section 26 05 44.

D. Equipment foundations: Section 26 05 28.

1.3 PAYMENT PROCEDURES

A. New electric service will be installed by Delmarva Power and Light (the Power Company).

B. Submit the bill on completion of this part of the work. Owner will directly pay the Power Company.

1.4 SUBMITTALS

A. Product data: Each type of device or equipment required for the installation.

B. Shop drawings: Submit shop drawings and other information as required to the Power Company.

C. Certifications: Copy of certification for installation required by Power Company.

1.5 COORDINATION

A. New electric service will be installed by Delmarva Power and Light (the Power Company). Contact the designated power company service representative and verify the status of the project service application. If the current service application has expired, resubmit the service application using load data from the original application.

B. New communications service(s) will be installed by the telephone company and the cable television company. Contact the service company representative(s) to coordinate installation of the new service(s).

C. Arrange a project site meeting to verify that the proposed service entrance configuration is acceptable to the service company. Participants of the meeting shall include the service company representative, the Owner, the Contractor and the Architect.

D. Contact "Miss Utility" (1-800-257-7777) prior to any excavation or underground work. The location and depth for all utilities shall be verified. Provide test pits to verify location and depth of all existing utilities crossing new incoming service

PART 2 - PRODUCTS

2.1 CONDUITS AND FITTINGS,

A. Power Company will provide primary and secondary cables, transformers, and meters, as described in the article "Installation by Power Company," below.

B. Conduits: As specified and scheduled in Section 26 05 33, Conduits.

C. Ductbanks: As specified in Section 26 05 44, Underground Ducts and Utility, and in accordance with Power Company requirements.

D. Fittings: As required by installation and by Power Company requirements, and as specified in Section 26 05 33, Conduits.

1. Service entrance heads: UL 514B, threaded for rigid conduit (RGS), weather-resistant, galvanized malleable iron body and phenolic insulator.
2. Basis of design: O-Z/Gedney Type 17.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate installation with Power Company.

B. Coordinate installation with communications service company.

C. Coordinate installation with installation of gas lines and other underground utilities specified in Divisions 23 and 31.

3.2 INSTALLATION BY POWER COMPANY

A. Primary power from Power Company lines to a point underground at the property line.

B. Primary and secondary cables, transformer and foundation, and terminations to building main panelboard, including meters.

3.3 INSTALLATION INCLUDED IN WORK OF THIS PROJECT

A. Concrete encased ductbank from property line to power company transformer as indicated on the drawings, minimum 5 inches (127 mm), as specified in Section 26 05 44, Underground Ducts and Utility Structures, including markers or underground warning tape and in accordance with Power Company requirements.

B. Concrete encased ductbank from transformer to building as indicated on the drawings, minimum 4-inches (102 mm), as specified in Section 26 05 44, Underground Ducts and Utility Structures, including markers or underground warning tape, and in accordance with Power Company requirements.

C. Where conduit enters a transformer or meter cabinet, provide bellmouth fittings on conduit ends 2 inches (51 mm) above the concrete slab.

D. Concrete foundation for Power Company transformer: Specified in Section 26 05 28, Equipment Foundations.

E. Handholes as shown on the drawings: Specified in Section 26 05 44, Underground Ducts and Utility Structures.

3.4 TELECOMMUNICATIONS SERVICES INSTALLATION

A. Conduit for telecommunications services are indicated on the drawings.

B. Provide conduits in ductbank for telecommunications services, as specified in Section 26 05 44. Spacing between conduits shall be no less than 3 inches.

END OF SECTION 26 05 41

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 05 44 - UNDERGROUND DUCTS AND UTILITY STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Ducts in directly-buried duct banks.
2. Ducts in concrete-encased duct banks.
3. Handholes and handhole accessories.

B. Related sections include the following:

1. Section 26 05 26 for grounding electrodes, counterpoise conductors, clamps and connectors for grounding metallic manhole and handhole accessories, and testing of grounds.

1.2 REFERENCES

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

1. AASHTO-HB 17: Standard Specifications for Highway Bridges. Includes the AASHTO categories for structural loads:

a. Heavy traffic: HS20.
b. Medium traffic: HS15.
c. Light traffic: H10.

B. ASTM International (ASTM)

1. ASTM C 478: Precast Reinforced Concrete Manhole Sections.
2. ASTM C 857: Minimum Structural Design Loading for Underground Precast Concrete Utility Structures. Includes classes which correspond to AASHTO categories:

a. Heavy traffic: Class A-16.
b. Medium traffic: Class A-12.
c. Light traffic: Class A-8.
d. Walkway: Class A-0.3, 300 lb/sq ft (1465 kg/sq m).

3. ASTM C 858: Specification for Underground Precast Concrete Utility Structures.

C. Society of Cable Telecommunications Engineers (SCTE):

1. SCTE 77: Specification for Underground Enclosure Integrity. Light duty and pedestrian traffic only. Includes Tiers for specific applications, and static vertical wheel load ratings:

a. Tier 5: Sidewalk applications with a safety factor for occasional nondeliberate vehicular traffic.
b. Tier 8: Sidewalk applications with a safety factor for nondeliberate vehicular traffic.
c. Tier 15: Driveway, parking lot, and off-roadway applications subject to occasional nondeliberate heavy vehicular traffic.

1.3 SUBMITTALS

A. Product data: For the following:

1. Handholes.
2. Conduit and ducts, including elbows, bell ends, bends, fittings, and solvent cement.
3. Duct bank materials, including spacers and miscellaneous components.
4. Underground warning tape.

B. Shop drawings: Show fabrication and installation details for underground ducts and utility structures and include the following:

1. For precast handholes, shop drawings shall be signed and sealed by a qualified professional engineer, and shall show the following:

a. Construction of individual segments.
b. Joint details.
c. Design calculations.

C. Coordination drawings: Show duct profiles and coordination with other utilities and underground structures. Include plans and sections drawn to scale, and show all bends and location of expansion fittings.

1.4 QUALITY ASSURANCE

A. Electrical components, devices, and accessories (including ducts for communications and telephone service): 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 ANSI C2.

C. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver ducts to project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.

B. Store precast concrete units at project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.

C. Lift and support precast concrete units only at designated lifting or supporting points.

1.6 PROJECT CONDITIONS

A. Existing utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated.

1. Notify Architect at least two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

1.7 COORDINATION

A. Coordinate layout and installation of ducts and handholes with final arrangement of other utilities and site grading, as determined in the field.

B. Coordinate elevations of ducts and duct bank entrances into handholes with final profiles of conduits as determined by coordination with other utilities and underground obstructions. Revise locations and elevations from those indicated as required to suit field conditions and to ensure duct runs drain to handholes, and as approved by Architect.

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.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Available manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

1. Nonmetallic ducts and accessories:

a. ARNCO Corp.
b. Beck Manufacturing Inc.
c. Cantex, Inc.
d. CertainTeed Corp.; Pipe & Plastics Group.
e. ElecSys, Inc.
f. Electri-Flex Co.
g. IPEX, Inc.

h. Lamson & Sessions; Carlon Electrical Products.
i. Manhattan/CDT
j. Spiraduct/AFC Cable Systems, Inc.
k. Or approved equal.

2. Precast polymer concrete enclosures for underground construction:

a. Armorcast Products Company.
b. NewBasis.
c. Quazite/Strongwell (Hubbell Power Systems, Inc.).
d. Synertech (Division of Oldcastle Precast).
e. Or approved equal.

2.2 CONDUIT

A. Conduit and fittings are specified in Section 26 05 33.

2.3 DUCTS

A. Rigid nonmetallic conduit: NEMA TC 2, Type EPC-40-PVC, UL 651, with matching fittings by the same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

B. Rigid nonmetallic conduit: NEMA TC 2, Type EPC-80-PVC, UL 651, with matching fittings by the same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

C. Reinforced fiberglass epoxy duct: Type FRE, NEMA TC-14A (IPS) medium wall, UL listed and meeting applicable ASTM standards for medium-voltage service.

2.4 HANDHOLES

A. Polymer concrete handholes: Molded of sand and aggregate bound with polymer resin, and reinforced with steel, with 6-inch (150-mm) square cable entrance at each side and weatherproof cover with nonskid finish and legend. Unit, when buried, shall be designed to support SCTE 77 Tier 15 loading.

B. Cover legend: “ELECTRIC” or “COMMUNICATIONS”.

2.5 ACCESSORIES

A. Duct spacers: Rigid, nonmetallic, horizontally and vertically interlocking spacers, selected to provide minimum duct spacings and cover depths indicated while supporting ducts during concreting and backfilling.

B. Duct-sealing compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F (2 deg C). Capable of withstanding temperature of 300 deg F (150 deg C) without slump and of adhering to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

C. Warning tape: Underground-line warning tape specified in Section 26 05 53, Identification for Electrical Systems.

2.6 CONSTRUCTION MATERIALS

A. Mortar: Comply with ASTM C 270, Type M, except for quantities less than 2.0 cu. ft. (60 L) where packaged mix complying with ASTM C 387, Type M, may be used.

B. Concrete: Use 3000-psi- (20.7-MPa-) minimum, 28-day compressive strength and 0.375-inch (10-mm) maximum aggregate size. Concrete and reinforcement are specified in Division 03 Section “Cast-in-Place Concrete.”

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Underground ducts for electrical cables higher than 600 V: Type FRE, concrete-encased duct bank.

B. Underground ducts for electrical feeders 600 V and below and for communications outside plant cable: Type EPC-40-PVC, concrete-encased duct bank.

C. Underground ducts for electrical branch circuits 600 V and below: Type EPC-40-PVC, directly-buried duct bank, except use Type EPC-80-PVC when crossing roads.

D. Underground ducts for telephone utility service: Type EPC-40-PVC, directly-buried duct bank, except use Type EPC-80-PVC when crossing roads.

E. Underground ducts for communication circuits: Type EPC-40-PVC, directly-buried duct bank.

F. Handholes: Underground precast concrete utility structures or precast polymer concrete enclosures.

3.2 EARTHWORK

A. Excavation and backfill: Comply with Division 31 Section specifying Earthwork but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 32 Section specifying Landscaping.

D. Restore disturbed pavement. Refer to "Cutting and Patching" in Section 26 01 01.

3.3 CONDUIT AND DUCT INSTALLATION

A. Slope: Pitch ducts a minimum slope of 1:300 down toward handholes and away from buildings and equipment.

B. Curves and bends: Use manufactured rigid steel elbows for stub-ups at equipment and at building entrances. Use manufactured long sweep bends with a minimum radius of 25 feet (7.5 m), both horizontally and vertically, at other locations.

C. Use solvent-cement joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in the same plane.

D. Duct entrances to handholes: Space end bells approximately 10 inches (250 mm) o.c. for 5-inch (125-mm) ducts and vary proportionately for other duct sizes. Change from regular spacing to end-bell spacing 10 feet (3 m) from the end bell without reducing duct line slope and without forming a trap in the line. Grout end bells into manhole walls from both sides to provide watertight entrances.

E. Building entrances: Make a transition from underground duct to rigid steel conduit at least 10 feet (3 m) outside the building wall. Use fittings manufactured for this purpose. Follow the appropriate installation instructions below:

1. Concrete-encased ducts: Install reinforcement in duct banks passing through disturbed earth near buildings and other excavations. Coordinate duct bank with structural design to support duct bank at wall without reducing structural or watertight integrity of building wall.
2. Waterproofed wall and floor penetrations: Install a watertight entrance-sealing device with sealing gland assembly on the inside. Anchor device into masonry construction with one or more integral flanges. Secure membrane waterproofing to the device to make permanently watertight.

F. Concrete-encased, nonmetallic ducts: Support ducts on duct spacers, spaced as recommended by manufacturer and coordinated with duct size, duct spacing, and outdoor temperature. Install as follows:

1. Separator installation: Space separators close enough to prevent sagging and deforming of ducts and secure separators to earth and to ducts to prevent floating during concreting. Stagger spacers approximately 6 inches (150 mm) between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.

2. Concreting: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct bank application. Pour each run of envelope between manholes or other terminations in one continuous operation. If more than one pour is necessary, terminate each pour in a vertical plane and install 0.75-inch (19-mm) reinforcing rod dowels extending 18 inches (450 mm) into concrete on both sides of joint near corners of envelope.
3. Reinforcement: Reinforce duct banks where they cross disturbed earth and where indicated.
4. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
5. Minimum clearances between ducts: 3 inches (75 mm) between ducts and exterior envelope wall, 2 inches (50 mm) between ducts for like services, and 4 inches (100 mm) between power and signal ducts.
6. Depth: Install top of duct bank at least 24 inches (600 mm) below finished grade in nontraffic areas and at least 30 inches (750 mm) below finished grade in vehicular traffic areas, unless otherwise indicated.

G. Directly-buried ducts: Support ducts on duct spacers, spaced as recommended by manufacturer and coordinated with duct size, duct spacing, and outdoor temperature. Install as follows:

1. Separator installation: Space separators close enough to prevent sagging and deforming of ducts.
2. Install expansion fittings as shown on shop drawings.
3. Trench bottom: Continuous, firm, and uniform support for duct bank. Prepare trench bottoms as specified in Division 31 Section specifying earthwork.
4. Backfill: Install backfill as specified in Division 31 Section specifying earthwork. After installing first tier of ducts, backfill and compact. Repeat backfilling after placing each tier. After placing last tier, hand-place backfill to 4 inches (100 mm) over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, complete backfilling normally.
5. Minimum clearances between ducts: 3 inches (75 mm) between ducts for like services and 6 inches (150 mm) between power and signal ducts.
6. Depth: Install top of duct bank at least 24 inches (600 mm) below finished grade, unless otherwise indicated.

H. Warning tape: Bury warning tape approximately 12 inches (300 mm) above all concrete-encased duct banks. Align tape parallel to and within 3 inches (75 mm) of the centerline of duct bank.

I. Stub-ups: Use rigid steel conduit for stub-ups to equipment. For equipment mounted on outdoor concrete bases, extend steel conduit a minimum of 5 feet (1.5 m) from edge of base. Install insulated grounding bushings on terminations. Couple steel conduits to ducts with adapters designed for this purpose and encase coupling with 3 inches (75 mm) of concrete.

J. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig (1.03-MPa) hydrostatic pressure.

K. Pull rope: Equal to Graybar Electric Co., Inc., "Pro-Pull": Polypropylene, minimum 0.1875 inch (5 mm) thick, tensile strength 800 lbs (3559 N), work load 130 lbs (578 N).

3.4 MANHOLE AND HANDHOLE INSTALLATION

A. Precast concrete handhole installation: Unless otherwise indicated, comply with ASTM C 891.

1. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.
2. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch (25-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

3.5 FIELD QUALITY CONTROL

A. Testing: Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.

B. Grounding: Test manhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 26 05 26.

C. Duct integrity: Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of the duct. If obstructions are indicated, remove obstructions and retest.

D. Correct installations if possible and retest to demonstrate compliance. Remove and replace defective products and retest.

3.6 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

END OF SECTION 26 05 44

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes electrical identification materials and devices required to comply with ANSI, NFPA, and OSHA standards.

B. This section addresses identification of electrical equipment, raceways, boxes, conductors, and other related electrical system components.

1.2 SECTION INCLUDES

A. Identification for raceways and cables.

B. Identification of power conductors and control cables.

C. Identification of equipment and instructions.

D. Miscellaneous identification products.

1.3 RELATED SECTIONS

A. Sections in Divisions 26, 27, and 28.

1.4 REFERENCES

A. ANSI Z535.4: Standard for Product Safety Signs and Labels.

B. ANSI/IEEE C2: National Electrical Safety Code.

C. NFPA 70: National Electrical Code.

D. NFPA 70E: Standard for Electrical Safety in the Workplace.

E. OSHA 29 CFR 1910.144: Safety Color Code for Marking Physical Hazards.

F. OSHA 29 CFR 1910.145: Specifications for Accident Prevention Signs and Tags.

G. UL 969: Standard for Marking and Labeling Systems.

H. Definitions:

1. Circuit designation includes both equipment source and equipment position.

1.5 SUBMITTALS

A. Product data: For each type of electrical identification product.

B. Identification schedule: An index of nomenclature for electrical equipment and system components used in identification signs and labels.

1.6 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with OSHA standards.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.7 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other sections requiring identification applications, drawings, shop drawings, manufacturer's wiring diagrams, and the operation and maintenance manual; and with those required by codes, standards, and safety regulations. Use consistent designations throughout Project.

B. Coordinate installation of identification materials and devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identification materials and devices with location of access panels and doors.

D. Install identifying materials and devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following manufacturers, or approved equal:

1. Brady USA, Inc.
2. Carlton Industries
3. Graphic Products, Inc.

4. Ideal Industries, Inc.
5. Panduit Corporation
6. Presco
7. Seton Identification Products
8. Thomas & Betts Company
9. Utility Safeguard
10. Or approved equal.

2.2 GENERAL PRODUCT REQUIREMENTS

A. Except where otherwise indicated, provide manufacturer's standard identification products of category and type suitable for each application. Where more than one identification method is specified for an application, the Installer shall select and utilize each material in a consistent manner.

2.3 RACEWAY IDENTIFICATION

A. Comply with ANSI A13.1 for minimum lettering size, length of color field, and coloring schemes for each raceway size, type, and location.

1. Colors: Black letters on Orange field.
2. Legend: Raceways carrying the following:

    a. Power circuits less than 600V: Indicate system voltage.
    b. Low-voltage systems less than 50V: Indicate system type (Example – "TELECOMMUNICATIONS").

B. Adhesive labels: Preprinted, flexible, self-adhesive vinyl with legend overlaminated with a clear weather- and chemical-resistant coating.

C. Color-coded, adhesive tape: Self-adhesive vinyl tape, in appropriate colors for system voltage and phase.

1. Exterior locations: Heavy-duty, waterproof, fade-resistant, suitable for outdoor use.

2.4 CONDUCTOR AND CABLING IDENTIFICATION

A. Adhesive labels: Preprinted, flexible, self-adhesive vinyl with legend overlaminated with a clear weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

B. Color-coded, adhesive tape: Self-adhesive, vinyl tape, in appropriate colors for system voltage and phase.

2.5 EQUIPMENT IDENTIFICATION

A. Engraved plastic nameplates: Laminated plastic, engraved, white letters on black background, except where other color schemes are noted or specified.

1. Size: Minimum 0.75 inches (19 mm) by 2.5 inches (64 mm).
2. Letter size: Minimum height of 0.375 inches (10 mm).
3. Mechanically fastened , except adhesive mounted where necessary due to substrate.

a. Mechanical fastener: Punched or drilled, with vandalproof stainless steel or brass screws or rivets.

B. Adhesive film label: Machine-printed, black letters on white background, through thermal transfer or equivalent process, with clear weatherproof and UV-resistant covering. Minimum letter size height of 0.375 inches (10 mm).

2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Underground warning tape: Permanent, bright-colored, continuous-printed, vinyl tape for use with underground cables, conduits, and ductbanks. Comply with ANSI Z535.

1. Not less than 6 inches wide by 4 mils thick (152 mm wide by 0.102 mm thick).
2. Tape Material:

a. Made of metal detectable polyester or vinyl.
b. Compounded for permanent direct-burial service. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to destructive substances commonly found in soils.

3. Printed legend with black lettering, indicating type of underground line.

a. Provide inscriptions for power cabling with red-colored tape: Example – “CAUTION – BURIED ELECTRIC LINE BELOW”.
b. Provide inscriptions for low-voltage system cabling with orange-colored tape: Example – “CAUTION – BURIED FIBER OPTIC LINE BELOW”.

B. Wiring device tape labels:

1. Adhesive film label: Machine-printed, black letters on clear background, through thermal transfer or equivalent process. Minimum letter size height of 0.25 inches (6 mm).

a. Labeling for electrical devices and components such as receptacles, switches, control device stations, manual motor starters, network and phone jacks, junction and pull boxes, etc.

C. Warning labels:

1. Self-adhesive warning labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configures for display on front cover, door, or other access to equipment unless otherwise noted.

D. Cable ties: Fungus-inert, self-extinguishing, one-piece, self-locking, color-coded, nylon cable ties suitable for the application (general purpose, UV-stabilized outdoor, or plenum rated).

E. Adhesive: Heavy-duty, thermo-resistant, industrial grade adhesive, for adhesion to any surface without identification curling, peeling, or falling off.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification products at locations for most convenient viewing without interference with operation and maintenance of equipment.

1. For finished public spaces, coordinate identification product mounting locations with Architect.

C. Apply identification products to surfaces after equipment finish work has been completed.

D. Clean surfaces before applying identification products, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. System identification labeling for raceways and cables: Each label shall be installed on sidewall of conduit and easily placed for proper identification. Locate labels at changes in direction, at penetrations of walls and floors, at 50-foot (15-meter) maximum intervals in straight runs, and at 25-foot (7.6-meter) maximum intervals in congested areas.

G. System identification color-coding bands for raceways and cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-meter) maximum intervals in straight runs, and at 25-foot (7.6-meter) maximum intervals in congested areas.

H. Cable ties: For attaching tags, use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In spaces handling environmental air: Plenum rated.

I. Underground-line warning tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.

3.2 APPLICATION

A. Miscellaneous:

1. Access doors and panels: Apply engraved nameplate labels at access doors identifying concealed electrical item. Do not locate labels in finished, public spaces.
2. Available fault current labels: Refer to Section 26 05 73, Overcurrent Protective Device Studies, for fault current labeling requirements.
3. Arc flash warning labels: Refer to Section 26 05 73, Overcurrent Protective Device Studies, for arc flash labeling requirements.

B. Junction and pull boxes:

1. Label each junction and pull box, identifying circuit designation or type of system.

    a. Exposed and concealed boxes: Place label on coverplate, externally visible.
    b. Recessed boxes: Place label or tag on inside cover of box.
    c. Junction boxes concealed above suspended ceilings or exposed in non-occupied spaces may be marked with permanent ink marker in lieu of printed labels.

2. Boxes with conductors greater than 600 volts: Apply labels identifying nominal system voltage on cover and minimum of one fixed side. One label shall be visible from the floor where boxes are installed exposed.
3. Fire alarm system boxes shall have red finish. Boxes shall be prefinished prior to installation.

C. Raceway identification: Apply identification products for each raceway.

1. Apply color-coded identification products to raceways as follows:

    a. Normal power system: None.
    b. Standby/emergency power system: Orange.
    c. Fire alarm system: Red, solid colored.
    d. Telecommunications system: None.
    e. Security System: None.

2. Apply labels identifying nominal system voltage for the raceways containing feeders and raceways larger than 2 inches (53 mm) with power conductors.
3. Apply system identification labels identifying type of system for low-voltage system raceways.
4. Apply circuit designation markings on each feeder and branch circuit raceway entering and leaving each panelboard and switchboard. Mark raceway clearly with permanent ink marker or printed labels.

5. Empty raceways: Apply labels indicating description of empty raceways (i.e., spare, future use) and identifying the beginning and end locations. Mark raceway clearly with permanent ink marker or printed labels.

D. Wiring and cabling identification:

1. Power circuit conductor identification, 600 volts or less: Apply color-coded identification for cables, feeders, and power circuit conductors exposed in accessible vaults, junction and pull boxes, utility structures, and equipment enclosures. Apply color-coding scheme as indicated below throughout the building's network of feeders and circuits, unless otherwise required by the authority having jurisdiction.

   a. Colors on conductors No. 10 and smaller, or No. 6 and smaller for grounded and grounding conductors: Solid colored insulation.
   b. Colors on conductors No. 8 and larger, or No. 4 and larger for grounded and grounding conductors: Apply colored tape wrapped a minimum of 6 inches (150 mm) on either end of conductor and in boxes where splices or taps are made.
   c. Conductors used solely for grounding purposes shall be green, if insulated. Isolated ground conductors shall be green with a yellow strip.
   d. Where multi-conductor cables are used, use same color coding system for identification of wiring.

COLOR CODE (600 volts maximum)				
VOLTAGE	NEUTRAL	PHASE		
		A	B	C
120 volts, 2-wire	White	Black, Red, or Blue depending on phase		
208/120 volts wye, 3-phase, 4-wire	White	Black	Red	Blue

2. Conductors for future use: Attach tags with circuit designation for conductors to be extended for future use.
3. Control and low-voltage system wiring shall be coded with colors and markings different from those used to designate phase wires.

E. Wiring device labels: For wiring devices such as receptacles, devices installed in surface raceway assemblies, and other wiring devices operating at or greater than 120 volts.

1. Apply adhesive film labels on outside of wiring device coverplates identifying circuit designation serving device, except apply on the inside cover for the following locations.

   a. Public lobbies, corridors, and vestibules.

2. For special receptacle configurations, apply label identifying applicable device NEMA configuration designation in location not concealed by plug.
3. Apply labels to devices serving low-voltage system devices including the following:

   a. Fire alarm devices and test stations: Circuit designation.
   b. Telecommunications device stations: Work area outlet designation.
   c. Audio-visual device stations: Device designation.
   d. Security device stations: Device designation.

F. Equipment identification: Install unique designation label consistent with contract documents and shop drawings.

1. Labeling instructions:

a. Engraved plastic laminate nameplates, unless otherwise indicated.
b. Unless otherwise required, provide a single line of text with 0.5-inch (13-mm) high lettering on 1.5-inch (38-mm) high label. Where two or more lines are required, use single label with increased height.
c. For multi-section or multi-compartment equipment, apply labels identifying each compartment or section.
d. For fusible equipment, identify fuse type and size on the front cover.
e. For enclosed circuit breaker equipment, identify device trip rating where rating is not visible.

2. Additional labeling requirements:

a. Identify the designation and location of the power source where the equipment power feed originates. (Example "Feed from: XXXXX; Location: XXXXX").

(1) Where equipment has more than one source of power (i.e., transfer switch, separate control power source), the location and designation of each power source shall be clearly identified at the equipment location.

b. Identify available fault current and calculation date for service entrance equipment.

3. Apply nameplates and labels to equipment according to the below identification schemes:

a. Identify available fault current and calculation date. Apply products to the following equipment:

(1) Panelboards

b. Identify equipment designation; voltage rating; phase and number of wires; and designation and location of load served. Apply products to the following equipment:

(1) Panelboards
(2) Dimming system equipment

c. Identify equipment designation; primary and secondary voltage ratings; phase and number of wires; circuit designation and location of primary source; and designation and location of load served. Apply products to the following equipment:

(1) Enclosed switches (disconnects/safety switches)
(2) Enclosed circuit breakers
(3) Contactors
(4) Motor starters and combination motor starter-disconnects
(5) Battery inverter equipment

d. Identify equipment designation; and circuit designation and location of primary source. Apply products to the following equipment:

(1) Monitoring and control equipment
(2) Control stations
(3) Fire alarm control panels and auxiliary equipment
(4) Security panels and auxiliary equipment

4. Nameplates shall incorporate white lettering on colored backgrounds based on the following color-coding scheme:

a. Normal power system: Black background.
b. Emergency power system (battery backup): Red background.

G. Warning and caution labels:

1. Apply warning and caution labels on equipment in accordance with NFPA 70 and 70E, ANSI, and OSHA requirements including arc flash hazard warning labels and special clearance requirements.
2. Apply warning and caution labels at locations where safe operation and maintenance of electrical system equipment is of concern.

H. Service-entrance equipment: Provide field marking of service entrance equipment maximum available fault current values in accordance with NFPA 70 requirements.

I. Underground warning tape: Apply underground warning tape above underground ductbanks, conduit, or direct-buried cable.

J. Operating instruction signs:

1. Apply instruction signs at locations where directions for safe operation and maintenance of electrical system equipment are necessary. Apply approved text where instructions are needed for proper system operation.

a. Emergency instructions: Provide white text on red background.

3.3 FIELD QUALITY CONTROL

A. Coordinate names, abbreviations, colors, and other designations with construction documents, submittals, and applicable code and standards requirements. Utilize consistent designations and identification techniques throughout project.

B. Install identification products at locations that are clearly visible at normal viewing angles and without interference with operation and maintenance of the equipment.

C. Install identification products in a neat and clean, workmanship-like manner where products are securely attached and oriented parallel to equipment edges.

END OF SECTION 26 05 53

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 05 73 - OVERCURRENT PROTECTIVE DEVICE STUDIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Electrical system fault-current and protective device study:

1. Fault-current analysis.
2. Arc flash hazard analysis.

B. Description: Provide fault hazard and arc flash analysis for building power distribution system.

1.2 RELATED SECTIONS

A. Sections in Division 26.

1.3 REFERENCES

A. Institute of Electrical and Electronics Engineers (IEEE):

1. IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems.
2. IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings.
3. IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
4. IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis.
5. IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.
6. IEEE 1584 - Guide for Performing Arc flash Hazard Calculations.

B. American National Standards Institute (ANSI):

1. ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.
2. ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures.
3. ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis.
4. ANSI C37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.

C. National Fire Protection Association (NFPA):

1. NFPA 70 – National Electrical Code, latest edition.

2. NFPA 70E – Standard for Electrical Safety in the Workplace.

D. Occupational Safety and Health Administration (OSHA):

1. OSHA 29 Code of Federal Regulations (CFR) Part 1910, Subpart S.

1.4 SUBMITTALS

A. Product data: For computer software to be used to perform studies.

B. Product certificates: For coordination-study and fault-current analysis computer software programs, certifying compliance with IEEE 399.

C. Qualifications:

1. Submit evidence indicating individual and organization compliance with requirements indicated in "Quality Assurance" below.

D. Preliminary electrical system study: Submit for review before distribution equipment shop drawings have been submitted, and before equipment order has been released to the manufacturer.

1. If formal completion of the study may delay the project schedule, Owner and Architect may approve use of the preliminary draft for ordering equipment.
2. If approved for use in ordering equipment, preliminary draft shall include sufficient study data to ensure that the selection of device ratings and characteristics will be satisfactory.

E. Final electrical system study:

1. Submit final report for review and record.
2. Incorporate changes resulting from deficiencies and corrections of preliminary draft report.

F. Reports:

1. Electrical system study report: Submit reports required above including the following items:

a. General report information: Scope, definitions, descriptions, assumptions, and other information necessary to properly interpret results of the report.
b. Tabulated summary comparing protective device ratings and calculated available fault-current levels.
c. Tabulated summary of protective device settings including circuit breaker, fuse, and relays.
d. Fault-current analysis calculations.
e. Selective coordination study overlay, plots of device time-current curves and relationship to other distribution system components.
f. Arc flash hazard calculations including details of the incident energy and flash protection boundary calculations.
g. Recommendations for system improvements.

h. System one-line diagram.
i. Input and output data used for each component and for study calculations.

2. Submit final reports as electronic files in portable document format (.pdf) to Owner. Submit program base files in file format of computer software utilized to perform study.

1.5 QUALITY ASSURANCE

A. Electrical system study shall be performed by one or more independent qualified organizations, and under the supervision and approval of a Registered Professional Engineer skilled in performing and interpreting the power system studies.

B. Qualifications of organization performing electrical system study: An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices:

1. Registered Professional Engineer shall be a full-time employee of the equipment manufacturer or of an approved engineering firm.
2. Registered Professional Engineer shall have a minimum of five (5) years of experience in performing power system studies and registered in the state where the project is located.

C. Qualifications of computer-based software: Widely available, complying with standards, guides, and codes as referenced above.

D. Comply with IEEE 399 for general study procedures.

E. Comply with IEEE 242 for short-circuit currents and coordination time intervals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Computer software: Subject to compliance with requirements, utilize product by one of the following:

1. EDSA Micro Corporation
2. Operation Technology, Inc.
3. SKM Systems Analysis, Inc. (Basis of Design)
4. Or approved equal.

2.2 COMPUTER SOFTWARE REQUIREMENTS

A. Comply with IEEE 399.

B. Computer software program shall be capable of performing fault-current analysis of project electrical distribution system.

C. Computer software program shall be capable of plotting and diagramming time-current characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

D. Computer software program shall be capable of performing arc fault hazard analysis using equations as established by IEEE 1584 and requirements presented in NFPA 70E, Annex D.

E. Software shall include a comprehensive equipment library of manufacturer-based and IEEE / ANSI based equipment to accurately model the electrical distribution system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine project submittals for compliance with electrical distribution system requirements outlined on the drawings and in electrical specification sections.

3.2 SYSTEM DATA COLLECTION

A. The Contractor shall furnish all data required to perform the power system studies. The Engineer performing the fault analysis, protective device coordination, and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to ensure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.

B. If applicable, include fault contribution of existing motors and equipment in the study. The Contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.

C. The Engineer performing the studies shall gather and tabulate input data necessary to support each study including the following:

1. Product data for each component of the electrical distribution system.
2. Utility available fault contribution and impedance values.
3. Drawings, one-line, and riser diagrams showing system configuration, equipment designations, feeder lengths, and other applicable system characteristics.

3.3 SYSTEM FAULT CURRENT ANALYSIS

A. Calculate the maximum available short-circuit momentary current and interrupting duties in amperes rms symmetrical for electrical power distribution system components. The calculation shall be performed for current immediately after initiation and for a three-phase bolted fault at each of the following locations:

1. Electric utility's supply termination.
2. Distribution panelboards.
3. Branch circuit panelboards.

B. Study the project's electrical distribution system from normal and alternate power sources throughout electrical distribution system. Where system configuration allows multiple switching and operation arrangements through paralleled sources, include study that results in maximum fault conditions.

C. For grounded systems, provide line-to-ground fault current values for areas as defined above for the three-phase, bolted fault, short-circuit study.

D. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with IEEE 241 and IEEE 242.

E. Study report:

1. Input data: Gather and provide the following input data, in tabular or graphic form, used to perform fault calculations and other studies in this section.

    a. Utility three-phase and line-to-ground available contribution with associated X/R ratios.
    b. Short-circuit reactance of rotating machines with associated X/R ratios.
    c. Cable type, construction, size, quantity per phase, length, impedance and conduit type.
    d. Circuit breaker types and sizes.

2. Methods and assumptions: Indicate calculation methods and assumptions that may have been used to perform analysis.
3. Results: Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram. Provide the following in a table format:

    a. Source fault impedance and generator contributions
    b. X/R ratios
    c. Asymmetry factors
    d. Motor contributions
    e. Short circuit KVA
    f. Symmetrical and asymmetrical fault currents

4. Equipment evaluation and conclusions:

    a. Verify interrupting ratings and withstand ratings are equal to or higher than calculated fault current levels.
    b. Verify adequacy of phase conductors at maximum three-phase, bolted fault currents.

5. Recommendations: List recommendations for equipment with inadequate ratings. Notify Architect, in writing of existing equipment improperly rated for the calculated available fault current of the system.

3.4 AVAILABLE FAULT CURRENT LABELS

A. Provide a machine printed adhesive label on the enclosure for each panelboard. The label shall include the following information, at a minimum:

1. Available fault current
2. Calculation date

B. Labels will be based on calculated maximum available short-circuit momentary current and will be provided after the results of the analysis have been presented to the Owner and after any system changes, upgrades or modifications have been incorporated in the system.

C. Labels shall be in compliance with NFPA 70E and OSHA standards.

3.5 SYSTEM ARC FLASH HAZARD ANALYSIS

A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA 70E, Annex D.

B. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (such as panelboards) where work could be performed on energized parts.

C. The arc flash hazard analysis shall include electrical equipment locations where work such as examination, adjustment, service, or maintenance could be performed on energized parts.

D. Safe working distances shall be based upon the calculated arc flash boundary considering incident energy of 1.2 cal/cm2.

E. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations.

F. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off).

1. Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum number of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable.

G. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follows:

1. Fault contribution from induction motors should not be considered beyond 3-5 cycles.
2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g., contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).

H. For each equipment location with a separately enclosed main device (where there is adequate separation between the line side terminals of the main protective device and the work location), calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.

I. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.

J. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.

K. Arc flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

L. Incident energy and flash protection boundary calculations:

1. Arcing fault magnitude
2. Device clearing time
3. Duration of arc
4. Arc flash boundary
5. Working distance
6. Incident energy
7. Hazard Risk Category

3.6 ARC FLASH WARNING LABELS

A. The Contractor and organization performing the Arc Flash Hazard Analysis shall provide a 3.5 in. x 5 in. thermal transfer type label of high adhesion polyester for each work location analyzed.

B. Labels will be based on recommended overcurrent device settings and will be provided after the results of the analysis have been presented to the Owner and after any system changes, upgrades or modifications have been incorporated in the system.

C. The label shall include the following information, at a minimum:

1. Location designation
2. Nominal voltage
3. Flash protection boundary
4. Hazard risk category
5. Incident energy
6. Working distance
7. Engineering report number, revision number and issue date

D. Labels shall be machine printed, with no field markings.

E. Labels shall be in compliance with NFPA 70E and OSHA standards.

F. Provide arc flash labels in the following manner based on recommended overcurrent device settings.

1. For each 600V, 480V, and applicable 208V panelboard, one arc flash label shall be provided.

3.7 FIELD QUALITY CONTROL

A. Field adjustment: Adjust relay and protective device settings according to the recommended settings table provided by the coordination study. Field adjustments to be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

B. Make modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.

C. Notify Architect in writing of any required equipment modifications.

END OF SECTION 26 05 73

SECTION 26 09 23 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Toggle / snap switches for lighting.

B. Wall-box dimmer switches.

C. Occupancy sensors, non-networked, stand-alone.

D. Time-based control devices.

E. Lighting contactors.

F. Emergency lighting control transfer relay device.

G. Device programming requirements.

1.2 RELATED SECTIONS

A. Commissioning requirements: Division 01.

B. Identification: Section 26 05 53.

C. Interior lighting: Section 26 51 00.

D. Exterior lighting: Section 26 56 00.

1.3 REFERENCES

A. IECC: International Energy Conservation Code

B. NECA 1: Standard Practices for Good Workmanship in Electrical Construction.

C. NFPA 70: National Electrical Code.

1.4 SUBMITTALS

A. Product data: Each type of device used in the project.

B. Bill of materials: Provide detailed list of components and quantities.

C. Shop drawings: Detail assemblies of standard and project specific components. Indicate dimensions and arrangement of components.

1. Floor plans: Identify locations of lighting control system components; interconnection of components. Utilize reflected ceiling plans to show location, orientation, and coverage area of sensors.
2. Wiring diagrams: Power, signal, and control wiring, differentiating between manufacturer-installed and field-installed wiring, provided on a schematic diagram.
3. Include representative views of components, including button layouts, engraving, colors, and other physical characteristics pertinent to each device.

D. Field quality control test reports.

E. Operation and maintenance data: For lighting controls system and associated components, provide product data, shop drawings, and test reports in operation and maintenance manual. In addition to items specified in Division 01, include list of replacement parts and assemblies.

1.5 QUALITY ASSURANCE

A. Devices shall be UL listed and labeled for their intended application.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store components indoors in a clean dry space with uniform temperature to prevent condensation. Protect devices from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.7 COMMISSIONING

A. This project includes commissioning under the direction of a Commissioning Agent (CxA). Contractor’s and subcontractors’ responsibilities are described in Division 01.

B. Cooperate with the CxA to accomplish the requirements of the Commissioning Plan during the construction and correction periods.

PART 2 - PRODUCTS

2.1 TOGGLE / SNAP SWITCHES FOR LIGHTING

A. Manufacturers:

1. Arrow Hart/Eaton Wiring Devices
2. Hubbell/Bryant Electric
3. Legrand/Pass & Seymour (P&S)
4. Leviton Manufacturing Co.

5. Or approved equal.

B. Toggle / snap switches: Specification grade conforming to UL 20:

1. General-use: Single-pole, 3-way, and 4-way, 20 amperes, 120/277 volts:

a. Basis of design: P&S PS20AC1, PS20AC3 (3-way), PS20AC4 (4-way), industrial extra heavy-duty.
b. Weatherproof cover with actuating lever mounted directly over general-use toggle switch:

(1) Basis of design: P&S CA1-GL cover, heavy-duty die-cast zinc, for PS20AC1, PS20AC3 (3-way) , and PS20AC4 (4-way) switches.

C. Device color: White

D. Device covers: Smooth nylon, color shall match device color.

1. Basis of design: P&S: Smooth nylon, TP series, color shall match device color.

2.2 WALL-BOX DIMMER SWITCHES

A. 0-10VDC dimmers:

1. Each dimmer shall have an air gap switch.
2. Color: White with matching wall plate.
3. 0-10VDC Dimming output.
4. Compatible with occupancy control.
5. UL listed.
6. Rated for 16-amps.
7. Compatible with load being dimmed.
8. Basis of design: Sensor Switch.

2.3 OCCUPANCY SENSORS

A. Acceptable manufacturers:

1. Sensor Switch, Acuity Brands Lighting, Inc. (Basis of Design)
2. Hubbell Control Solutions
3. Leviton Manufacturing Co.
4. Lutron Electronics Co., Inc.
5. Signify/Cooper Lighting LLC.
6. Wattstopper/Legrand

B. Sensor types:

1. Wall switch sensor: Wired, dual-technology, combination ultrasonic/passive infrared detector with override switch, capable of installation in a standard wall switch backbox.

    a. Line-voltage: 120/277-volt dual-input, 60 hertz.
    b. Device finish color: White, with matching decorator style device cover and mounting screws above and below device.

2. 0-10V Dimming Wall switch sensor: Wired, dual-technology, combination ultrasonic/passive infrared detector with override switch, 0-10VDC dimming control, capable of installation in a standard wall switch backbox.

    a. Line-voltage: 120/277-volt dual-input, 60 hertz.
    b. Device finish color: White, with matching decorator style device cover and mounting screws above and below device.

3. Ceiling sensor: Wired, dual-technology, combination ultrasonic/passive infrared detector capable of installation in acoustic ceiling tile or gypsum ceiling, 360-degree coverage, minimum 900 square feet, with one set of Form C auxiliary contacts to interface with other systems.

    a. Low-voltage: 24-volt input, 60 hertz, with power pack and low-voltage wiring per manufacturer's requirements.
    b. Device finish color: White.

C. Characteristics:

1. Adjustable delayed off-time range: Between 30 seconds and 30 minutes, factory set to 20 minutes.
2. Fail on: Lights will go to full brightness if sensor fails.
3. Ultrasonic detector: Volumetric sound wave at 40 kHz frequency. Detector shall automatically adjust detection threshold to compensate for learned environmental behavior.
4. Infrared detector: Passive, with field-adjustable ambient light adjustment.

D. Auxiliary components:

1. Power pack: Universal 120/277-volt switched input, controlled through a high-current 20-ampere relay. Low-voltage output, less than or equal to 24 volts DC, for powering low-voltage occupancy sensors. Plenum rated enclosure.
2. Override switch: Low-voltage operating on voltage less than or equal to 24 volts DC, with a momentary contact actuator to send a signal to the associated power pack to change the current lighting state, and color to match device finish color specified above. Field Programmable for Manual or Automatic on operation.

    a. Device finish color: White.

3. Override dimming switch: Low-voltage operating on voltage less than or equal to 24 volts DC, with a momentary contact actuator and 0-10VDC dimming output to send a signal to the associated power pack to change the current lighting state, dimming level, and color to match device finish color specified above. Field Programmable for Manual or Automatic on operation.

    a. Device finish color: White.

2.4 TIME-BASED CONTROL DEVICES

A. Digital time clock / time switch: Equal to TORK/NSi Industries, catalog number EWZ201, UL 917 listed, electronic 7-day time switch, microprocessor-based, solid-state, two-channel control, with LCD display and automatic tracking of sunrise and sunset times in order to automatically turn lights ON at sunset and OFF at sunrise.

1. Input voltage: 120/277 volts AC.
2. Output dry contacts: 30 amperes at 120 volts AC; 20 amperes at 277 volts AC.
3. Scheduling: Twenty ON and OFF set points, capable of different schedules each day of the week.
4. Sunset astronomic: Adjusts daily to changes in sunset times. Adjustable from 10 to 60 degrees, northern or southern latitudes. Can be individually offset plus/minus 1-240 minutes from both sunset and sunrise times.
5. Daylight savings: Automatic adjustment.
6. Leap year: Automatic compensation.
7. Manual override: Until the next regularly scheduled ON or OFF, automatic operation then resumes.
8. Clock format: AM/PM.
9. Power outage backup: Permanent schedule retention. Capable of operating during a power outage for 4 days with an integral supercapacitor.
10. Enclosure: Polycarbonate indoor/outdoor NEMA 250 Type 3R with lockable hasp.

2.5 LIGHTING CONTACTORS

A. Lighting contactors: UL 508 listed, in NEMA 250 Type 1 enclosure, mechanically held, electrically operated, enclosed silver-alloy double-break contacts, coil-clearing contacts; withstand rating as indicated on the drawings; Hand/Off/Auto selector switch on cover.

1. Provide contactor with two-wire control relay for two-wire control of mechanically held lighting contactor.
2. Basis of design: Square D 8903.

2.6 EMERGENCY LIGHTING CONTROL TRANSFER RELAY DEVICE

A. External type (multiple fixture): Self-contained, modular unit mounted within accessible ceiling. UL 924 and UL 1008 listed as “emergency lighting equipment” and UL listed for field installation.

1. Capable of bypassing the local switching means when normal utility power has been lost.
2. Device shall consist of a remote test switch, normal power indicator light and an alternate power indicator light in a common faceplate. This remote indicating station shall be mounted in an acoustical ceiling tile or drywall ceiling near the device whenever the location of the transfer relay device is obstructed from view.
3. Includes 0-10 volt dimming override.
4. Includes contacts for interface with fire alarm and security systems.
5. Rated for 120 through 277 volts AC, up to 20 amperes of lighting load.
6. Basis of design: Bodine, model GTD20A.

2.7 CONDUCTORS AND CABLES

A. Wiring to supply side of remote-control power sources: Not smaller than No. 12 AWG. Comply with requirements in Section 26 05 19, Wires and Cables.

B. Low-voltage control cable: Manufacturer's standard multi-conductor cable with stranded-copper conductors not smaller than No. 22 AWG, plenum rated.

1. Class 2 control cables: Multi-conductor cable with copper conductors not smaller than No. 18 AWG.
2. Class 1 control cables: Multi-conductor cable with copper conductors not smaller than No. 14 AWG.

2.9 DEVICE PROGRAMMING REQUIREMENTS

A. Refer to lighting controls diagrams and lighting controls schemes on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install devices in complete compliance with manufacturer's recommendations.

B. Provide a single cover plate where two or more devices are grouped together in one box.

C. Verify door swings with door frame installed prior to rough-in for switches.

D. Ground components according to Section 26 05 26, Grounding and Bonding.

E. Devices shall be installed and programmed to meet the control intent.

3.2 INSTALLING OCCUPANCY SENSORS

A. Install in accordance with manufacturer's written instructions.

B. Provide line-voltage type detectors when a single wall or ceiling device controls lighting within a single space.

C. Provide low-voltage type ceiling detectors when a device controls lighting within a single space as indicated on the drawings.

D. Coverage pattern: Verify coverage pattern of a single detector or system of detectors to be capable of complete coverage of the space in which the lighting is intended to be controlled. Provide additional detectors as necessary to satisfy complete coverage.

E. Install at least three feet away from HVAC diffusers, or as indicated in manufacturer's written instructions

F. Programming requirements: Indicated on the drawings.

1. Vacancy mode (manual on, automatic off).
2. Occupancy mode (automatic on, automatic off).

3.3 IDENTIFICATION

A. Materials: Refer to Section 26 05 53, "Identification for Electrical Systems." Identify devices and wiring.

3.4 FIELD QUALITY CONTROL

A. Functional testing: Perform tests and prepare test reports for the following:

1. Occupancy sensors: Confirm that the placement, sensitivity, and time-out settings are optimized to ensure lights turn off only after each space is vacated and do not turn on unless the space is occupied.
2. Digital time clock / time switch: Confirm lights are turning on and off as programmed. Confirm time settings with Architect and document device settings.
3. Spring-wound timers: Confirm time cycle turns the lights off at indicated time.
4. Photocells: Confirm photocell location is optimized to achieve maximum energy savings while maintaining the desired setpoint and that the electric light is reduced relative to the amount of usable daylight in the space.
5. Fully document control device calibration settings and submit information as a part of the operation and maintenance data.

END OF SECTION 26 09 23

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Circuit breaker panelboards, distribution and lighting and appliance branch-circuit types.

1.2 RELATED SECTIONS

A. Identification for electrical systems: Section 26 05 53.

B. Overcurrent protective device studies: Section 26 05 73.

C. Fuses: Section 26 28 13.

D. Surge protective devices: Section 26 43 13.

1.3 REFERENCES

A. ANSI/NECA 407: Recommended Practice for Installing and Maintaining Panelboards.

B. NEMA 250: Enclosures for Electrical Equipment (1000 Volts Maximum).

C. NEMA PB 1: Panelboards.

D. NEMA PB 1.1: Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.

E. NETA ATS: Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

F. UL 50: Enclosures for Electrical Equipment.

G. UL 67: Panelboards.

H. UL 1449: Surge Protective Devices.

1.4 DEFINITIONS

A. Circuit-breaker panelboards in this section:

1. Distribution panelboard: Capable of accepting up to 1200-ampere branch circuit breakers.
2. Lighting and appliance panelboards: Maximum branch circuit breaker amperage:

a. 120/208-volt panelboards: 100 amperes.

1.5 SUBMITTALS

A. Product data: For each type of panelboard, overcurrent protective device, surge protective device, accessory, and component indicated.

B. Bill of materials: Provide detailed list of components.

C. Shop drawings: For each type of panelboard, include the following details:

1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings in panel schedule format.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Features, characteristics, ratings, and factory settings of individual protective devices and auxiliary components.

D. Coordination drawings: Floor plans, drawn to 1/4"=1'-0" scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Dimensioned showing: mounting location; outline of equipment; and required clearances; relationship between components and adjacent architectural, structural, and mechanical elements.

a. Underground or underfloor conduit stub-up locations.
b. Identify equipment sections including orientation.
c. Identify space for future panel installation as indicated on drawings.

2. Submit proposed layout for each electrical room, closet, or location where equipment will be installed for Engineer review.

E. Operation and maintenance data: For panelboards and components to include in operation and maintenance manuals. In addition to items specified in Division 01 and Section 26 01 01, include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Copy of each printed panelboard schedule representing final version following installation.

1.6 QUALITY ASSURANCE

A. Do not submit equipment submittals prior to completing Short-Circuit and Coordination Study as indicated in Section 26 05 73.

B. Source limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.

C. Electrical components, devices, and accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency accepted by the authority having jurisdiction, and marked for intended location and application; listed as a complete assembly.

1. UL label and local testing (where required): As specified in Section 26 05 00, Common Work Results for Electrical.

D. Comply with referenced standards and listings previously identified including NEMA PB 1, NFPA 70, and UL 67.

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, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store equipment indoors in clean dry space with uniform temperature to prevent condensation. Protect equipment from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.9 PROJECT CONDITIONS

A. Environmental limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient temperature: Not exceeding 23 degrees F (minus 5 degrees C) to plus 104 degrees F (plus 40 degrees C).
b. Altitude: Not exceeding 6600 feet (2000 m).

1.10 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Furnish spare breakers for panelboards as indicated in schedule on drawings.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Circuit breaker panelboards: Subject to compliance with requirements, provide circuit breaker panelboards manufactured by Schneider Electric; Square D products or comparable product by one of the following:

1. ABB; General Electric products
2. Eaton Corporation
3. Schneider Electric; Square D products
4. Siemens Industry, Inc.
5. Or approved equal.

2.2 PANELBOARDS, GENERAL

A. UL listing: UL 67, listed and labeled.

B. Panelboards for service entrance shall be listed and labeled for service entrance.

C. Integrated equipment short-circuit rating: Each panelboard, as a complete unit, shall have a short-circuit rating equal to or greater than the integrated equipment rating shown or scheduled on the drawings.

1. Rating shall be established by testing in accordance with UL 67, with the overcurrent devices mounted in the panelboard. Make short-circuit tests on the overcurrent devices and on the panelboard structure simultaneously, by connecting the fault to each overcurrent device with the panelboard connected to its rated voltage source. The source shall be capable of supplying specified panelboard short-circuit current or greater.
2. Testing of overcurrent devices only while individually mounted is not acceptable. Testing the bus structure by applying a fixed fault to the bus structure alone is not acceptable.
3. Mark each panelboard with its maximum short-circuit current rating at the supply voltage.
4. Series rating of panelboards with devices outside of the panelboard enclosure are not permitted.

D. Enclosures: Flush- or surface-mounted as indicated, NEMA PB 1, Type 1, UL 50, galvanized steel.

1. Size: Where multiple-width or multiple-section panelboards are indicated or required, each cabinet shall be the same width and height.
2. Provide enclosure type as indicated below or listed on drawings:

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Outdoor Locations: NEMA 250, Type 3R.

E. Directory card: Inside panelboard door, mounted in transparent card holder with information as indicated in Part 3, Identification.

F. Provisions for future devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. Furnish each unit with a master nameplate, listing standard manufacturer information including voltage, ampacity, frequency, and short-circuit ratings; manufacturer's model and project designations.

2.3 CIRCUIT-BREAKER PANELBOARDS

A. Factory-assembled complete with bolt-on circuit breakers.

B. Cabinets and fronts: Minimum 20 inches wide, wiring gutter space in accordance with UL 67, with minimum four-inch width on every side.

1. Cabinet front: Door-in-door construction, one or more latches as required for size, with outer door covering the gutter.
2. Door: Required for sizes up to and including 600 amperes.

a. Lock: Flush, cylinder tumbler type, with catch and spring-loaded stainless steel door pull. All panelboards shall be keyed alike. Provide two keys per lock. Provide extra keys as required in "Extra Materials" in Part 1 above.
b. Hinges: Steel, completely concealed.

C. Circuit breakers: UL 489; voltage, continuous-current rating, and interrupting rating as indicated on the drawings or determined by the results of the Short-Circuit Analysis performed under Section 26 05 73, whichever is greater.

1. Breakers shall be 1-, 2- or 3-pole, with an integral crossbar to ensure simultaneous opening of all poles in multipole circuit breakers.
2. Operating mechanism: Over center, trip-free, toggle-type with quick-make, quick-break action. Handles shall have on, off, and tripped positions.
3. Circuit breakers shall be able to be installed in the panelboard without requiring additional mounting hardware or disturbing adjacent units, bars, or branch circuit connections.

4. Where indicated on the drawings, provide shunt-trip main breakers, standard main breakers, or lugs.
5. Main and branch circuit breakers shall have device ampacity rating engraved on the front or side of each breaker handle. The breaker rating shall be clearly visible without removing panelboard cover.
6. Circuit breakers shall be rated for use with 75 deg C wire (conductor temperature rating).
7. 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 amperes and larger.
8. Adjustable instantaneous-trip circuit breakers: Magnetic trip element with front mounted, field-adjustable trip setting.
9. Ground-fault circuit interrupter (GFCI) type circuit breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
10. Tandem breakers are not permitted.

D. Bussing assembly and temperature rise: Panelboard bus structure and main lugs or main circuit breaker shall have current ratings as shown on the panelboard schedule, established by heat rise tests conducted in accordance with UL 67.

1. Conductor dimensions shall not be accepted in lieu of actual heat tests.
2. Current-carrying parts of the bus structure shall be hard-drawn copper, 98 percent conductivity.
3. Provide a separate copper ground bus with screw terminals for branch wiring and feed-through lugs.
4. Where indicated on the drawings, provide a separate isolated ground bus in addition to the equipment ground bus.

E. Additional connections: Where indicated on drawings, provide the following:

1. Feed-through lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
2. Sub-feed (double) lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

F. Distribution panelboards: Distribution panelboard shall be capable of accepting up to 250-ampere branch circuit breakers, or as indicated on drawing wiring panel schedules. Current characteristics shall be as scheduled on the drawings.

G. Branch circuit panelboards: Panelboard shall be capable of accepting up to 100-ampere branch circuit breakers.

1. Single-pole, 15- and 20-ampere circuit breakers intended to switch fluorescent lighting loads on a regular basis shall carry the SWD marking.
2. Branch circuit breakers serving exit lights, fire alarm, emergency lighting, and security equipment shall be provided with handle-blocking devices which shall prevent accidental operation but not prevent tripping.

2.4 SURGE PROTECTIVE DEVICE (SPD)

A. As part of the panelboard, provide surge protective device specified in Section 26 43 13, Surge Protective Devices, where indicated on drawings. Note the requirement of that section for a single manufacturer to provide surge protective device of all types in the project.

2.5 SOURCE QUALITY CONTROL

A. With branch circuit breakers installed, short-circuit test panelboards as complete units, in accordance with requirements of UL 67.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Securely attach panelboards to the wall where indicated on the drawings. Install in accordance with NEMA PB 1.1 and manufacturer's written installation instructions.

1. Mounting height:

a. 72 inches (1829 mm) to top of panelboard.
b. Panelboards taller than 72 inches (1829 mm): Bottom edge no more than 4-inches (102 mm) above floor.
c. Top breaker maximum height: No more than 6-feet, 7-inches (2.0 m) above the floor or working platform.

B. Comply with applicable portions of NECA 407.

C. Frame and mount printed circuit directory indicating type and location of equipment on each circuit.

D. Wiring in gutters: Arrange conductors into groups, and bundle and wrap with wire ties.

E. Install filler plates in unused spaces.

F. Spare conduits: Where panelboards are recessed in wall construction, stub four 1-inch (27 mm) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future.

3.2 CONNECTIONS

A. Connect panelboards and components to wiring and to ground as indicated.

B. Shared neutral conductors shall not be permitted, except where indicated.

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's values are not indicated, use those specified in UL 486A and UL 486B.

3.3 IDENTIFICATION

A. Materials: Refer to Division 26 Section "Identification for Electrical Systems." Identify units, auxiliary devices, controls, and wiring. Identify equipment ratings.

B. Nameplates: Refer to Division 26 Section "Identification for Electrical Systems" for additional requirements. Provide identification nameplate for each panelboard and associated components located on front of assembly.

C. Identify field-installed wiring and components. Refer to Division 26 Section "Identification for Electrical Systems" for additional requirements.

D. Identify available fault current and calculation date. Refer to Division 26 Section "Overcurrent Protective Device Studies" for additional requirements.

E. Provide printed directory for each panelboard. Handwritten directories are not acceptable. Copying of panel schedules and descriptions on drawings is not acceptable. Circuit directory shall reflect final circuit installation. Include the following information:

1. Panelboard designation and room location.
2. Circuit breakers, size and number of poles.
3. Circuit or feeder description including destination room name(s) and number(s).
4. Clear description of type of load circuit serves.
5. Panelboard ratings: Main bus ampacity, main circuit breaker or main lug ampacity, AIC rating.
6. Incoming primary feeder size and source panelboard circuit designation.

F. Room names and numbers on the panelboard circuit directories shall match names and numbers used by the Owner. Note that room names and numbers on the drawings may not match the Owner's final room name and numbering scheme.

3.4 FIELD QUALITY CONTROL

A. Make insulation-resistance tests of each panelboard bus, component, and connecting supply, feeder, and control circuit.

B. Make continuity tests of each circuit.

C. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification for molded-case circuit breakers. Certify compliance with test parameters.

D. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 CLEANING

A. Clean interior and exterior of panelboards.

B. Refinish painted surfaces damaged during construction to match the rest of the panelboard.

END OF SECTION 26 24 16

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 27 16 - CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Indoor enclosures.

B. Weatherproof enclosures.

1.2 SUBMITTALS

A. Product data: Each type of enclosure required for the project.

PART 2 - PRODUCTS

2.1 INDOOR ENCLOSURES

A. Type 1 in accordance with NEMA 250 and conforming to UL 57, of size required by NEC to fit equipment or as shown on the drawings.

B. Construction: Code grade galvanized steel.

2.2 FINISHES

A. Satin gray enamel, inside and out.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Securely attach enclosure to wall on plywood backboard, set on housekeeping pad, or hang on frame, as indicated.

3.2 LOCATIONS

A. Provide indoor type inside building and weatherproof type in exterior locations.

END OF SECTION 26 27 16

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Receptacles.

B. Toggle / snap switches for power.

C. Emergency shutoff pushbuttons.

D. Wiring devices for floor boxes and poke-through service fittings.

1.2 RELATED SECTIONS

A. Boxes: Section 26 05 34.

B. Identification: Section 26 05 53.

C. Toggle / snap switches for lighting: Section 26 09 23.

1.3 REFERENCES

A. ANSI/NEMA WD 6: Wiring Devices - Dimensional Specifications.

B. NEMA WD 1: General Color Requirements for Wiring Devices.

C. UL 20: General-Use Snap Switches.

D. UL 498: Attachment Plugs and Receptacles.

1.4 SUBMITTALS

A. Product data: Each type of device used in the project.

B. Field quality-control test reports.

PART 2 - PRODUCTS

2.1 RECEPTACLES

A. Acceptable manufacturers:

1. Eaton/Arrow Hart
2. Hubbell/Bryant
3. Legrand/Pass & Seymour (P&S)
4. Leviton Manufacturing Co.
5. Or approved equal.

B. Receptacles: NEMA 5-20R, 20-ampere rating, 125 volts AC, 2-pole, 2-wire plus ground, conforming to NEMA WD 1 and WD 6 configuration numbers, and UL 498.

1. Specification grade:

a. General-use, duplex:

(1) Basis of design: P&S PS5362, heavy-duty, brass mounting strap.

b. General-use for mobile charging, duplex, with USB charging ports:

(1) Basis of design: Leviton T5833, one USB-A charging port and one USB-C charging port, 5.1 amperes 5 volts DC total USB charging output, tamper-resistant.

c. Tamper-resistant type, duplex:

(1) Basis of design: P&S TR5362, hard-use.

d. Ground-fault circuit-interrupter (GFCI) type, self-test, duplex:

(1) Basis of design: P&S 2097TR, tamper-resistant.

e. Ground-fault circuit-interrupter (GFCI) type for exterior and wet locations, duplex:

(1) Basis of design: P&S 2097TRWR, tamper-resistant, weather-resistant.

f. Surge protective type:

(1) Basis of design: P&S 5362__SP.

C. Device color:

1. Normal power receptacles: White.
2. Specialty wall normal power receptacles: Brown
3. Generator power receptacles: Red

D. Device covers:

1. Wall plates: Smooth nylon, color shall match device color.

a. Basis of design: P&S smooth nylon, TP series, color shall match device color.

2. Wet-location, weatherproof cover, single-gang, extra-duty:

    a. Basis of design: P&S WIUC10FRED, while-in-use, polycarbonate, frosted.

2.2 TOGGLE / SNAP SWITCHES FOR POWER

A. Acceptable manufacturers:

1. Arrow Hart/Eaton Wiring Devices
2. Hubbell/Bryant Electric
3. Legrand/Pass & Seymour (P&S)
4. Leviton Manufacturing Co.
5. Or approved equal.

B. Toggle / snap switches: Specification grade

1. General-use: UL 20, single-pole, 20 amperes, 120/277 volts:

    a. Basis of design: P&S PS20AC1, industrial extra heavy-duty.

2. Weatherproof cover with actuating lever mounted directly over general-use toggle switch:

    a. Basis of design: P&S CA1GL cover, heavy-duty die-cast zinc.

3. Manual motor rated switch: UL 508, toggle type, 30 amperes, 600 volts, no overload protection, capable of being locked in the off position:

    a. Basis of design: P&S 7802MD, double-pole, single-phase.

C. Device color: White.

2.3 WIRING DEVICES FOR FLOOR BOXES AND POKE-THRU SERVICE FITTINGS

A. Floor boxes and poke-through service fittings for power and communications: As specified in Section 26 05 34, Boxes, complete with specification grade 20-ampere, 125-volt receptacles as indicated on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices in complete compliance with the manufacturer’s recommendations.

B. Arrangement of devices: Unless otherwise indicated, mount flush with long dimension vertical. Group adjacent devices under single multi-gang wall plates.

C. Receptacles:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the left.

D. Wall plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard wall plates do not fit flush or do not cover rough wall opening.

3.2 IDENTIFICATION

A. Comply with Section 26 05 53 "Identification for Electrical Systems."

B. Identify receptacles with panelboard identification and circuit number. Use self-adhesive labeling.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and inspections:

1. After installing devices and after electrical circuitry has been energized, test for compliance with requirements.
2. Receptacles:

a. Insert and remove test plug to verify that device is securely mounted.
b. Verify polarity of hot and neutral pins.
c. Measure line voltage.
d. Measure grounding circuit continuity; impedance shall be not greater than 2 ohms.

C. Report results of tests and inspections in writing.

END OF SECTION 26 27 26

SECTION 26 28 00 - ENCLOSED CIRCUIT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Enclosed switches (disconnects/safety switches).

B. Elevator disconnecting switch.

1.2 RELATED SECTIONS

A. Motors:

1. Motor requirements for plumbing equipment: Section 22 05 13.
2. Motor requirements for HVAC equipment: Section 23 05 13.

B. Fuses: Section 26 28 13.

C. Overcurrent protective device study: Section 26 05 73.

1.3 REFERENCES

A. NEMA AB 1: Molded Case Circuit Breakers and Molded Case Switches.

B. NEMA KS 1: Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

C. UL 98: Enclosed and Dead-Front Switches.

D. UL 489: Molded Case Circuit Breakers and Circuit Breaker Enclosures.

1.4 SUBMITTALS

A. Product data: Each type of enclosed switch, enclosed circuit breaker and elevator disconnecting switch.

1.5 QUALITY ASSURANCE

A. Comply with the following standards:

1. NEMA KS 1 for enclosed switches.
2. UL 98.
3. UL 198E.

B. UL label and local testing (if required): As specified in Section 26 0500, Common Work Results for Electrical.

PART 2 - PRODUCTS

2.1 ENCLOSED SWITCHES (DISCONNECTS/SAFETY SWITCHES)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB; General Electric products.
2. Eaton Corporation.
3. Schneider Electric; Square D products.
4. Siemens Industry, Inc.
5. Or approved equal.

B. Properly size switches for number of poles and provide fused or non-fused as required for project conditions and to meet NFPA 70 requirements.

1. Neutral kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
2. Auxiliary contact kit: Two NO/NC (Form “C”) auxiliary contact(s), arranged to activate before switch blades open.

C. Fuse contacts and quick-make/quick-break jaws shall ensure positive contacts with reinforcing spring clips or other approved means.

D. Switches shall be front-operated.

E. Current-carrying parts: Plated copper.

F. Hinges: Noncurrent-carrying.

G. Switches shall be lockable in either open or closed position.

H. Type:

1. Non-fused switches: General-duty type on 120/208-volt systems.
2. Fused switches: Heavy-duty type.

I. Enclosures: Indoors NEMA 250 Type 1; outdoors Type 3R with raintight hubs.

2.2 ELEVATOR DISCONNECTING SWITCH

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Corporation; Bussmann.
2. Mersen.
3. Littelfuse, Inc.
4. Or approved equal.

B. Separately enclosed in NEMA 250 Type 1 enclosure with externally operable lockable handle allowing switch to be locked in the OFF position ensuring load side power isolation during servicing.

1. Properly sized Class J fuses, Class J fuse block, connected in series with molded case safety switch.

    a. Basis of design: Cooper Bussmann JKS Limitron fuse.

2. Properly sized molded case switch, with 120 VAC shunt trip operation, connected in series with fuses.
3. Control circuit: 120-volt.

    a. Control power transformer: Primary voltage as required for the motor, 120 V secondary voltage; capacity to operate control devices and 100 percent spare capacity.
    b. Primary and secondary fuse protection for each control power transformer: Class CC fuses, current-limiting rejection type, rated 0.1 to 30 A, 600 V, and 200 kA interrupting rating.

4. Fire safety interface isolation relay: 3PDT, 10-ampere, 120-volt relay with coil voltage as required to interface with the fire alarm system.
5. Voltage monitoring relay: To monitor shunt trip voltage.
6. Auxiliary control contacts:

    a. One normally open and one normally closed primary auxiliary contact.
    b. One normally open and one normally closed secondary auxiliary contact.

7. Power ON pilot light.
8. Ground lug.
9. Key-to-test switch.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install enclosed switches where indicated and as required for motor outlets, transformers, and other equipment.

B. Securely attach and properly connect enclosed switches and elevator disconnecting switches.

C. Provide an enclosed switch for each motor, as required by NFPA 70, except where it is provided in a panelboard within sight and easy reach of the motor, and provide wiring and connections from source. Enclosed switches shall be fused where protection is required or indicated on drawings and unfused elsewhere.

D. Enclosed switches:

1. Provide neutral kit where required for four-wire application.
2. Provide auxiliary contact kit where indicated on drawings.

END OF SECTION 26 28 00

SECTION 26 28 13 - FUSES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fuses.

1.2 RELATED SECTIONS

A. Motors:

1. Motor requirements for plumbing equipment: Section 22 05 13.
2. Motor requirements for HVAC equipment: Section 23 05 13.

B. Enclosed switches: Section 26 28 00.

1.3 REFERENCES

A. UL 198E: Class R fuses.

B. UL 198C: High-Interrupting-Capacity Fuses, Current Limiting Types.

1.4 SUBMITTALS

A. Product data: Each type of fuse.

B. Published data on fuses shall include time/current curves, peak-let-through curves and I2t melting and clearing curves.

1.5 QUALITY ASSURANCE

A. Comply with UL 198C, Class L fuses, also Classes G and J.

B. UL label and local testing (if required): As specified in Section 26 05 00, Common Work Results for Electrical.

1.6 EXTRA MATERIALS

A. Provide three spare fuses for each type and size of fuse in the work.

PART 2 - PRODUCTS

2.1 FUSES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Corporation; Bussmann
2. Littelfuse, Inc.
3. Mersen
4. Or approved equal.

B. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

C. Fuses 0-600 amperes for 600-volt or 250-volt, UL labeled Class RK1 with time delay, with a minimum short-circuit interrupting capacity of 200,000 rms symmetrical amperes, and shall carry 500 percent of rating for a minimum of 10 seconds.

1. Fuses for enclosed switches (disconnects/safety switches) for packaged HVAC equipment: Size and type recommended by the equipment manufacturer and as required for equipment to meet UL rating.

D. Fuses 601 amperes and larger shall be UL labeled Class L with time delay, 600-volt, with minimum short circuit interrupting capacity of 200,000 rms symmetrical amperes and dimensions to properly mount in switchboard or disconnecting switches.

E. Fuses 0-30 amperes for control power transformers shall be UL labeled Class CC with time delay, 600-V, with a minimum short-circuit interrupting capacity of 200,000 rms symmetrical amperes, and dimensions to properly mount in fuse blocks at control power transformers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fuses where indicated and as required for motor outlets or other equipment.

END OF SECTION 26 28 13

SECTION 26 29 14 - ENCLOSED MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Alternating-current motor starters (enclosed controllers) rated 600 V and less that are supplied as enclosed units.

1. Manual motor starters.

1.2 RELATED SECTIONS

A. Motors:

1. Motor requirements for plumbing equipment: Section 22 05 13.
2. Motor requirements for HVAC equipment: Section 23 05 13.

B. Manual motor-rated switches (toggle / snap switches for power): Section 26 27 26.

1.3 SUBMITTALS

A. Product data:

1. Each type of motor starter included in the project, including dimensions, ratings, and data on features and components.

B. Shop drawings: Composite wiring diagram showing the interlocking and control wiring.

C. Operation and maintenance data: For operating and maintenance manuals, as specified in Section 26 01 01.

1.4 QUALITY ASSURANCE

A. Source limitations: Obtain motor starters of a single type through one source from a single manufacturer.

B. Electrical components, devices, and accessories shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to the authorities having jurisdiction, and marked for intended use.

1.5 COORDINATION

A. Coordinate layout and installation of motor starters with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required clearances for work space and for access.

B. Coordinate features, accessories, and functions of each motor starter with ratings and characteristics of supply circuit, motor, control sequence, and duty cycle of motor and load.

1. Refer to wiring diagrams required in the sections specifying the equipment.

PART 2 - PRODUCTS

2.1 MOTOR STARTERS, GENERAL

A. Basis-of-design product: Subject to compliance with requirements, provide the specified Schneider Electric; Square D products, or comparable products by one of the following:

1. ABB; General Electric products.
2. Eaton Corporation.
3. Schneider Electric; Square D products.
4. Siemens Industry, Inc.
5. Or approved equal.

2.2 MANUAL MOTOR STARTERS

A. Enclosures: NEMA 250 Type 1 for interior use and NEMA 250 Type 3R for exterior or damp or wet locations.

1. Mounting: Flush-mounted in finished areas and where possible; surface-mounted elsewhere, with cover plates to suit the mounting.
2. Indicating lights mounted in enclosure.
3. Engraved plastic identification plates.

B. Manual motor-starting switch: Single- or two-pole as required, with built-in thermal overload protection.

1. Basis of design: Square D Class 2510.

C. Switch: Toggle, quick-make and quick-break, with self-indicating, trip-free handle, and means for locking in Off position.

D. Overload protection unit: Melting-alloy type, interchangeable; starter shall be inoperative if unit is removed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. For equipment at walls, bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For equipment not at walls, mount on lightweight structural-steel channels bolted to floor or to structure above ceiling.

B. Provide wiring as indicated on the drawings.

C. Applications: Magnetic motor starters for all equipment unless otherwise specified or indicated on drawings.

D. Install starters, auxiliary contacts, and automatic control devices furnished with equipment, except those that are already mounted on the equipment, fully wired and connected. See coordination requirements specified in Part 1 above.

E. Check the size of the overload protection, and change or adjust it as required, after the HVAC systems have been adjusted and balanced as specified in Section 23 05 93, Testing, Adjusting, and Balancing.

END OF SECTION 26 29 14

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 33 23 - CENTRAL BATTERY EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes fast-transfer central battery inverters with the following features:

1. Output distribution section.
2. Internal maintenance bypass/isolation switch.
3. Remote monitoring provisions.

1.2 DEFINITIONS

A. LED: Light-emitting diode.

B. THD: Total harmonic distortion.

1.3 SUBMITTALS

A. Product data:

1. Electrical ratings, including the following:

a. Capacity to provide power during failure of normal ac.
b. Inverter voltage regulation and THD of output current.
c. Rectifier data.
d. Data for specified optional features.

2. Inverter.
3. Battery charger.
4. Batteries.
5. Battery monitoring.

B. Shop drawings: Detail equipment assemblies and indicate dimensions, weights, components, and location and identification of each field connection. Show access, workspace, and clearance requirements; details of control panels; and battery arrangement.

1. Wiring diagrams: Detail internal and interconnecting wiring; and power, signal, and control wiring.
2. Elevation and details of control and indication displays.
3. Output distribution section.

C. Field quality-control test reports.

D. Operation and maintenance data: For central battery inverter equipment to include in emergency, operation, and maintenance manuals.

E. Warranty: Special warranty specified in this section.

1.4 QUALITY ASSURANCE

A. Central battery inverter system: UL 924 and UL 1778 listed. Comply with ANSI 62.41; ANSI C62.45 (Categories A and B).

B. Comply with NFPA 70 and NFPA 101.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment in fully enclosed vehicles.

B. Store equipment in spaces having environments controlled within manufacturers' written instructions for ambient temperature and humidity conditions for non-operating equipment.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace batteries that fail in materials or workmanship within specified warranty period. Special warranty, applying to batteries only, applies to materials only, on a prorated basis, for period specified.

1. Warranty Period: Include the following warranty periods, from date of Substantial Completion:

a. Nickel-Cadmium, Wet-Cell Batteries:

(1) Full Warranty: 1 year.
(2) Pro Rata: 14 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-design product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Bigbeam Emergency Systems, Inc.; Siltron Division.
2. Phillips Electronics; Chloride Systems.
3. Cooper Industries, Inc.; Sure-Lites Division.

4. Crucial Power Products.
5. Dual-Lite.
6. Phillips Electronics; Lightguard.
7. Lithonia Lighting; Emergency Lighting Systems.
8. Thomas & Betts Corporation; Emergi-Lite Division.
9. Thomas & Betts Corporation; Lightalarms Division.
10. Or approved equal.

2.2 INVERTER PERFORMANCE REQUIREMENTS

A. Fast-transfer central battery inverters: Automatically sense loss of normal ac supply and use a solid-state switch to transfer loads. Transfer in 0.004 second or less from normal supply to battery-inverter supply.

1. Operation: Unit supplies power to output circuits from a single, external, normal supply source. Unit automatically transfers load from normal source to internal battery/inverter source. Retransfer to normal is automatic when normal power is restored.

2.3 SERVICE CONDITIONS

A. Environmental conditions: Inverter system shall be capable of operating continuously in the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Ambient temperature for electronic components: 32 to 98 deg F (0 to 37 deg C).
2. Relative humidity: 0 to 95 percent, noncondensing.
3. Altitude: Sea level to 4000 feet (1220 m).

2.4 INVERTERS

A. Description: Solid-state type, with the following operational features:

1. Automatically regulate output voltage to within plus or minus 5 percent.
2. Automatically regulate output frequency to within plus or minus 1 Hz, from no load to full load at unit power factor over the operating range of battery voltage.
3. Output Voltage Waveform of Unit: Sine wave with maximum 10 percent THD throughout battery operating-voltage range, from no load to full load.

    a. THD may not exceed 5 percent when serving a resistive load of 100 percent of unit rating.

4. Output Protection: Current-limiting and short-circuit protection.
5. Overload Capability: 110 percent for 10 minutes; 150 percent surge.
6. Brownout Protection: Produces rated power without draining batteries when input voltage is down to 92 percent of normal.

2.5 BATTERY CHARGER

A. Description: Solid-state, automatically maintaining batteries in fully charged condition when normal power is available. With LED indicators for “float” and “high-charge” modes.

2.6 BATTERIES

A. Description: Nickel-cadmium, wet-cell batteries.

1. Capable of sustaining full-capacity output of inverter unit for minimum of 90 minutes.

2.7 ENCLOSURES

A. NEMA 250, Type 1 steel cabinets with access to components through hinged doors with flush tumbler lock and latch.

B. Finish: Manufacturer’s standard baked-enamel finish over corrosion-resistant prime treatment.

2.8 CONTROL AND INDICATION

A. Description: Group displays, indications, and basic system controls on common control panel on front of central battery inverter enclosure.

B. Minimum displays, indicating devices, and controls shall include those in lists below. Provide sensors, transducers, terminals, relays, and wiring required to support listed items. Alarms shall include an audible signal and a visual display.

C. Indications: Labeled LED.

1. Quantitative indications:

a. Input voltage.
b. System output voltage.
c. System output current.
d. System output frequency.
e. DC bus voltage.
f. Battery current and direction (charge/discharge).
g. Elapsed time-discharging battery.

2. Basic status condition indications:

a. Normal operation.
b. Load-on battery.
c. Alarm condition exists.

3. Alarm indications:

    a. Overload.
    b. Input overvoltage or undervoltage.
    c. Approaching end of battery operation.
    d. Battery undervoltage shutdown.
    e. Inverter transformer overtemperature.
    f. Inverter overtemperature.
    g. Inverter output overvoltage or undervoltage.

4. Controls:

    a. Inverter on-off.
    b. Start.
    c. Battery test.
    d. Alarm silence/reset.
    e. Output-voltage adjustment.

D. Include the following minimum array:

1. Ready, normal-power on light.
2. Charge light.
3. Inverter supply load light.

E. Enclosure: Steel, with hinged lockable doors, suitable for wall mounting. Manufacturer's standard corrosion-resistant finish.

2.9 OPTIONAL FEATURES

A. Emergency-only circuits: Automatically energize only when normal supply has failed. Disconnect emergency-only circuits when normal power is restored.

B. Maintenance bypass/isolation switch: Switch is interlocked so it cannot be operated unless static bypass transfer switch is in bypass mode. Switch provides manual selection among the following three conditions without interrupting supply to the load during switching:

1. Full isolation: Load is supplied, bypassing central battery inverter system. Normal ac input circuit, static bypass transfer switch, and central battery inverter load terminals are completely disconnected from external circuits.
2. Maintenance bypass: Load is supplied, bypassing central battery inverter system.
3. Central battery inverter ac supply terminals are energized to permit operational checking, but system load terminals are isolated from the load.
4. Normal: Normal central battery inverter ac supply terminals are energized and the load is supplied either through static bypass transfer switch and central battery inverter rectifier-charger and inverter or through battery and inverter.

2.10 OUTPUT DISTRIBUTION SECTION

A. Panelboard: Comply with Section 26 24 16, Panelboards, except provide assembly integral to equipment cabinet.

2.11 SYSTEM MONITORING AND ALARMS

A. Remote status and alarm panel: Labeled LEDs on panel faceplate shall indicate five basic status conditions. Audible signal indicates alarm conditions.

1. Cabinet and faceplate: Surface or flush mounted to suit mounting conditions indicated.

B. Provisions for Remote Computer Monitoring: Communication module in unit control panel provides capability for remote monitoring of status, parameters, and alarms specified in the Article, Control and Indication, above. Remote computer and connecting signal wiring will be provided by Owner. Include the following features:

1. Connectors and network interface units or modems for data transmission via RS-232 link.
2. Software shall be designed to control and monitor inverter system functions and to provide on-screen explanations, interpretations, diagnosis, action guidance, and instructions for use of monitoring indications and development of reports. Include capability for storage and analysis of power-line transient records. Software shall be compatible with requirements in Section 26 09 13, Electrical Power Monitoring and Control, and the operating system and configuration of Owner-furnished computers.

C. Battery-cycle warranty monitoring: Electronic device, acceptable to battery manufacturer as a basis for warranty action, for monitoring charge-discharge cycle history of batteries covered by cycle-life warranty.

1. Basic functional performance: Automatically measures and records each discharge event.
2. Additional monitoring functions and features shall include the following:

a. Measuring and recording of total voltage at battery terminals; providing alarm for excursions outside proper float voltage level.
b. Monitoring of ambient temperature at battery and initiating an alarm if temperature deviates from normally acceptable range.
c. Alarm contacts arranged to provide local and remote alarm for battery discharge events and abnormal battery voltage or temperature.
d. Memory device to store recorded data in nonvolatile electronic memory.
e. RS-232 port to permit downloading of data to a portable personal computer.
f. Modem to make measurements and recorded data accessible to remote personal computer via telephone line.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment will be installed, before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

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

3.2 INSTALLATION

A. Install system components on floor and attach by bolting.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

B. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

3.3 CONNECTIONS

A. Connections: Interconnect system components. Make connections to supply and load circuits according to manufacturer's wiring diagrams, unless otherwise indicated.

B. Ground equipment according to Section 26 05 26, Grounding and Bonding. Do not connect as a separately-derived system.

C. Connect wiring according to Section 26 05 19, Wires and Cables

3.4 IDENTIFICATION

A. Identify equipment and components according to Section 26 05 00, Common Work Results for Electrical.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Tests and Inspections:

1. Inspect interiors of enclosures for integrity of mechanical and electrical connections, component type and labeling verification, and ratings of installed components.
2. Test manual and automatic operational features and system protective and alarm functions.
3. Test communication of status and alarms to remote monitoring equipment.
4. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specifications. Certify compliance with test parameters.
5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
6. Remove and replace malfunctioning units and retest as specified above.

3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Verify that central battery inverter is installed and connected according to the Contract Documents.

C. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 26 Sections.

D. Complete installation and startup checks according to manufacturer's written instructions.

3.7 ADJUSTING AND CLEANING

A. Set field-adjustable switches as indicated.

B. Install new filters in each equipment cabinet within 14 days from date of Substantial Completion.

3.8 DEMONSTRATION

A. As specified in Section 26 05 00, provide operating instructions.

B. Provide at least 2 hours of additional instruction time for the systems and equipment specified in this section other than remote computer monitoring, consisting of 2 periods of 1 hour, during a period of not more than 60 days.

C. Provide at least 4 hours of additional instruction time for the remote computer monitoring specified in this section, consisting of 2 periods of 2 consecutive hours, during a period of not more than 60 days.

END OF SECTION 26 33 23

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 43 13 - SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Surge protective devices (SPD's) for the protection of AC electrical circuits from the effects of lightning-induced currents, substation switching transients, and internally generated transients resulting from inductive or capacitive load switching.

1.2 RELATED SECTIONS

A. Service entrance: Section 26 05 41.

B. Panelboards: Section 26 24 16.

C. Circuit breaker: Section 26 24 16, Panelboards.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. MCOV: Maximum continuous operating voltage.

C. MOV: Metal-oxide varistor.

D. SPD: Surge protective device.

E. VPR: Voltage protection rating.

1.4 SUBMITTALS

A. Product data: Manufacturer’s catalog information, including unit dimensions and rated capacities for each type of unit included in the project.

B. Certifications:

1. Cover page of manufacturer’s UL test report for each type of unit, showing that the unit is UL 1449 Fourth Edition listed.

2. UL 1449 Fourth Edition listing documentation verifying the following:

a. Voltage protection rating (VPR).
b. Maximum continuous operating voltage (MCOV).

3. Electromagnetic interference certification in accordance with UL 1283.

1.5 QUALITY ASSURANCE

A. Each SPD shall be UL 1449 Fourth Edition listed and labeled.

B. A single manufacturer shall provide SPD's for every location.

1.6 WARRANTY

A. In addition to the general project warranty and correction period, provide manufacturer's special warranties providing unlimited replacements of suppressor modules if they are destroyed by transients. Length of warranties:

1. Service entrance SPD: Ten years.
2. Secondary distribution SPD: Ten years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-design product: Subject to compliance with requirements, provide externally mounted SPD units manufactured by Eaton, or comparable product by one of the following:

1. ABB; General Electric products.
2. ASCO Power Technologies.
3. Eaton Corporation.
4. Erico International Corp.; Pentair.
5. Schneider Electric; Square D products.
6. Siemens Industry, Inc.
7. Surge Suppression Inc.
8. Or approved equal.

2.2 SERVICE ENTRANCE SURGE PROTECTIVE DEVICE

A. Service entrance SPD unit externally mounted and field wired to service entrance distribution panelboard as specified in Section 26 24 16, Panelboards.

B. Suppression components shall be MOV based, serviceable, and replaceable.

C. SPD shall provide surge current paths for the following modes of protection: L-N, L-G, L-L, and N-G.

D. SPD shall incorporate a UL 1283 listed EMI/RFI filter with minimum attenuation of - 50dB at 100 kHz.

E. Provide terminals for the necessary power and ground connections. Each terminal shall accommodate wire sizes of No. 10 to No. 1 AWG.

F. SPD shall meet or exceed the following criteria:

1. Surge current capacity, single pulse rated (L-N + N-G): 200 kA per phase (8/20 µs waveform).
2. The UL 1449 Fourth Edition; voltage protection ratings (VPR) shall not exceed the following:

System Voltage	L-N	L-G	L-L	N-G
208Y/120V	700V	800V	1200V	700V

3. UL 1449 listed maximum continuous operating voltage (MCOV):

System Voltage	Allowable System Voltage Fluctuation	MCOV
208Y/120V	25 percent	150V

G. SPD shall be equipped with the following:

1. Visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED.
2. Audible alarm with on/off silence function and diagnostic test function.
3. One set of normally open/normally closed dry contacts.

H. Enclosure: NEMA 250 Type 1.

2.3 SURGE PROTECTIVE DEVICES FOR SECONDARY BRANCH CIRCUIT PANELBOARDS

A. SPD unit externally mounted and field wired to the panelboard as specified in Section 26 24 16, Panelboards.

B. Suppression components shall be MOV based, serviceable, and replaceable.

C. SPD shall provide surge current paths for the following modes of protection: L-N, L-G, L-L, and N-G.

D. SPD shall incorporate a UL 1283 listed EMI/RFI filter with minimum attenuation of - 50dB at 100 kHz.

E. Provide terminals for the necessary power and ground connections. Each terminal shall accommodate wire sizes of No. 10 to No. 1 AWG.

F. SPD’s shall meet or exceed the following criteria:

1. Surge current capacity, single pulse rated, (L-N + N-G):

a. For branch-circuit panelboards: 50kA per phase.

2. The UL 1449 Fourth Edition; voltage protection ratings (VPR) shall not exceed the following:

System Voltage	L-N	L-G	L-L	N-G
208Y/120V	700V	800V	1200V	700V

3. UL 1449 listed maximum continuous operating voltage (MCOV):

System Voltage	Allowable System Voltage Fluctuation	MCOV
208Y/120V	25 percent	150V

G. SPD shall be equipped with the following:

1. Visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED.
2. Audible alarm with on/off silence function and diagnostic test function.
3. One set of normally open/normally closed dry contacts.

H. Enclosure: NEMA 250 Type 1.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install per manufacturer’s installation instructions and recommendations.

B. Install SPD's plumb, level and rigid without distortion.

3.2 INSTALLING SERVICE ENTRANCE SURGE PROTECTIVE DEVICE

A. Install one primary SPD at utility service entrance to the facility as shown on the drawings.

B. Install the SPD on the load side of the main service disconnect.

C. Keep conductors between the SPD and point of attachment short and straight.

D. Bond SPD’s ground to the service entrance ground.

3.3 INSTALLING SURGE PROTECTIVE DEVICES FOR PANELBOARDS

A. Install SPD external to branch panelboards.

B. Install per manufacturer's installation instructions with lead lengths as short (less than 24 inches) and straight as possible.

1. Rearrange circuit breaker locations in panelboards to ensure short and straightest possible leads to each SPD.

3.4 ADJUSTMENTS AND CLEANING

A. Remove debris from SPD and wipe dust and dirt from all components.

B. Repaint marred and scratched surfaces with touch up paint to match original finish.

3.5 FIELD QUALITY CONTROL

A. Test and inspections:

1. Perform each visual and mechanical inspection and electrical test in accordance with NETA Acceptance Testing Specifications in section for Surge Arresters, Low-Voltage, except for inspection and test procedures involving anchorage and bolted connections. Certify compliance with test parameters.
2. After installing SPD devices but before electrical circuitry has been energized, test for compliance with requirements.
3. Complete startup procedures according to manufacturer's written instructions.

B. SPD device shall be considered defective if it does not pass tests and inspections.

END OF SECTION 26 43 13

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 51 00 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Lighting fixtures, including LED light engines, LED drivers, and accessories.

1.2 RELATED SECTIONS

A. Commissioning requirements: Division 01.

B. Dimming control:

1. Lighting control devices: Section 26 09 23.

C. Occupancy sensors: Section 26 09 23.

1.3 SUBMITTALS

A. Product data: For each type of lighting fixture indicated, arranged in order of fixture designation. Include data on features, accessories, and the following:

1. Dimensions of fixtures, photometrics and efficiency, wattage, reflectors, voltage, suspension, and appurtenances.
2. Certified results of laboratory tests for lighting fixtures for photometric performance.
3. Emergency lighting unit battery and charger.
4. LED drivers.

B. Shop drawings: Show details of nonstandard or custom fixtures. Indicate dimensions, weights, method of field assembly, components, features, and accessories.

1. Wiring diagrams: Detail wiring for fixtures and differentiate between manufacturer-installed and field-installed wiring.

C. Samples: If contractor has selected fixtures not identical to scheduled fixtures, as permitted in Part 2 below as an option, Architect may require submittal of samples.

1. One complete fixture of each approved type, except as otherwise instructed by the Architect.
2. Install approved samples as work of the project, in locations as directed, as standards for all fixtures of the same type.
3. Ascertain that the fixture will fit in the available space and is coordinated with adjacent and connected products.

D. Maintenance data: For lighting fixtures to include in maintenance manuals specified in Division 01.

E. Warranties: Special warranties specified in this section.

1.4 QUALITY ASSURANCE

A. UL label and local testing (if required): As specified in Section 26 05 00, Common Work Results for Electrical.

B. Comply with requirements for commissioning specified in Division 01.

C. Fixtures, emergency lighting units, and accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

D. Comply with NFPA 70.

E. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.5 COORDINATION

A. Fixtures, mounting hardware, and trim: Coordinate layout and installation of lighting fixtures with ceiling system and other construction.

1.6 WARRANTY

A. Special warranty for batteries: Written warranty, executed by manufacturer agreeing to replace rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Special warranty period for batteries: Manufacturer’s standard, but not less than 5 years from date of substantial completion. Full warranty shall apply for first year, and prorated warranty for last four years.

1.7 COMMISSIONING

A. This project includes commissioning under the direction of a Commissioning Agent (CxA). Contractor’s and subcontractors’ responsibilities are described in Division 01 for Commissioning Requirements.

B. Cooperate with the CxA to accomplish the requirements of the Commissioning Plan during the construction and correction periods.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-design products: Fixtures indicated in the Fixture Schedule on the drawings are the basis of design of the project.

1. Subject to compliance with requirements, provide the scheduled products. Unnamed products will only be considered and approved according to Bidding and Contracting requirements and Division 01 requirements for substitutions.

B. Subject to compliance with requirements, provide products by one of the following:

1. Drivers:

a. Philips/Advance
b. Osram Sylvania
c. Universal Lighting Technologies
d. Lutron
e. EldoLED
f. Or approved equal.

2.2 LIGHTING FIXTURES, GENERAL

A. Lighting fixtures shall comply with UL 1598 and be complete with sockets, casings, fittings, holders, shades, and appurtenances, wired and completely assembled.

B. Metal parts: Free from burrs, sharp corners, and edges.

C. Sheet metal components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

D. Doors, frames, and other internal access: Smoothly operating, free from light leakage under operating conditions, and arranged to permit access without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during access and when secured in operating position.

E. Metal finishes: Painted after fixture fabrication.

F. Reflecting surfaces: 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 metalized film: 90 percent.

G. Lenses, diffusers, and covers: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated, exactly as scheduled or specified in optical details and lighting characteristics.

1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
2. Lens thickness: 0.125 inch (3 mm) minimum, unless greater thickness is indicated.

2.3 LED DRIVERS

A. Driver shall operate from a 120-volt or 277-volt, 60-Hz input power source and be suitable for outputting power to 12-volt or 24-volt LED light sources, as required.

B. Drivers, where specified, shall be capable of being dimmed. Dimmable drivers shall be controlled by a Class 2 low-voltage 0-10VDC controller.

C. Performance Criteria:

1. Driver shall have a Class A sound rating.
2. Driver shall have a power factor (PF) greater than 0.90.
3. Driver shall have Total Harmonic Distortion (THD) of input current equal to or less than 20 percent.

D. Driver shall meet FCC and Title 47 CFR regulations for EMI/RFI.

E. Driver shall comply with ANSI C62.41 Class A requirements for transient protection.

2.4 EXIT SIGNS

A. General requirements: Exit signs shall meet the Energy Star Program requirements to operate on 5 watts or less input power per face. Comply with UL 924 and the following:

1. Sign colors and lettering size: Comply with authorities having jurisdiction.

B. Internally lighted signs: As follows:

1. Lamps for ac operation: Fluorescent, two for each fixture, 20,000 hours rated lamp life.
2. Light sources for ac operation: Light-emitting diodes, 70,000 hours minimum rated life.

C. Self-powered exit signs (battery type): Integral automatic charger in a self-contained power pack.

1. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically energizes lights from unit when circuit voltage drops to 80 percent of nominal or below. When normal voltage is restored, relay disconnects lights, and battery is automatically recharged and floated on charger.

2.5 EMERGENCY LIGHTING UNITS

A. General requirements: Self-contained units. Comply with UL 924. Units include the following features:

1. Battery: Sealed, maintenance-free, lead-acid type with minimum 10-year nominal life and special warranty.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lights on when supply circuit voltage drops to 80 percent of nominal voltage or below. Lights automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lights, and battery is automatically recharged and floated on charger.

2.6 EMERGENCY POWER SUPPLY UNIT

A. Internal type: Self-contained, modular, battery-inverter unit factory mounted within fixture body. Comply with UL 924.

1. Test switch and light-emitting diode indicator light: Visible and accessible without opening fixture or entering ceiling space.
2. Battery: Sealed, maintenance-free, nickel-cadmium type with minimum 10-year nominal life.
3. Charger: Fully automatic, solid-state, constant-current type.
4. Operation: Relay automatically energizes light(s) from unit when normal supply circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects light(s), and battery is automatically recharged and floated on charger.

B. External type: Self-contained, modular, battery-inverter unit. Comply with UL 924.

1. Test switch and light-emitting diode indicator light: Visible and accessible without entering ceiling space.
2. Battery: Sealed, maintenance-free, nickel-cadmium type with minimum 10-year nominal life.
3. Charger: Fully automatic, solid-state, constant-current type.
4. Operation: Relay automatically energizes light(s) from unit when normal supply circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects light(s), and battery is automatically recharged and floated on charger.
5. Housing: NEMA 250, Class 1 enclosure.

2.7 LED LIGHT ENGINES

A. The LED manufacturer shall provide the quantity and wattage of LEDs required to achieve the defined lighting output set forth by the lighting fixture manufacturer.

B. LED light engines shall be integrated into an engineered package for the specific lighting fixture application, including heat dissipation components.

C. Color temperature: As specified in lighting fixture schedule, with a tolerance of plus or minus 100K and within a range of three macadam ellipses. Noticeable color temperature variation between adjacent lighting fixtures shall be considered a failure to meet these specifications and shall be replaced at no cost to the owner.

D. Minimum performance characteristics:

1. Life: Minimum lumen maintenance of L70 at 50,000 hours, as defined by IES LM-80.
2. Lumen output: Based on absolute photometry, lumens (total luminous flux exiting the physical luminaire), as specified on contract drawings and schedules.
3. Color rendering index: Rated at 80 or higher.

2.8 FIXTURE SUPPORT COMPONENTS

A. Comply with Section 26 05 00, Common Work Results for Electrical, for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-stem hangers: 1/2-inch (12-mm) steel tubing with swivel ball fitting and ceiling canopy. Finish same as fixture.

C. Twin-stem hangers: Two, 1/2-inch (12-mm) steel tubes with single canopy arranged to mount a single fixture. Finish same as fixture.

D. Rod hangers: 3/16-inch- (5-mm-) minimum diameter, cadmium-plated, threaded steel rod.

E. Hook hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

F. Aircraft cable support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

2.9 FINISHES

A. Fixtures: Manufacturer’s standard, unless otherwise indicated.

1. Paint finish: Applied after fabrication over corrosion-resistant treatment or primer, free of defects.
2. Metallic finish: Corrosion-resistant.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before ordering the light fixtures, consult with the installer of the ceilings to ensure that the correct fixture trim is supplied and installed. Provide the supports and accessories required for installation in each ceiling system.

B. Before ordering the light fixtures, verify the specified voltage with the voltage shown on the drawings to ensure the correct voltage is supplied.

3.2 INSTALLATION

A. Furnish and install a complete lighting fixture for every outlet indicated on the drawings so that every outlet shall be properly provided with a suitable fixture of type specified, of wattage indicated.

B. Fixture wire shall bear UL label. Fixture wiring for fixtures and branch circuit wiring in fixture channels shall be type THHN.

C. Each fixture shall be completely equipped with lamps of the size, type, wattage and shape indicated and specified. Lamps shall be of the proper voltage for the building.

D. Furnish fixtures in the quantities, sizes, and types indicated on drawings.

E. Where a letter designating fixture type is adjacent to a row of fixtures, it shall be understood that all fixtures in the row shall be of this type, consisting of either four-foot or eight-foot units, the rows consisting of the total lengths indicated. Where the catalog numbers of the fixtures refer to 4-foot units, 8-foot units may be used where applicable.

F. Provide recessed fixtures with flexible conduit connector and wire (fixture whip), or a removable wiring access plate, so that they may be wired without removing ballast cover. Plate shall be screwed to fixture housing and conduit shall be securely attached and grounded to fixture to meet NEC requirements.

3.3 FIXTURE SUPPORT

A. Support from building structure: Provide fasteners appropriate to the supporting substrate, and wire, jack chain, or rods as specified for particular fixture types below.

1. Provide channels bolted or welded between joists where required to obtain proper spacing for lighting supports.
2. Connections to joists or beams: Beam clamps. For wire supports, wrap wire securely around structural member.
3. Connections to concrete: Embedded, as specified in Section 26 05 33, Conduits.

B. In suspended plaster and drywall ceilings, fixtures may be supported from the suspended ceiling construction. Fasten box and fixture supports securely to suspension system. Where fixtures are surface-mounted, cut neat holes in the plaster as required for supports.

C. Recessed fixtures in suspended acoustical ceilings: Coordinate fixture installation with ceiling installer. Ensure that ceiling supports are located to clear fixtures.

1. Support from ceiling suspension system: Use grid for support. Provide no fewer than four rods or wires where grid supports a fixture, located within 6 inches (150 mm) of each corner.

a. Support clips: Fasten to fixture and to ceiling grid member at or near each corner.

2. Support from building structure: Use fasteners specified in Section 26 05 33, Conduits, and No. 10 wire.

a. Provide 2 supports for each individual fixture, one at each end of fixture. In continuous rows, install additional supports at each joint.

D. Surface-mounted and stem-suspended fixtures on or below suspended acoustical ceilings: Supported from the building structure above with 0.25-inch (6-mm) rods.

1. Install double nuts on rods.
2. Provide 2 supports for each individual fixture, 1 at each end of fixture. In continuous rows, install an additional support at each joint.
3. Surface-mounted fixtures mounted on low-density ceilings shall be provided with spacers where required.

E. Where it is necessary for a fixture to be installed directly below an air duct, install two hanger rods, one on each side of the duct, bolted to a channel or angle suspended from the hangers under the duct, and support the fixtures from the suspended channel or angle.

3.4 ADJUSTMENT PERIOD

A. Occupancy adjustments: When requested within 6 months of date of Substantial Completion, provide on-site assistance in adjusting fixtures to suit occupied conditions. Provide up to 2 visits to project outside of normal occupancy hours for this purpose. Some work may be required after dark.

3.5 CLEANING

A. Light fixtures, used for temporary lighting during construction, shall be cleaned free of construction dirt to like-new condition.

END OF SECTION 26 51 00

SECTION 26 56 00 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Poles

B. Fixtures

1.2 RELATED SECTIONS

A. Commissioning requirements: Division 01.

B. Conduits: Section 26 05 33.

C. Wires and cables: Section 26 05 19.

D. Equipment foundations: Section 26 05 28.

E. Excavation and fill for electrical work: Section 26 05 01.

1.3 DEFINITIONS

A. Bracket: An attachment to a standard, on which a luminaire is carried.

B. Luminaire: A lighting device consisting of a light source together with its direct appurtenances, including globe, reflector, refractor, housing, and such support as is integral with the housing. The standard and the bracket are not part of the luminaire.

C. Pole: A support generally used to carry overhead lighting distribution circuits.

D. Standard (lamp post): A support used to carry a luminaire, provided with

1. Internal attachments for wiring and
2. External attachments for brackets (if any) and luminaire.

1.4 SUBMITTALS

A. Product data: Submit for each type of fixture, pole and standard.

1. Type
2. Wattage
3. Voltage
4. Efficiency

5. Suspension
6. Glassware
7. Finished diameters
8. Mounting heights
9. Lamps
10. LED drivers
11. Length and diameter of poles and standards
12. Appurtenances

B. Shop drawings shall show complete dimensions of complete assembled unit with accessories. Include wiring diagrams, showing clearly manufacturer-installed and field-installed wiring.

C. Samples: If contractor has selected fixtures not identical to scheduled fixtures, as permitted in Part 2 below as an option, Architect may require submittal of samples.

1. One complete fixture of each approved type, except as otherwise instructed by the Architect.
2. Install approved samples as work of the project, in locations as directed, as standards for all fixtures of the same type.
3. If substitute fixtures should be requested, submit samples as required.
4. For selection, manufacturer's complete line of colors and textures.

1.5 QUALITY ASSURANCE

A. UL label and local testing (if required): As specified in Section 26 05 00, Common Work Results for Electrical.

B. Comply with requirements for commissioning specified in Division 01.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver glassware and lamps in their original cartons, clearly labeled.

1.7 COMMISSIONING

A. This project includes commissioning under the direction of a Commissioning Agent (CxA). Contractor's and subcontractors' responsibilities are described in Divisions 01 for Commissioning Requirements.

B. Cooperate with the CxA to accomplish the requirements of the Commissioning Plan during the construction and correction periods.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-design products: Fixtures indicated in the Fixture Schedule on the drawings are the basis of design of the project.

1. Subject to compliance with requirements, provide the scheduled products. Unnamed products will only be considered and approved according to bidding and Contracting requirements and Division 01 requirements for substitutions.

B. Subject to compliance with requirements, provide products by one of the following:

1. LED drivers:

a. EldoLED
b. Lutron
c. Osram Sylvania
d. Philips/Advance
e. Universal Lighting Technologies
f. Or approved equal.

2.2 CONCRETE

A. Concrete shall be 3,000 psi strength.

2.3 EXTERIOR LIGHTING FIXTURES

A. Provide lighting fixtures of sizes, types, and ratings scheduled, complete with, but not limited to, housings, energy-efficient ballasts, starters, and wiring.

2.4 LED DRIVERS

A. Driver shall operate from a 120-volt or 277-volt, 60-Hz input power source and be suitable for outputting power to 12-volt or 24-volt LED lamp sources, as required.

B. Drivers, where specified, shall be capable of being dimmed. Dimmable drivers shall be controlled by a Class 2 low-voltage 0-10VDC controller.

C. Performance criteria:

1. Driver shall have a Class A sound rating.
2. Driver shall have a power factor (PF) greater than 0.90.

3. Driver shall have Total Harmonic Distortion (THD) of input current equal to or less than 20 percent.

D. Driver shall meet FCC and Title 47 CFR regulations for EMI/RFI.

E. Driver shall comply with ANSI C62.41 Class A requirements for transient protection.

2.5 LAMPS

A. Lamps, LED:

1. The LED manufacturer shall provide the quantity and wattage of LEDs required to achieve the defined lighting output set forth by the lighting fixture manufacturer.
2. LED lamps shall be integrated into an engineered package for the specific lighting fixture application, including heat dissipation components.
3. Color temperature: As specified in lighting fixture schedule, with a tolerance of plus or minus 100K and within a range of three macadam ellipses. Noticeable color temperature variations between adjacent lighting fixtures shall be considered a failure to meet these specifications and shall be replaced at no cost to the Owner.
4. Minimum performance characteristics:

a. Life: Minimum lumen maintenance of L70 at 50,000 hours, as defined by IES LM-80.
b. Lumen output: Based on absolute photometry, lumens (total luminous flux exiting the physical luminaire), as specified on contract drawings and schedules.
c. Color rendering index: Rated at 85 or higher.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install poles, accessories, and fixtures as indicated, in accordance with manufacturer’s written instructions, applicable requirements of NFPA 70, NESC and NEMA standards, and with recognized industry practices.

3.2 INSTALLING POLES

A. Provide reinforced concrete bases as shown on the drawings Chamfer exposed edges of concrete. Grout base plates to concrete bases to provide proper leveling.

B. Base size and depth shall be as indicated on the drawings.

C. Use belt slings or rope, not chain or cable, to protect finishes when raising and setting finished poles and standards.

D. Where poles and standards are indicated to be embedded in soil, set to depth required for adequate structural support, but not less than minimum 5 foot 6 inches below finish grade.

E. Set poles and standards plumb. Support adequately during backfilling, or when anchoring them to the foundations.

F. Provide sufficient space encompassing hand-access and cable-entrance holes for installation of underground cabling where indicated.

G. Fasten electrical lighting fixtures and brackets securely to indicated structural supports, including poles/standards; and ensure that installed fixtures are plumb and level.

H. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standards 486A and B, and the National Electrical Code.

3.3 GROUNDING

A. Provide equipment grounding connections for poles and standards as indicated, and in accordance with Section 26 05 26, Grounding and Bonding. Tighten connections to comply with tightening torques specified in UL 486A.

3.4 FIELD QUALITY CONTROL

A. At the date of substantial completion, replace lamps in exterior lighting fixtures which are observed to be noticeably dimmed after Contractor's use and testing, as judged by the Architect.

3.5 ADJUSTING AND CLEANING

A. Aim adjustable lighting fixtures and lamps in night test of system. Verify that measured illuminance values comply with approved photometric diagram.

B. Clean lighting fixtures of dirt and debris upon completion of installation.

C. Protect installed fixtures from damage during construction period.

3.6 DEMONSTRATION

A. Upon completion of installation of exterior lighting fixtures, and associated electrical supply circuitry, apply electrical energy to circuitry to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

END OF SECTION 26 56 00

SECTION 28 01 01 - ELECTRONIC SAFETY AND SECURITY GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. General provisions and requirements for electronic safety and security work.

1.2 RELATED SECTIONS

A. Requirements of this section generally supplement requirements of Division 01.

B. Division 01 includes sections specifying requirements for commissioning and construction waste management.

1.3 REFERENCES

A. NFPA 10: Portable Fire Extinguishers.

B. NFPA 241: Safeguarding Construction, Alteration, and Demolition Operations.

1.4 SYSTEM DESCRIPTION

A. The full set of Contract Documents applies to work of Division 28.

B. Visit the site and study all aspects of the project and working conditions, as required by General and Supplementary Conditions, Bidding and Contracting Requirements, Drawings, and Specifications. Verify field dimensions.

C. The work covered in technical sections includes the furnishing of all labor, equipment and materials, and the performance of all operations pertinent to the work described.

D. Except as required otherwise in Division 01, promptly obtain and pay for, all necessary signatures and paperwork, all permits, fees and inspections required for work of this division by authorities having jurisdiction, including any utility connection or extension charge. No payment will be made until a copy of the permit is forwarded to the Owner.

E. Electronic safety and security work of this project includes, as a brief general description, the following:

1. The project includes providing a building wide fire alarm system with manual activation and smoke detection.
2. The project includes providing access control and security systems in accordance with Delaware Department of Technology and Information. (DIT)

1.5 PRODUCT OPTIONS

A. Except as modified by provisions of Bidding and Contracting Requirements and Division 01, these options apply to Division 28 specifications.

B. General: Where Contractor is permitted to use a product other than the specified item and model named as the basis of design, Contractor is responsible for all coordination and additional costs as specified in article "Substitutions" below for substitutions.

C. Products specified by reference standards or by description only: Any product meeting those standards or description.

D. Products specified by naming one or more manufacturers, or model name or catalog reference number: Products specified establish a standard of quality, options to be included, and performance, and shall not be construed as limiting competition. Contractor may use products of any manufacturer, which meet the specifications.

E. Products specified by naming one manufacturer and particular product, with no provision for other options: No options or substitutions allowed.

1.6 SUBSTITUTIONS

A. Substitutions will be considered only as permitted or required by the Bidding and Contracting Requirements and Division 01. Except as modified by those requirements, the requirements below apply to Division 28 specifications.

B. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

C. Document each request with complete data substantiating compliance of proposed substitution with contract documents.

D. A request constitutes a representation that the Bidder or Contractor:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
2. Will provide the same warranty for the substitution as for the specified product.
3. Will coordinate installation and make changes to other work which may be required for the work to be complete with no additional cost to Owner.
4. Waives claims for additional costs or time extension which may subsequently become apparent.
5. Will reimburse Owner for review or redesign services associated with re-approval by authorities.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

F. Substitution submittal procedure is specified in Bidding and Contracting Requirements and Division 01.

1.7 MATERIALS AND EQUIPMENT

A. All materials and equipment shall be new and the best of their respective kinds, suitable for the conditions and duties imposed on them by the project and of representative manufacturer. The description, characteristics and requirements of the materials to be used shall be in accordance with the specifications.

B. All equipment, construction and installation must meet requirements of local, state and federal governing codes.

C. Singular number: In cases where material, a device, or part of the equipment is referred to in the singular number in the specifications, it is intended that such reference shall apply to as many items of material, devices, or parts of the equipment as are required to complete the installation as shown on the drawings or required for proper operation of the system.

D. Terms have the following meanings:

1. Furnish: Supply item
2. Install: Mount and connect item
3. Provide: Furnish and install

E. All materials and equipment shall be installed and completed in a first class and workmanlike manner and in accordance with the best modern methods, practice and manufacturer's instructions. Any work which shall not present an orderly and neat or workmanlike appearance shall be removed and replaced with satisfactory work when so directed in writing by the Architect.

F. The specifications and drawings are intended to define the minimum requirements, as to quality of materials, construction, finish and overall workmanship.

G. General Conditions describe the correlation and intent of the Contract Documents. In case of discrepancies between the specifications and drawings, the specifications should be followed as to the general methods and principles and the drawings followed as to sizes, capacities and specifics for corresponding parts. If sizes are omitted, the Architect will determine sizes to be utilized.

H. In all cases of doubt, uncertainty, or conflict as to the true meaning of the specifications or drawings, it is the responsibility of the Contractor to notify the Architect of said uncertainty, doubt, or conflict and obtain a decision as to the intent prior to initiating any work which may be affected by this decision.

1.8 COORDINATION

A. Should a situation develop during construction to prevent the proper installation of any equipment or item where shown on the drawings, call the situation to the attention of the Architect and await a written decision.

B. Plan and coordinate all work to proceed in an orderly and continuous manner without undue delay, and in conformance with the project schedule. Submit samples, shop drawings, schedules, insurance policies and certificates, and the like in time to avoid delays in actual construction. Coordinate electronic safety and security work so that work of each trade is completed before other construction begins which would obstruct it.

C. Coordinate trades to ensure that proper clearances between work of the various trades allow access to items which require operation and maintenance.

D. Coordinate location and elevation of all conduit, light fixtures, equipment, and appurtenances in such a manner that the finished installation is as indicated on drawings. In the event difficulties are encountered which prevent this, it is the Contractor's responsibility to bring this to the attention of the Architect prior to initiation of work. Correct improperly coordinated installation at no additional cost.

E. The Contractor's assistants shall include a competent electronic safety and security foreman, who shall be on the premises at all times to check, lay out, coordinate and superintend the installation of work. The foreman shall establish all basic requirements relative to the work before starting, and be responsible for the accuracy thereof.

1.9 SUBMITTALS

A. Manufacturers' and subcontractors' lists:

1. As specified in Division 01, submit a complete list of proposed manufacturers for all equipment, materials and subcontractors used for the work of this division. Lists shall follow the sequence of the specifications. No considerations will be given for partial or incomplete lists. After review of lists, submit shop drawings and product data.

B. Shop drawings and product data:

1. Submit in accordance with the requirements of Division 01 or as established at the preconstruction conference, the required number of copies of Shop Drawings and Product Data for every item of equipment. Shop drawings or product data will not be considered until Manufacturers' Lists have been approved. Shop drawings and product data shall be submitted, as required by the General Conditions, with sufficient time for checking, return to Contractor, and resubmission as required before Contractor shall install any item.

2. Each item submitted shall be properly labeled, indicating the specific service for which the equipment or material is to be used, section and paragraph number of specification or drawing number to which it applies, Contractor's name and project name and number. Data submitted shall be specific and shall include product data and printed information in sufficient detail and scope to verify compliance with requirements of the contract documents. Clearly identify each item within the data. Data of a general nature will not be accepted. Each sheet must clearly show the project name and number.
3. The review of a shop drawing or product data shall not be considered as a guarantee of the measurements or building conditions or that the shop drawings or product data have been checked to see that item submitted properly fits the building conditions. This review shall not relieve the Contractor of the responsibility for furnishing material or performing work as required by the contract documents, for correctness of dimensions and quantities, or for proper coordination of details and interfaces among trades.
4. All exclusively electronic safety and security items furnished as items associated with mechanical items but not specifically described in the mechanical item submission, shall be submitted as a separate submittal but shall be clearly marked as associated with the mechanical item by identified specification paragraph.
5. Product data sheets shall be 8.5-inches by 11-inches cut sheets for operating and maintenance manual.

C. Submit at least three copies of the results of every test required under any section in this division.

D. Specialist shall submit a list of at least three projects similar to this project in type, size, and quality, which have been in place and operating satisfactorily for at least five years.

1. Include project name, address, name and phone number of owner's representative, and project type and size.

E. After the work is completed, submit all required certificates of approval from approved inspection agencies and authorities having jurisdiction over work of this division. Certificates of approval must be received by the Architect prior to final acceptance of the work.

1.10 SPECIALIST

A. The term "Specialist" as used in the specification shall mean an individual or firm of established reputation (or, if newly organized, whose personnel have previously established a reputation in the same field,) which is regularly engaged in, and which maintains a regular force of workers skilled in either (as applicable) manufacturing or fabricating items required by the contract, installing items required by the contract, or otherwise performing work required by the contract. Where the specification requires installation by a specialist, the term shall also be deemed to mean the manufacturer of the item, an individual or firm licensed by the manufacturer, or an individual or firm who will perform the work under the manufacturer's direct supervision.

1.11 CONTRACT CLOSEOUT SUBMITTALS

A. Project record documents:

1. Maintain on site one set of the following record documents; record actual revisions to the work of this division:

    a. Contract drawings.
    b. Specifications.
    c. Addenda.
    d. Change orders and other modifications to the Contract.
    e. Reviewed shop drawings, product data, and samples.

2. Maintain record documents separate from documents used for construction.
3. Record information concurrent with construction progress.
4. Specifications: Legibly mark and record in each section a description of actual products installed, including the following:

    a. Manufacturer's name and product model and number.
    b. Product options, substitutions, or alternates utilized.
    c. Changes made by addenda and modifications.

2. Record documents and shop drawings: Legibly mark each item to record actual construction, including:

    a. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
    b. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the work.
    c. Field changes of dimension and detail.
    d. Details not on original Contract Drawings.

3. Submit documents as specified in Division 01.

B. Operation and maintenance data:

1. Submit sets prior to final inspection as specified in Division 01. Unless otherwise specified in Division 01, submit no fewer than three sets. In addition to requirements specified in Division 01, submit operating and maintenance manuals for the work of this division as specified below.
2. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, typed on white paper.
3. Part 1: Directory, listing names, addresses, and telephone numbers of engineers; contractor; electronic safety and security subcontractors; and major electronic safety and security equipment suppliers.
4. Part 2: Operation and maintenance instructions, arranged by specification section. For each category, identify names, addresses, and telephone numbers of subcontractors and suppliers. Identify the following:

    a. Significant design criteria.
    b. List of equipment.
    c. Parts list for each component, including recommended spare parts list.
    d. Operating instructions.

e. Maintenance instructions for equipment and systems.
f. Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.

5. Part 3: Project documents and certificates, including the following:

a. Shop drawings and product data.
b. Photocopies of certificates.
c. Photocopies of warranties, guarantees, and bonds.
d. Test reports: Copies of the results of all tests required under all sections of specifications.

6. Submit one copy of completed volumes in final form 15 days prior to final inspection. This copy will be returned after final inspection, with Engineer comments. Revise content of documents as required prior to final submittal.
7. Submit final volumes revised, within ten days after final inspection.

1.12 REGULATORY REQUIREMENTS

A. When these specifications call for materials or construction of a better quality or larger sizes than required by the following codes and standards, the provisions of the specifications shall take precedence.

B. Provide, without extra charge, any additional materials and labor which may be required for compliance with these codes and standards even though the work is not mentioned in these specifications or shown on the contract drawings.

C. Perform the work of this division in strict accordance with the following authorities. The latest revision of these codes accepted by the authority having jurisdiction as of the date of the contract documents shall apply.

1. The electrical, building, fire, and safety codes of the state and county or city in which the work is being performed.
2. The National Electric Code, NFPA 70 (NEC).
3. The National Fire Protection Association Code. (NFPA)
4. International Building Code (IBC).
5. International Energy Conservation, Fire, and Electrical Codes (ICC).

1.13 REFERENCE STANDARDS

A. Perform the work of this division using the standards of the following organizations, as referred to in technical sections, as a minimum requirement for construction and testing. Unless specified otherwise in Bidding and Contract Documents or Division 01, the latest revision current as of the date of the contract documents shall apply.

1. American National Standards Institute (ANSI)
2. American Society for Testing and Materials (ASTM)

3. International Code Council (ICC)
4. Institute of Electrical and Electronics Engineers (IEEE)
5. National Electrical Code (NEC) (NFPA 70)
6. National Electrical Manufacturer's Association (NEMA)
7. National Fire Protection Association (NFPA)
8. The Occupational Safety and Health Act (OSHA)
9. Underwriters Laboratory Inc. (UL)
10. Maryland Occupational Safety and Health Act (MOSHA)

1.14 TEMPORARY STORAGE

A. Maintain upon premises, where directed, a storage area, and be responsible for all contents within these areas. Provide all security measures necessary for this area.

B. Area shall be maintained and shall be returned to original condition at the completion of the project.

C. Store electronic safety and security construction materials such as wire, raceways and boxes, devices, and equipment in buildings, enclosed trailers, or portable enclosed warehouses.

1. Materials and products subject to damage from moisture: Store in dry locations. If necessary, protect with protective wraps or covers.
2. Plastics and other materials and products subject to damage from heat or cold: Store at manufacturer's recommended temperatures.
3. Plastics and other materials and products subject to damage from sunlight: Protect from sunlight.

D. Electronic safety and security equipment stored before installation and installed during construction: Provide clean, dry locations at manufacturer's recommended temperatures, and cover or wrap if required to protect from incidental damage.

1.15 PROTECTION

A. Each trade and subcontractor is responsible for preventing damage and soiling of work performed by other trades or subcontractors. Each trade and subcontractor is responsible for providing temporary protection of its own work.

1. Protect work from spills, splatters, drippings, adhesives, bitumens, mortars, paints, plasters, and damage from welding or burning.
2. Protect finished work from damage, defacement, staining, or scratching.
3. Protect finishes from cleaning agents, or grinding and finishing equipment.
4. Protect adjacent and finished work from damage, using tape, masking, covers or coatings and protective enclosures.
5. Coordinate installations and temporarily remove items to avoid damage from finishing work.

B. Repair all damage or soiling to the complete satisfaction of the Architect; replace any materials or work damaged to such an extent that they cannot be restored to their original condition, all at no addition to the Contract sum.

C. Protect work stored in place and supplies stored in the building.

1. Store materials and products, subject to damage from moisture, in dry locations. If necessary, protect in wraps or covers.
2. Store plastics, other materials, and products subject to damage from heat or cold at manufacturer's recommended temperatures.

D. Protect electronic safety and security materials and products from weather events and accidents of construction.

E. Use of sidewalk or roadway areas outside of the property lines shall be with permission and approval of the local authorities having jurisdiction.

1.16 FIRE PROTECTION

A. As a minimum, provide hand-carried, portable, UL-rated extinguishers with each work crew working inside the building.

B. Select extinguishers in accordance with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

1.17 SECURITY REQUIREMENTS

A. Refer to Division 01 for project security requirements.

1.18 PROJECT CONDITIONS

A. Drawings showing utilities in concealed locations are based on the best information available but are not represented as being precisely correct. Work of the contract includes digging, cutting, drilling, using nondestructive methods, and other methods of locating concealed utilities in the field, as well as patching and repairing as specified in "Cutting and Patching" below.

B. If, in the course of the work, workers encounter a material they suspect to present some hazard:

1. Promptly notify the [Owner and] Architect in writing.
2. Do not perform any work which would disturb the suspected material until written instructions have been received.

1.19 WARRANTY

A. All work and equipment provided as work of this division shall be fully warranted under the general project warranty. In addition, provide added special warranties as specified in individual sections.

B. During the correction period, the Contractor shall begin correcting any work found to be not in accordance with the requirements of the Contract Documents within 4-hours of receiving written notice from the Owner. Provide detailed schedule for completion of work within 24-hours of receiving written notice from the Owner and revise schedule based on any Owner comments generated. Except as otherwise required in General Conditions and Division 01, the correction period is one year after the date of substantial completion of the work. Work requiring correction shall promptly be repaired or completely replaced at no addition to the Contract Sum.

1. Service reports for warranty work shall be provided to the Owner

C. When use of the permanent equipment has been permitted for temporary services during construction of the building, the warranty and correction periods shall nevertheless begin at the time of substantial completion, unless another date of acceptance has been agreed to by the Owner.

D. Special warranties are warranties required by individual specification sections, incidental product warranties, manufacturers' standard warranties, installer or subcontractor service agreements, and other individual warranties in addition to the general project warranty.

E. Provide copies of warranties as required for Operation and Maintenance Manual specified above, and by Division 01.

F. For items of work delayed beyond date of substantial completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

1.20 COMMISSIONING

A. This project includes commissioning under the direction of a Commissioning Agent (CxA). Contractors' and subcontractors' responsibilities are described in Division 01.

B. Cooperate with the CxA to accomplish the requirements of the Commissioning Plan during the construction and correction periods.

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

B. Cut walls, floors, partitions, roofs, and other appurtenances for the passage or accommodation of raceways. Close superfluous openings and remove all debris caused by work of this division.

C. No cutting of any structure or finish shall be done until the condition requiring such cutting has been examined and approved by the Architect.

D. New or existing surfaces disturbed as a result of such cutting or otherwise damaged shall be restored to match original work and all materials used for any patching or mending shall conform to the class of materials originally installed.

E. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

3.2 TEMPORARY FACILITIES

A. Temporary water facilities, electricity, telephone, toilet facilities, and temporary heat, shall be provided as specified in Division 01.

3.3 PROGRESS MEETINGS

A. Progress meetings shall be held as specified in Division 01, and also when and if the Contractor or Architect finds them necessary or advantageous to progress of work.

B. Contractor, those subcontractors and those material suppliers concerned with current progress or with the scheduling of future progress, Architect and Owner shall each be represented at these meetings by persons familiar with the details of work and authorized to conclude matters relating to work progress.

END OF SECTION 28 01 01

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 28 05 00 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements applicable to work of more than one section of Division 28.

B. Electronic safety and security identification.

C. Testing wiring systems.

1.2 RELATED SECTIONS

A. Division 01 includes sections specifying requirements for commissioning and construction waste management.

B. Operation and maintenance manuals: Division 01 and Section 28 01 01.

C. Painting: Division 09.

1.3 DEFINITIONS

A. Project correction period: A period after Substantial Completion of the work during which the Contractor shall correct every part of the work found to be not in accordance with the requirements of the contract documents, promptly after receipt of written notice.

B. Qualified testing agency: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

1.4 DESIGN REQUIREMENTS

A. The drawings and system performances have been designed on the basis of using the particular manufacturers' products specified and scheduled on the drawings.

B. Products of other manufacturers that are listed under the article "Acceptable Manufacturers," or permitted as "equal," are permitted provided:

1. Product shall meet the specifications.
2. Contractor shall make, without addition to the contract sum, all adjustments for deviations so that the final installation is complete and functions as the design basis product is intended.

C. Do not propose products with dimensions or other characteristics different from the design basis product that make their use impractical or cause functional fit, access, or connection problems.

D. The contract drawings are generally diagrammatic, and do not indicate all fittings or offsets in conduit or all pull boxes, access panels, or other specialties required.

1. Install conduit exposed to view parallel with the lines of the building and as close to walls, columns, and ceilings as may be practical, maintaining adequate clearance for access at parts requiring servicing.
2. Install conduit a sufficient distance from other work to permit a clearance of not less than 0.5 inch (15 mm) between its finished covering and adjacent work.
3. No conduit shall be run below the head of a window or door.
4. Pull boxes and other appurtenances which require operation or maintenance shall be easily accessible. Do not cut or form handholes for operation or maintenance of appliances through walls or ceilings.

1.5 SUBMITTALS

A. Test reports: Show that tests specified in Part 3 below demonstrate the specified results.

1.6 QUALITY ASSURANCE

A. Provide materials and perform work in accordance with the electrical, building, fire, and safety codes and regulations of the state, county, or city in which the work is performed.

B. Electronic safety and security equipment, materials and devices provided or installed as work of Division 28 shall bear UL label, or, if UL label is not available, the item shall be tested and labeled by a qualified testing agency, acceptable to authorities having jurisdiction, and in accordance with NFPA 70. Provide testing, if required, without addition to the contract sum.

C. VOC content: Field-applied adhesives and sealants, limits per South Coast Air Quality Management District (SCAQMD), Rule No. 1168.

D. Products shall contain no urea-formaldehyde content.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Electronic equipment backing panels: Plywood, DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated in accordance with AWPA C27, in thickness indicated, not less than 0.5 inch (13 mm) nominal.

1. One side finished.

B. Wood-preservative-treated lumber: Treated by pressure process, AWPA C2, with chemicals acceptable to authorities having jurisdiction, and marked with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

1. Application: Treat items indicated on the drawings, and the following:

a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, or waterproofing.
b. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
c. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
d. Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.
e. Wood floor plates that are installed over concrete slabs-on-grade.

C. Nameplates: Laminated plastic, engraved, white letters on black background, except where other colors are noted or specified.

1. Size: Minimum 0.75 inch (19 mm) by 2.5 inches (64 mm).
2. Letter size: Minimum height 0.1875 inch (5 mm).
3. Fasteners: Vandalproof brass screws or rivets.

D. Aircraft cable: 0.25-inch (6-mm) steel wire rope, galvanized, construction 7 by 19 strands, minimum 7000 lbs (31138 N) breaking strength.

2.2 DATE-SENSITIVE EQUIPMENT

A. Date-sensitive equipment: Systems, equipment, or components which use or process date and time data in order to perform their functions.

B. Each item of date-sensitive equipment used in the project shall be warranted by the manufacturer to properly function and correctly use or process all time-related data for all dates and times which occur during a reasonable life expectancy of the equipment.

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS AND EQUIPMENT

A. Manufacturers' instructions: Except as modified by drawings or specifications, install products and equipment in accordance with manufacturers' instructions and recommendations applicable to the project conditions.

1. Immediately notify Architect if a difference or discrepancy is found between manufacturers' instructions and the drawings or specifications.

B. Install plywood backing panels with finished face exposed.

3.2 IDENTIFICATION

A. Items to be identified include, but are not limited to:

1. Control devices.
2. Cables.
3. Control panels.
4. Equipment
5. Other appurtenances.

B. Identify function, equipment served, and area served.

3.3 TESTS

A. During the progress of the work and after completion, test the circuits, and electronic safety and security system, and the low-voltage alarm and signal systems.

B. Results of the tests shall show that the wiring meets the requirements of this specification. Should any test indicate defect in materials or workmanship, immediately repair, or replace with new, the faulty installation, and retest the affected portions of the work.

C. Furnish equipment and instruments necessary for testing.

D. Tests shall demonstrate the following:

1. Power, control, and system circuits are continuous and free from short circuits.
2. Circuits are free from unspecified grounds.
3. The resistance to ground of each non-grounded circuit is not less than one megohm.
4. Circuits are properly connected in accordance with the applicable wiring diagrams.
5. Circuits are operable.

E. Immediately repair defects and retest until systems are operating correctly.

F. Submit test reports.

3.4 OPERATING INSTRUCTIONS

A. Furnish the necessary technicians, skilled workers, and helpers to overview operation of the electronic safety and security systems and equipment of the entire project for one 8-hour day.

B. Where specified in technical sections, provide longer periods required for specialized equipment.

C. Instruct the Owner or designated personnel in operation, and adjustment of systems and equipment.

D. The Operating and Maintenance Manual shall be available at the time of the instructions for use by instructors and Owner personnel.

E. Schedule the general and specialized instruction periods for a time agreed upon by the Owner and Architect.

END OF SECTION 28 05 00

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 28 31 00 - FIRE DETECTION AND ALARM SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Provide a complete fire detection and alarm system of the noncoded, addressable, analog type, with manual stations, detectors, notification appliances, controls, and devices.

B. Costs of certification and testing, including tests required by NFPA 72, shall be included in the contract sum.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Duct smoke detectors: Section 23 09 13.

1.3 RELATED SECTIONS

A. Division 08 section specifying door hardware for coordinating electrical hardware operators.

1.4 DEFINITIONS

A. FACP: Fire alarm control panel.

B. HVAC: Heating, ventilation, and air-conditioning.

C. LED: Light-emitting diode.

D. SPDT: Single pole, double throw.

E. Definitions in NFPA 72 apply to fire alarm terms used in this section.

1.5 SYSTEM DESCRIPTION

A. Control of system: By the FACP.

B. System supervision: Automatically detect and report open circuits, shorts, and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.

C. Priority of signals: Automatic alarm response functions resulting from an alarm signal from one zone or device are not altered by subsequent alarm, supervisory, or trouble signals. An alarm signal is the highest priority. Supervisory and trouble signals have second- and third-level priority. Higher-priority signals take precedence over signals of lower priority, even when the lower-priority condition occurs first. Annunciate and display all alarm, supervisory, and trouble signals regardless of priority or order received.

D. Noninterference: A signal on one zone shall not prevent the receipt of signals from other zones.

E. System reset: All zones are manually resettable from the FACP after initiating devices are restored to normal.

F. Transmission to remote alarm receiving station.

G. System alarm capability during circuit fault conditions: System wiring and circuit arrangement prevent alarm capability reduction when a single ground occurs in an initiating device circuit, signal line circuit, or notification-appliance circuit.

H. Loss of primary power at the FACP initiates a trouble signal at the FACP. The FACP indicates when the fire alarm system is operating on the secondary power supply.

I. Basic alarm performance requirements: Unless otherwise indicated, operation of a manual station or automatic alarm operation of a smoke or heat detector, initiates the following:

1. Notification-appliance operation.
2. Identification at the FACP and the remote annunciator of the zone and device originating the alarm.
3. Release of fire and smoke doors held open by magnetic door holders.
4. Operation of duct smoke detector shall initiate a supervisory signal and shutdown of fans and other air-handling equipment serving zone where alarm was initiated.
5. Recording of the event in the system memory.
6. Initiate the transmission of alarm to the Owner's remote alarm receiving station.

J. In addition to functions mentioned above, elevator smoke detectors shall perform elevator recall functions in accordance with ANSI requirements. Elevator heat detectors shall activate the shunt trip breakers.

K. Fire and smoke doors held open by magnetic door holders shall only be released by automatic operation of smoke detectors at the respective location.

L. Alarm silencing, system reset and indication: Controlled by switches in the FACP and the remote annunciator.

1. Silencing-switch operation halts alarm operation of notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained.
2. Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.

3. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset. System reset shall be controlled only at the FACP.

M. Remote detector sensitivity adjustment: Manipulation of controls at the FACP causes the selection of specific addressable, analog smoke detectors for adjustment, display of their current status and sensitivity settings, and control of changes in those settings. Same controls can be used to program repetitive, scheduled, automated changes in sensitivity of specific detectors. Sensitivity adjustments and sensitivity-adjustment schedule changes are recorded in system memory.

N. Removal of an alarm-initiating device or a notification appliance initiates the following:

1. Transmission of trouble signal to remote alarm receiving station.

O. FACP alphanumeric display: Plain-English-language descriptions of alarm, supervisory, and trouble events; and addresses and locations of alarm-initiating or supervisory devices originating the report. Display monitoring actions, system and component status, system commands, programming information, and data from the system's historical memory.

1.6 SUBMITTALS

A. General:

1. When approved, no variation will be permitted except with the approval of the Architect.
2. Submit to the authority having jurisdiction and to the Architect for review and approval.

B. Shop drawings:

1. Floor plans indicating final equipment and device locations and raceway routes.
2. System operation description: Detailed description for this project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
3. Details of graphic display and annunciator.
4. Wiring diagrams and riser diagrams.

C. Product data: Schedule and each type of system component, including dimensioned plans and elevations showing minimum clearances and installed features and devices. Include UL listings.

D. Battery calculations.

E. Provide a complete project record drawing as specified in Division 01 and Section 28 01 01 Section 01 77 00 showing the location of all the outlets, cable taps, cable routes, and other components installed. Drawings shall be made part of Operating and Maintenance Manuals.

F. Certifications:

1. UL Certificate of Compliance of system supplier as specified in "Quality Assurance" below.
2. Fire and smoke detection system inspection and test report, completed by the factory representative, endorsed by the Owner and the factory representative, including test data, detector locations and serial numbers, a summary of maintenance performed, recommendations for relocation or addition of detectors and final action regarding these recommendations, and system certification.

1.7 QUALITY ASSURANCE

A. System and equipment shall be UL listed. Each major component shall bear the manufacturer's name and catalog number.

B. UL labels and local testing (if required): As specified in Section 28 05 00, Common Work Results for Electronic Safety and Security.

C. Single-source responsibility: Obtain system components from a single source who assumes responsibility for their compatibility.

D. Qualifications of system supplier and installer:

1. Staff shall consist of at least one NICET Level III Technician or a professional engineer registered in Delaware.
2. Has installed at least ten systems of the type specified which have performed satisfactorily for not less than two years.
3. Maintains a facility with a sufficient stock of spare parts.
4. Shall respond within 24 hours of notification to correct system failure or malfunction. During the project correction period defined in General Conditions and in Section 28 05 00, perform such corrections at no addition to the Contract Sum.

E. Factory-authorized service representative: Trained and certified by the manufacturer of the system, and experienced in the installation and operation of the type of system included in the work.

F. Comply with NFPA 72, applicable local codes, and regulations and requirements of the authorities having jurisdiction. New Castle County and the State of Delaware are the local code authority.

1.8 INSPECTIONS AND SERVICE CONTRACT

A. During the general project correction period, every six months starting six months after Substantial Completion, the supplier shall inspect and test the system.

1. Submit written reports to the Owner and Architect, describing test results, including defects found and how they have been corrected, and listing components replaced.

B. At the end of the correction period, offer the Owner a service contract for the complete system.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis-of-design system: Subject to compliance with requirements, provide Fire-Lite system by Honeywell or comparable system by one of the following:

1. Edwards (EST); Carrier
2. Fire-Lite Alarms; Honeywell
3. Siemens Industry, Inc.
4. Silent Knight; Honeywell
5. Or approved equal.

2.2 CENTRAL FACP

A. Cabinet: Lockable steel enclosure. Arrange interior components so operations required for testing or for normal maintenance of the system are performed from the front of the enclosure. If more than one unit is required to form a complete control panel, fabricate with matching modular unit enclosure to accommodate components and to allow ample gutter space for field wiring and interconnecting panels.

1. Mounting: Surface.

B. Alarm and supervisory systems: Modules replaceable without removal of field wiring.

C. Control modules: Include types and capacities required to perform all functions of fire alarm systems.

D. Indications: Local, visible, and audible signals announce alarm, supervisory, and trouble conditions. Each type of audible alarm has a different sound.

E. Resetting controls: Prevent the resetting of alarm, supervisory, or trouble signals while the alarm or trouble condition still exists.

F. Alphanumeric display and system controls: Arranged for interface between human operator at the FACP and addressable system components, including annunciation, supervision, and control.

1. Display: A minimum of 80 characters; alarm, supervisory, and component status messages; and indicate control commands to be entered into the system for control of smoke detector sensitivity and other parameters.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

2.3 EMERGENCY POWER SUPPLY

A. General: Components include nickel-cadmium battery, charger, and an automatic transfer switch.

1. Battery nominal life expectancy: 20 years, minimum.

B. Battery capacity: 24 hours of supervisory power with 15 minutes of general alarm capability at end of 24 hours.

C. Battery charger: Solid-state, fully automatic, variable-charging-rate type. Provide capacity for 150 percent of the connected system load while maintaining batteries at full charge. If batteries are fully discharged, the charger recharges them completely within four hours. Charger output is supervised as part of system power supply supervision.

D. Integral automatic transfer switch: Transfers the load to the battery without loss of signals or status indications when normal power fails.

2.4 REMOTE ANNUNCIATOR AND GRAPHIC DISPLAY

A. Remote annunciator: Flush-mounted liquid crystal display (LCD) annunciator.

1. Display: Supervised, back-lit, LCD with no fewer than 4 lines with 20 characters per line.

a. Back lighting shall turn off after 4 minutes when there is no switch activity and no unacknowledged message.
b. The first event of the highest priority shall capture the display, so that arriving firefighters can view the first alarm event immediately.

2. Key operated switches:

a. Alarm silence.
b. Trouble silence.
c. Test

B. Description: Duplicate annunciator functions of the FACP for alarm, supervisory, and trouble indications. Also duplicate manual switching functions of the FACP, including alarm silence, trouble silencing, and test.

1. Mounting: Recessed cabinet, NEMA 250, Type 1.

C. Graphic display: As shown on drawings, panel indicating the building floor plan with a "You are here" note and zone and device locations permanently marked on panel surface.

1. Mounting: Adjacent to remote annunciator.

2.5 MANUAL PULL STATIONS

A. Description: Fabricated of metal or plastic, and finished in red with molded, raised-letter operating instructions of contrasting color.

1. Single-action mechanism initiates an alarm.
2. Station reset: Key or wrench operated; double pole, double throw; switch rated for the voltage and current at which it operates.
3. Integral addressable module: Arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP.

B. Where indicated for mullion mounting at aluminum or steel-framed glass wall, furnish with side mounting red, cold-rolled steel backbox equal to Space Age Electronics Red PSB box #SSU03171.

2.6 SMOKE DETECTORS

A. General: UL 268A listed. Include the following features:

1. Operating voltage: 24 volts DC, nominal.
2. Self-restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
3. Plug-in arrangement: Detector and associated electronic components are mounted in a module that connects in a tamper-resistant manner to a fixed base with a twist-locking plug connection. Terminals in the fixed base accept building wiring.
4. Integral visual-indicating light: LED type. Indicates detector has operated.
5. Sensitivity: Can be tested and adjusted in-place after installation.
6. Integral addressable module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
7. Remote controllability: Unless otherwise indicated, detectors are analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.

    a. Detectors which will be installed in ducts or other concealed locations shall be capable of being tested from an indicating and test station specified below.

B. Photoelectric smoke detectors: Include the following features:

1. Sensor: LED or infrared light source with matching silicon-cell receiver.
2. Detector sensitivity: Between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.
3. Integral thermal detector: Fixed-temperature type with 135 deg F (57 deg C) setting.

C. Duct smoke detector: Photoelectric type.

1. Sampling tube: Design and dimensions as recommended by the manufacturer for the specific duct size, air velocity, and installation conditions where applied.
2. Relay fan shutdown: Contacts rated to interrupt fan motor-control circuit.

2.7 OTHER DETECTORS

A. Heat detector, fixed-temperature type:

1. Actuated by temperature that exceeds a fixed temperature of the following:

a. Elevator shafts and elevator control/machine rooms: 135 degrees F (57 degrees C).
b. Other locations or where indicated on drawings: 190 degrees F (88 degrees C).

2. Mounting:

a. Adapter plate for outlet box mounting.
b. Plug-in or twist-lock base, interchangeable with smoke detector bases.

3. Integral addressable module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

2.8 NOTIFICATION APPLIANCES

A. Description: Equipped for mounting as indicated and have screw terminals for system connections.

1. Combination devices: Factory-integrated audible and visible devices in a single-mounting assembly.

B. Horns: Electric-vibrating-polarized type, 24 volts DC; with provision for housing the operating mechanism behind a grille. Horns produce a sound-pressure level of 90 dB, measured 10 feet from the horn.

C. Visible alarm devices: Synchronized LED or xenon strobe lights listed under UL 1971 with clear or nominal white polycarbonate lens. Mount lens on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch-high letters on a removable sleeve on the lens.

1. Rated light output: Indicated on drawings for each location.
2. Strobe leads: Factory connected to screw terminals.
3. Housing: White in color, fire-retardant, high-impact, polycarbonate suitable for flush or surface mounting.

2.9 FIRE ALARM NOTIFICATION BOOSTER

A. Power supply booster designed to extend power available to notification appliance circuits.

B. Enclosure: Steel, with lockable front panel allowing access to all interior components, surface-mounted.

C. Functions: Contains circuits to monitor and charge batteries, control and supervise 4 Class B appliance circuits, and monitor two controlling inputs from external sources.

1. Configurable to operate at any one of three signaling rates, or to follow the main panel's notification appliance circuit.
2. Trouble contact with 16-second delay.

D. Batteries: Two, sized for 24 hours of standby followed by 15 minutes of alarm.

E. Indicators: LEDs, one for each circuit, one for battery supervision, one for ground fault, and one for power.

2.10 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching door plate.

1. Electromagnet: Requires no more than 3 watts to develop 25-lbf holding force.
2. Wall-mounted units: Flush mounted, unless otherwise indicated.
3. Rating: 120 volts AC.

B. Material and finish: Match door hardware.

2.11 ADDRESSABLE INTERFACE DEVICE

A. Monitor module: Microelectronic monitor module listed for use in providing a system address for external alarm-initiating devices with normally open contacts.

1. Dual circuit, intelligent, signaling circuit interface module.

B. Control module: Microelectronic control relay module listed for use in providing control to external appliances or equipment shutdown, to elevator controller to initiate elevator recall and to circuit-breaker shunt trip for power shutdown.

1. One Form C (SPDT) dry relay contact rated at 2 amps and 24 volts DC.

C. Isolator module: Microelectronic fault isolator module listed for isolating and removing a fault from a data circuit while allowing the remaining data loop to continue operating.

1. Protect loop system against wire-to-wire short circuits by isolating section of loop and permitting other loop sections to continue to operate.

D. Non-addressable control relay: Isolation relay for the control of HVAC unit contactors, magnetic door holders, and elevator recall circuits, UL 864 Listed.

1. Construction: Sealed, non-removable, with terminations to pressure-type screw terminals.
2. Rating: Use with circuits up to 240 volts AC at 7amperes inductive.

2.12 WIRE AND WIRING SYSTEM

A. Non-power-limited circuits: Solid-copper conductors with 600-volt rated, 75 degrees C, color-coded insulation.

1. Low-voltage circuits: Stranded No. 16 14 AWG THHN, minimum.
2. Line-voltage circuits: Stranded No. 12 AWG THHN, minimum.

B. Power-limited circuits: NFPA 70, Types FPL, FPLR, or FPLP, as recommended by manufacturer.

C. Wiring system: Class B in accordance with NFPA 72.

D. Type MC fire alarm cable: Equal to AFC Cable Systems FPLP metal-clad, multi-conductor, fire alarm and control cable.

1. Ratings:

a. Plenum rated.
b. Approved for use as fixed wiring concealed in building.
c. Maximum operating temperatures:

(1) 105 degrees C dry for FPLP applications at nominal voltage ratings 300 V and less.
(2) 90 degrees C dry for MC cable installations at nominal voltage ratings of 600 V and less.

d. UL listed for penetrations of wall and floor assemblies of gypsum wallboard, concrete, and concrete masonry with one-, 2-, and 3-hour fire ratings.

2. Shield over conductor assembly: Laminated aluminum and mylar tape and tinned copper drain wire.

a. Drain wire: Minimum No. 18 AWG, in contact with aluminum shield.

3. Listed in accordance with UL 1596:

a. Insulated or bare grounding conductor in accordance with Table 6.3, cabled with the circuit conductors and identified in compliance with Section 35.
b. Galvanized steel armor, red, applied over inner cable assembly with positive interlock conforming to the requirements of Section 12.
c. Tested in accordance with applicable requirements.

B. Survivability: Circuits necessary for the operation of notification appliances shall be protected by a 2-hour fire-rated cable, a 2-hour fire-rated cable system, or a 2-hour fire-rated enclosure.

2.13 PERIPHERAL EQUIPMENT

A. Alarm reporting device: UL Listed, digital alarm communicator transmitter (DACT) shall report an alarm or trouble condition. It shall notify Owner's fire alarm monitoring service and one or more facilities personnel. Provide unit compatible with the Owner's monitoring service.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Factory-authorized service representative, as required in "Quality Assurance" in Part 1 above, shall supervise installation, software documentation, adjustment, preliminary testing, final testing, and certification of the system, and provide the operating instructions.

B. Provide wiring, conduit, and outlet boxes required for the complete system, in accordance with system manufacturer's instructions and with requirements specified in Division 26 for wiring, conduit, and boxes. Provide 12 inches of slack at each outlet.

1. Install wiring in conduit, except where noted on drawings to provide Type MC fire alarm cable.
2. Install Type MC fire alarm cable in accordance with Article 330 of the National Electric Code (NFPA 70).
3. Identification: Paint fire alarm junction boxes and junction box covers red.

C. Device identification:

1. Refer to Section 26 05 53, Identification for Electrical Systems.
2. Label ID number on base of each device to match associated panel serving device.

a. Label notification devices with circuit number, panel number, and end-of-line.

D. Wires, cables, conduits, and wiring connections are specified in Division 26, Electrical. Include in the work of this section, wiring, conduits, and equipment connections complying with the requirements of Division 26, so that the fire alarm system will function as specified and indicated on the drawings.

E. Wiring: Free from grounds or crosses between conductors.

1. Identification: Color code wiring, not duplicating building wiring colors. Tag each wire at each junction point.

F. Final connections between equipment and the wiring system shall be made under the direction and supervision of the qualified supplier.

G. Provide 20 percent spare capacity for each notification appliance circuit.

H. Locate 135 degrees F (57 degrees C) rated heat detectors in elevator shafts and elevator control/machine rooms within 18 inches (457 mm) of sprinklers.

3.2 INSTALLATION, FIRE ALARM NOTIFICATION BOOSTER

A. Provide number of notification power supply boosters required for a complete fire alarm system.

B. Utilize spare single-pole, 20-ampere circuit breaker in a 120-volt electrical panelboard to make electrical connection to each power supply booster.

1. Circuit breakers shall match and shall be compatible with the other breakers in the panelboard.

C. Branch circuits from panelboards to each notification power supply booster: Two No. 12 wires and one No. 12 ground in conduit no less than 0.75-inch (21- mm) trade size.

D. Install conduits and wiring as specified in Sections 26 05 19 and 26 05 33.

E. Provide smoke detector above each power supply booster.

3.3 INTERFACE WITH OTHER WORK

A. Furnish duct smoke detectors to be installed as part of ductwork specified in Division 23.

3.4 LOCATIONS OF FIRE ALARM EQUIPMENT

A. Locate the control panel, annunciator, and other associated equipment as shown on the drawings.

B. Visual indicating appliances: Install where shown on the drawings. If field conditions require variation from drawings, do not violate ADA requirements, including, but not limited to, the following:

1. Any room or space required to have a visual appliance, including corridors or hallways: No place shall be more than 50 feet from the indicating appliance in the horizontal plane.
2. Rooms and spaces exceeding 100 feet in one dimension, without obstructions 6 feet above the finished floor: Indicating appliances may be placed around the perimeter, spaced approximately 100 feet apart.

C. Mount indicating and test station for concealed smoke detectors near ceiling under detector. Text engraved on plate shall be descriptive of the device identified.

D. Provide a smoke detector at each fire alarm panel location, including but not limited to main control, auxiliary control, and power panels.

3.5 INSPECTION, TEST, ADJUSTMENT AND REPORT

A. Furnish equipment and appliances for testing the complete system during progress of the work and after completion of the installation, including a megger test of wiring. The tests generally shall demonstrate the following:

1. Circuits are continuous and free from short circuits.
2. Circuits are free from unspecified grounds.
3. Resistance to ground of non-grounded circuits is not less than one megohm.
4. Circuits are properly connected in accordance with the applicable wiring diagrams.
5. Each detector operates correctly.
6. Detectors are correctly located and sufficient in number.

B. Defects or omissions observed during general and system tests shall be repaired as quickly as possible and the tests reconducted.

C. Submit report as required in Part 1 above.

3.6 OPERATING INSTRUCTIONS

A. As specified in Section 28 05 00, provide operating instructions.

B. Provide at least 8 hours of additional instruction time for the systems and equipment specified in this section, consisting of 2 periods of 4 consecutive hours, during a period of not more than 60 days.

END OF SECTION 28 31 00

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Removing existing trees, shrubs, groundcover, plants, and grass.
2. Clearing and grubbing.
3. Stripping and stockpiling topsoil.
4. Removing above- and below-grade site improvements.
5. Disconnecting, capping or sealing, and abandoning site utilities in place removing site utilities.
6. Temporary erosion and sedimentation control measures.

B. Related Sections include the following:

1. Division 31 Section "Earthwork" for soil materials, excavating, backfilling, and site grading.

1.3 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS (NOT USED)

1.6 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without written permission from the street owner.
2. Provide alternate routes around closed or obstructed traffic ways.

B. Utility Locator Service: Notify Miss Utility a minimum of 3 days prior to performing any land disturbing activities. Contact Miss Utility of Delmarva 1-800-282-8555

C. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS (Not Applicable)

2.1 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 2 Section "Earthwork."

1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly flag trees and vegetation to remain or to be relocated.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TREE PROTECTION

A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.

1. Do not store construction materials, debris, or excavated material within fenced area.
2. Do not permit vehicles, equipment, or foot traffic within fenced area.
3. Maintain fenced area free of weeds and trash.

B. Do not excavate within tree protection zones, unless otherwise indicated.

C. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

1. Cover exposed roots with burlap and water regularly.
2. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
3. Coat cut faces of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
4. Backfill with soil as soon as possible.

D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.

1. Replace trees that cannot be repaired and restored to full-growth status, as determined by Architect.

3.3 UTILITIES

A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.

1. Arrange with utility companies to shut off indicated utilities.
2. Owner will arrange to shut off indicated utilities when requested by Contractor.

B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify the Owner not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without the owner's written permission.

C. Excavate for and remove underground utilities indicated to be removed.

D. Removal of underground utilities is included in Division 2 Sections covering site utilities.

3.4 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 24 inches below exposed subgrade.
4. Use only hand methods for grubbing within tree protection zone.
5. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.5 TOPSOIL STRIPPING

A. Remove grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
   1. Remove subsoil and non-soil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.

   1. Do not stockpile topsoil within tree protection zones.
   2. Dispose of excess topsoil as specified for waste material disposal.
   3. Stockpile surplus topsoil to allow for re-spreading deeper topsoil.

3.6 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

   1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
   2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.7 DISPOSAL

A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

1. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

END OF SECTION 31 10 00

THIS PAGE INTENTIONALLY LEFT BLANIK

SECTION 31 20 00 - EARTHWORK SITE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for pavements, walkways, and pads.
2. Excavating and backfilling for retaining walls and structures.
3. Subbase course for concrete walks.
4. Subbase course for asphalt paving.
5. Subsurface drainage backfill for walls and trenches.
6. Excavating and backfilling for utility trenches.
7. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.

B. Related Sections include the following:

1. Division 31 Section *Site Clearing* for, site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
2. Division 32 Section *Erosion and Sediment Control,* for temporary erosion and sediment control.
3. Division 32 Section *Lawns and Grasses* for finish grading, including preparing and placing topsoil and planting soil for lawns.

1.03 DEFINITIONS

A. Backfill: Soil materials used to fill an excavation, including the backfill of retaining walls, footings and foundations.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill. See section 2.1 for the requirements of borrow soil.

E. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by an independent geotechnical testing agency, according to ASTM D 1586.

I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

J. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

K. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.04 SUBMITTALS

A. Comply with Division 1 Section *Submittal Procedures*.

B. For Approval

1. Product Data: For the following:

a. Geotextile support fabric.
b. Geotextile filter fabric.

C. For Information:

1. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

a. Classification according to ASTM D2487 of each on-site and borrow soil material proposed for fill and backfill.
b. Laboratory compaction curve according to ASTM D 698 for each on-site and borrow soil material proposed for fill and backfill.

1.05 PROJECT/ SITE CONDITIONS

A. Test borings and other exploratory operations may be made by the Contractor at no cost to the Owner.

B. Existing Utilities: Locate existing underground utilities by hand excavation in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations.

1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner. Do not break utility connections without providing temporary services, as acceptable to Engineer.
2. Do not interrupt existing utilities serving facilities occupied and used by Owner or others, during occupied hours, except when permitted in writing by Engineer and then only after acceptable temporary utility services have been provided.

a. Provide, to Architect, a minimum of 48 hour notice to proceed before interrupting any utility.

3. Demolish and completely remove from site any existing underground utilities indicated to be removed. Coordinate with utility companies for shut-off of services if lines are active.

C. Use of Explosives: The use of explosives is not permitted.

D. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.

1. Operate warning lights as recommended by authorities having jurisdiction.
2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

1.06 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with applicable regulatory requirements of municipality and utility companies.

B. Under pavements, prepared subgrade must be proof rolled to a visually firm and stable condition and to a minimum of 95 percent maximum dry density as determined by a standard proctor test (ASTM: D698) with a minimum 10-ton smooth-wheeled roller in presence of a qualified Geotechnical Engineer or Technician prior to the placing of any base material.

C. A qualified Geotechnical Engineer or Technician, paid for by the Owner, shall monitor all site preparing, grading, and fill construction. The Engineer/Technician should observe and document the site preparation, existing fill material removal, and fill/backfill construction work, and make appropriate field tests, as necessary, to verify that acceptable fill materials are being used and that construction is being performed in accordance with applicable plans, specifications and acceptable construction practices.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations. **Note: No warranty is made regarding the amount of onsite soils material suitable for use as fill or backfill of any kind.**

B. Satisfactory Soils: Satisfactory soils for use as fill are defined below:

1. Structural fill, Fill under building slabs on grade and foundations, drives and parking, and behind retaining walls (where applicable): Where available, on site soil materials may be used where these on site soils conform to the requirements of the Delaware Department of Transportation Type C – Select borrow. Where sufficient on site soils materials are not available, off site borrow conforming to the requirements of the Delaware Department of Transportation Type C – select borrow shall be provided.
2. Fill under walkways: Where available, on site soil materials may be used where these on site soils conform to the requirements of the Delaware Department of Transportation Type C – select borrow. When sufficient on-site soils materials are not available, off site borrow conforming to the requirements of the Delaware Department of Transportation Type C – select borrow shall be provided.
3. Fill under unimproved, grass or landscape areas: Any on site soil material free of organic material and rocks or clumps larger than 2 inches.

C. Backfill:

1. Backfill for all utility trenches under asphalt, walkway areas: may be on site material where these on site soils conform to the requirements of the Delaware Department of Transportation Type C – Select borrow. When sufficient on-site soils materials are not available, off site borrow conforming to the requirements of the Delaware Department of Transportation Type C – select borrow shall be provided.
2. Backfill for all utility trenches under unimproved, grass areas: Any on site soil material free of organic material and rocks or clumps larger than 2 inches.

D. Fill: All fill shall be comprised of satisfactory soil material as defined above, section 2.01.B.

E. Subbase: Shall be Delaware Department of Transportation Type A CR-1 graded aggregate, DelDOT specification section 821.03.

F. Bedding: Shall be Delaware Dept. of Transportation #57 stone.

G. Drainage Fill Course: Shall be Delaware Dept. of Transportation #57 stone.

2.02 GEOTEXTILES

A. Geotextile Filter Fabric: Nonwoven geotextile, specifically manufactured as a drainage and separation geotextile; made from polypropylene staple fibers; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:

1. Grab Tensile Strength: 120 lb; ASTM D 4632
2. Tear Strength: 60 lb; ASTM D4533
3. Puncture Resistance: 70 lb: ASTM D 4833.
4. Water Flow Rate: 135 gpm per sq. ft.: ASTM D 4491
5. Apparent Opening Size: No. 70: ASTM D 4751

B. Geotextile Support Fabric: Woven geotextiles, specifically manufactured for use as a support and separation geotextiles, comprised of UV stabilized polypropylene slit film; and with the following minimum properties according to ASTM D 4759 and referenced standard test methods:

1. Grab Tensile Strength: 315 lb; ASTM D 4632.
2. Tear Strength: 120 lb; ASTM D 4533.
3. Puncture Resistance: 120 lb: ASTM D 4833.
4. Apparent Opening Size: No. 40; ASTM D 4751.

2.03 GEOGRID REINFORCEMENT

A. For use in unsuitable soil areas, as directed by the Architect, shall be an integrally formed grid structure manufactured of a stress resistant polypropylene material. The geogrid shall accept applied force in use by positive mechanical interlock with compacted soil or construction fill materials. The geogrid shall possess sufficient flexural stiffness to enable efficient installation over weak or wet in situ soils and shall possess complete continuity of its properties throughout its structure. Geogrid soil reinforcement shall be Tensar BX1100 geogrid, or approved equal.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 2 Section "Site Clearing."

C. Protect and maintain erosion and sedimentation controls, which are specified in Division 2 Section "Site Clearing," during earthwork operations.

D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

3.02 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area. The bidder is responsible for complete dewatering for all site work including stormwater management and erosion control facilities. All dewatering methods must be approved by DNREC and must be per the DNREC ESC Handbook, latest revision effective February 2019. The bidder should thoroughly familiarize themselves with existing on-site soils and groundwater conditions and review the Geotechnical Report.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.03 EXPLOSIVES

A. Explosives: Do not use explosives.

3.04 SITE STRIPPING AND PREPARATION IN STRUCTURAL AREAS

A. At the start of construction all existing topsoil, roots, asphalt and existing fill material should be stripped and removed in their entirety from the proposed building, parking, and drive areas extending to a minimum lateral distance of 10' beyond outer edge of paved areas and 15' beyond outside edge of building footings. Any existing fill material that may be encountered in previously disturbed areas (e.g., utility trenches), as well as any existing utility lines, should also be removed in their entirety from the building area.

B. After completing removal of the above, and upon reaching grade (in cut areas) and/or subgrade (in fill areas), the entire area should be proof-rolled with a minimum 10-ton smooth-wheeled roller or other approved equipment. The purpose of the proof-rolling is to densify the exposed grade/subgrade areas, which have been loosened or disturbed during the stripping/grading operation. In addition, the proof-rolling will expose any localized soft areas not encountered during the test boring program. In subgrade areas to receive structural fill, the exposed subgrade areas should be compacted to a visually firm and stable condition; compacted subgrade must be inspected and approved by the Geotechnical Engineer. This subgrade compaction effort will enable any structural fill to be placed and compacted at the required densities. Any localized soft and/or excessively wet subgrade areas encountered during this program, which cannot be adequately stabilized by drying and compacting, should be undercut and replaced with properly compacted structural fill (DelDOT Type G) or other suitable materials as directed by Geotechnical Engineer.

3.05 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.06 EXCAVATION FOR RETAINING WALLS AND OTHER STRUCTURES (if applicable)

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

3.07 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.08 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit.

1. Clearance: 12 inches each side of pipe or conduit.

C. Trench Bottoms: Excavate trenches deeper than bottom of pipe elevation to allow for bedding course (bedding course thickness and material shall be as specified on the drawings and/or specs and as recommended by manufacturer). Hand excavate for bell of pipe.

3.09 SUBGRADE INSPECTION

A. Notify Architect/Geotechnical Engineer when excavations have reached required subgrade.

B. If Geotechnical Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below pavements, walkways and structures with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated, or frozen subgrades.

1. Completely proof-roll subgrade in one direction.
2. Proof-roll with a minimum 10-ton vibratory roller or a fully loaded tandem dump truck in the presence of a qualified soils technician.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Geotechnical Engineer, and replace with compacted backfill or fill as directed.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, dust/drought conditions, or construction activities, as directed by Geotechnical Engineer.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, foundations and retaining walls.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Place and compact initial backfill, material as defined in section 2.01.C to a height of 12 inches over the utility pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

D. Place and compact final backfill of material specified in section 2.01.C to final subgrade elevation.

3.13 STRUCTURAL LOAD BEARING FILL/BACKFILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. The load bearing fill material should be placed in horizontal thin lifts with a loose thickness no greater than 8 inches. For top 1-foot of pavement subgrade, each thin lift of fill material should be compacted to 98% maximum dry density, as determined by the Standard Proctor Test (ASTM D-698). For fills below 1 foot of pavement subgrade and for structural fill below building slab and footings/foundations, each thin lift of fill material should be compacted to 95% maximum dry density, as determined by the Standard Proctor Test (ASTM D-698). Structural fill placement, as defined above, shall extend to a minimum lateral distance of 10' beyond outer edge of paved areas and 15' beyond outside edge of building footings.

C. Place soil material on subgrades free of mud, frost, snow, ice, or other deleterious materials.

3.14 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under structures, building slabs, steps, and fills below 1-foot of pavement subgrade, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. For top 1-foot of pavement subgrade, each thin lift of fill material should be compacted to 98% maximum dry density.
3. Under walkways, scarify and recompact top 6 inches (below subgrade and compact each layer of backfill or fill soil material at 95 percent.
4. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
5. For utility trenches, compact each layer of backfill soil material at 95 percent.

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.
3. Pavements: Plus or minus 1/2 inch.

3.17 SUBBASE AND BASE COURSES

A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase and base course under pavements, courts, and walks as follows:

1. Where shown on the plans, install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Shape subbase course to required crown elevations and cross-slope grades.
3. Place subbase course 6 inches or less in compacted thickness in a single layer.
4. Place subbase course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
5. Compact subbase course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.18 FIELD QUALITY CONTROL

A. Testing Agency: Owner shall engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work complies with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved Areas and Areas beneath athletic courts: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than 3 tests.
2. Structural Fill and Backfill: At each compacted backfill layer, at least 1 test for each 2000 square feet, but no fewer than 2 tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet or less of trench length, but no fewer than 2 tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.19 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.20 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 31 20 00

SECTION 312319 – DEWATERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes construction dewatering.

B. Related Sections:

1. Division 01 Section "Construction Progress Documentation" for recording preexisting conditions and dewatering system progress.
2. Division 31 Section "Earth Moving" for excavating, backfilling, site grading, and for site utilities.
3. Division 31 Section "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
4. Division 33 Section "Subdrainage" for permanent foundation wall, underfloor, and footing drainage.

1.3 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

1. Delegated Design: Design dewatering system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
3. Prevent surface water from entering excavations by grading, dikes, or other means.
4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
5. Remove dewatering system when no longer required for construction.

1.4 SUBMITTALS

A. Shop Drawings: For dewatering system. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.

1. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
2. Include a written plan for dewatering operations including control procedures to be adopted if dewatering problems arise.

B. Delegated-Design Submittal: For dewatering system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Qualification Data: For qualified Installer, land surveyor, and professional engineer.

D. Field quality-control reports.

E. Other Informational Submittals:

1. Photographs: Show existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by dewatering operations.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that has specialized in design of dewatering systems and dewatering work.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to dewatering including, but not limited to, the following:

a. Inspection and discussion of condition of site to be dewatered including coordination with temporary erosion control measures and temporary controls and protections.
b. Geotechnical report.
c. Proposed site clearing and excavations.
d. Existing utilities and subsurface conditions.
e. Coordination for interruption, shutoff, capping, and continuation of utility services.
f. Construction schedule. Verify availability of Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

g. Testing and monitoring of dewatering system.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:

1. Notify Architect no fewer than (2) days in advance of proposed interruption of utility.
2. Do not proceed with interruption of utility without Architect's and Owner's written permission.

B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.

1. Make additional test borings and conduct other exploratory operations necessary for dewatering.
2. The geotechnical report is referenced elsewhere in the Project Manual.

C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1. During dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.

1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Provide temporary grading to facilitate dewatering and control of surface water.

D. Monitor dewatering systems continuously.

E. Promptly repair damages to adjacent facilities caused by dewatering.

F. Protect and maintain temporary erosion and sedimentation controls, which are specified in Division 01 Section "Temporary Facilities and Controls" Division 31 Section "Site Clearing" during dewatering operations.

3.2 INSTALLATION

A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

1. Space well points or wells at intervals required to provide sufficient dewatering.
2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.

B. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.

C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.

1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.

1. Maintain piezometric water level to the minimum DNREC required depth below surface of excavation.

E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

F. Provide standby equipment on site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.

1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.

G. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

3.3 FIELD QUALITY CONTROL

A. Observation Wells: Provide, take measurements, and maintain at least the minimum number of observation wells or piezometers indicated; additional observation wells may be required by authorities having jurisdiction.

1. Observe and record daily elevation of ground water and piezometric water levels in observation wells.
2. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly, suspend construction activities until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.
3. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.

B. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.

END OF SECTION 31 23 19

This page is intentionally left blank.

SECTION 321216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the Work specified in this Section.

1.2 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 011000, SUMMARY OF WORK. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Provisions for hot-mixed asphalt paving over prepared subbase.

C. Proof rolling of prepared subbase.

D. Traffic Paint

E. Contractor shall coordinate all construction documents; where conflicts arise between these specifications and the design drawings, the more stringent shall apply. The Contractor is advised to contact Owner with any questions prior to resolving any conflicts, or modifying any of the original design.

1.3 RELATED SECTIONS

A. Prepared subbase is specified in another Division 31, Section “Earthwork Site”.

B. Saw-cutting of edges of existing pavement is specified in site-clearing section.

1.4 SUBMITTALS

A. Material Certificates signed by material producer and Contractor, certifying that each material item complies with or exceeds specified requirements.

1.5 PROJECT/SITE CONDITIONS

A. Weather Limitations: Apply prime and tack coats when ambient temperature is above 50 deg F (10 deg C) and when temperature has not been below 35 deg F (1 deg C) for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture.

B. Construct hot-mixed asphalt surface course when atmospheric temperature is above 40 deg F (4 deg C) and when base is dry. Base course may be placed when air temperature is above 30 deg F (minus 1 deg C) and rising.

C. Grade Control: Establish and maintain required lines and elevations.

1.6 MATERIALS

A. General: Use locally available materials and gradations that exhibit a satisfactory record of previous installations.

B. Coarse Aggregate: Sound, angular crushed stone, crushed gravel, or properly cured crushed blast furnace slag, complying with ASTM D 692-88.

C. Fine Aggregate: Sharp-edged natural sand or sand prepared from stone, properly cured blast furnace slag, gravel, or combinations thereof, complying with ASTM D 1073.

D. Asphalt Cement: ASTM D 3381 for viscosity-graded material; ASTM D 946 for penetration-graded material.

E. Prime Coat: Cut-back asphalt type, ASTM D 2027; MC-30, MC-70 or MC-250.

F. Tack Coat: Emulsified asphalt; ASTM D 977.

G. Subbase Reinforcement Fabric. Structural Geogrid BX 1200

1.7 ASPHALT-AGGREGATE MIXTURE

A. Provide plant-mixed, hot-laid asphalt-aggregate mixture complying with ASTM D 3515 and applicable Delaware Department of Transportation standards.

1.8 TRAFFIC PAINT

A. Traffic Paint: Apply traffic paint for striping and other markings with mechanical equipment to produce uniform straight edges. Apply at manufacturer's recommended rates to provide a 15-mil minimum wet film thickness. All traffic striping is to conform to Delaware Department of Transportation standard specifications.

PART 2 - EXECUTION

2.1 SURFACE PREPARATION

A. General: Remove loose material from compacted subbase surface immediately before applying prime coat.

B. Proof-roll prepared subbase surface to check for unstable areas and areas requiring additional compaction.

C. Notify Engineer of unsatisfactory conditions. Do not begin paving work until deficient subbase areas have been corrected and are ready to receive paving.

D. Prime Coat: Apply at rate of 0.20 to 0.50 gal. per sq. yd., over compacted subgrade. Apply material to penetrate and seal, but not flood, surface. Cure and dry as long as necessary to attain penetration and evaporation of volatile.

E. Tack Coat: Apply to contact surfaces of previously constructed asphalt or Portland cement concrete and surfaces abutting or projecting into hot-mixed asphalt pavement. Distribute at rate of 0.05 to 0.15 gal. per sq. yd. of surface.

F. Allow to dry until at proper condition to receive paving.

G. Exercise care in applying bituminous materials to avoid smearing of adjoining concrete surfaces. Remove and clean damaged surfaces.

2.2 PLACING MIX

A. General: Place hot-mixed asphalt mixture on prepared surface, spread, and strike off. Spread mixture at minimum temperature of 225 deg F (107 deg C). Place areas inaccessible to equipment by hand. Place each course to required grade, cross-section, and compacted thickness.

B. Paver Placing: Place in strips not less than 10 feet wide, unless otherwise acceptable to Engineer. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete the base course for a section before placing surface course.

C. Immediately correct surface irregularities in finish course behind paver. Remove excess material forming high spots with shovel or lute.

D. Joints: Make joints between old and new pavements, or between successive days' work, to ensure continuous bond between adjoining work. Construct joints to have same texture, density, and smoothness as other sections of hot-mixed asphalt course. Clean contact surfaces and apply tack coat.

2.3 ROLLING

A. General: Begin rolling when mixture will bear roller weight without excessive displacement.

B. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

C. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling and repair displaced areas by loosening and filling, if required, with hot material.

D. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been evenly compacted.

E. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained 95 percent laboratory density.

F. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut out such areas and fill with fresh, hot-mixed asphalt. Compact by rolling to specified surface density and smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

2.4 FIELD QUALITY CONTROL

A. General: Test in-place hot-mix asphalt courses for compliance with requirements for thickness and surface smoothness. Repair or remove and replace unacceptable paving as directed by Engineer.

B. Thickness: In-place compacted thickness tested in accordance with ASTM D 3549 will not be acceptable if exceeding following allowable variations:

1. Base Course: Plus or minus ½ inch.
2. Surface Course: Plus or minus 1/4 inch.

C. Surface Smoothness: Test finished surface of each hot-mixed asphalt course for smoothness, using 10-foot straightedge applied parallel with and at right angles to centerline of paved area. Surfaces will not be acceptable if exceeding the following tolerances for smoothness:

1. Base Course Surface: 1/4 inch.
2. Wearing Course Surface: 3/16 inch.

D. Check surface areas at intervals as directed by Engineer.

END OF SECTION 32 12 16

SECTION 321313 – PORTLAND CEMENT CONCRETE PAVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the Work specified in this Section.

1.02 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Concrete steps, pads, curbs, and landings.

1.03 RELATED DOCUMENTS

A. The Delaware Department of Transportation Standard Specifications for Road and Bridge Construction is hereby incorporated into this section and all requirements set forth there, shall be adhered to.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Section 312000 - “Earth Moving” for subgrade preparation, grading and subbase course outside the building area.

C. The Contractor shall coordinate all construction documents related to work specified herein; where conflicts arise between these specifications and the design drawings, the more stringent shall apply. The Contractor is advised to contact the Architect with any questions prior to resolving any conflicts, or modifying any of the original design.

1.04 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, joint systems, curing compounds, dry-shake finish materials, and others if requested by Architect.

C. Design mixes for each class of concrete. Include revised mix proportions when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

D. Laboratory test reports for evaluation of concrete materials and mix design tests.

E. Material certificates in lieu of material laboratory test reports when permitted by Architect. Material certificates shall be signed by the manufacturer and the Contractor certifying that each material item complies with or exceeds requirements. Provide certification from admixture manufacturers that chloride content complies with requirements.

1.05 QUALITY ASSURANCE

A. Concrete Standards: Comply with provisions of the following standards, except where more stringent requirements are indicated.

1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
2. ACI 318, "Building Code Requirements for Reinforced Concrete."
3. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."
4. Delaware Department of Transportation Standard Specifications.

B. Concrete Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

C. Concrete Testing Service: Engage a qualified independent testing agency to perform materials evaluation tests and to design concrete mixes.

D. Seal all concrete surfaces with concrete sealer conforming to ASTM C309.

PART 2 - PRODUCTS

2.01 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other acceptable panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.

1. Use flexible or curved forms for curves of a 100-foot or less radius.

2.02 REINFORCING MATERIALS

A. Reinforcing Bars and Tie Bars: ASTM A 615, Grade 60, deformed.

B. Welded Steel Wire Fabric: ASTM A 185.

1. Furnish in flat sheets, not rolls, unless otherwise acceptable to Architect.

C. Deformed-Steel Welded Wire Fabric: ASTM A 497.

D. Fabricated Bar Mats: Welded or clip-assembled steel bar mats, ASTM A 184. Use ASTM A 615, Grade 60 steel bars, unless otherwise indicated.

E. Joint Dowel Bars: Plain steel bars, ASTM A 615, Grade 60. Cut bars true to length with ends square and free of burrs.

F. Supports for Reinforcement: Chairs, spacers, dowel bar supports and other devices for spacing, supporting, and fastening reinforcing bars, welded wire fabric, and dowels in place. Use wire bar-type supports complying with CRSI specifications.

1. Use supports with sand plates or horizontal runners where base material will not support chair legs.

2.03 CONCRETE MATERIALS

A. Concrete materials to be used in project shall comply fully with the requirements of the DelDOT Standard specifications.

B. Portland Cement: ASTM C 150, Type I.

1. Use one brand of cement throughout Project unless otherwise acceptable to Architect.

C. Fly Ash: ASTM C 618, Type F.

D. Normal-Weight Aggregates: ASTM C 33, Class 4, and as follows. Provide aggregates from a single source.

1. Maximum Aggregate Size: 1-1/2 inches.
2. Do not use fine or coarse aggregates that contain substances that cause spalling.
3. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Architect.

E. Water: Potable.

2.04 ADMIXTURES

A. Provide concrete admixtures that contain not more than 0.1 percent chloride ions.

B. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

C. Water-Reducing Admixture: ASTM C 494, Type A.

2.05 CURING MATERIALS

A. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.

B. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.

1. Waterproof paper.
2. Polyethylene film.
3. White burlap-polyethylene sheet.

2.06 CONCRETE MIX

A. Prepare design mixes for each type and strength of normal-weight concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use a qualified independent testing agency for preparing and reporting proposed mix designs.

1. Do not use the Owner's field quality-control testing agency as the independent testing agency.
2. Limit use of fly ash to 25 percent of cement content by weight.

B. Proportion mixes according to ACI 211.1 and ACI 301 to provide normal-weight concrete with the following properties:

1. Compressive Strength (28-Day): 4000 psi.
2. Compressive Strength (28-Day): 3500 psi.
3. Maximum Water-Cement Ratio at Point of Placement: 0.45.
4. Slump Limit at Point of Placement: 3 inches.

C. Adjustment to Concrete Mixes: Mix design adjustments may be requested by the Contractor when characteristics of materials, project conditions, weather, test results, or other circumstances warrant.

2.07 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94.

1. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

A. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

B. Remove loose material from compacted subbase surface immediately before placing concrete.

3.02 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for paving to required lines, grades, and elevations. Install forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.

B. Check completed formwork and screeds for grade and alignment to following tolerances:

1. Top of Forms: Not more than 1/8 inch in 10 feet.
2. Vertical Face on Longitudinal Axis: Not more than 1/4 inch in 10 feet.

C. Clean forms after each use and coat with form release agent as required to ensure separation from concrete without damage.

3.03 PLACING REINFORCEMENT

A. General: Comply with Delaware Department of Transportation Standard Specifications for placing reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities or replace units as required before placement. Set mats for a minimum 2-inch overlap to adjacent mats.

3.04 JOINTS

A. General: Construct contraction, construction, and isolation joints true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to the centerline, unless indicated otherwise.

1. When joining existing paving, place transverse joints to align with previously placed joints, unless indicated otherwise.

B. Contraction Joints: Provide weakened-plane contraction joints, sectioning concrete into areas as shown on Drawings. Construct contraction joints for a depth equal to at least 1/4 of the concrete thickness, as follows:

1. Tooled Joints: Form contraction joints in fresh concrete by grooving and finishing each edge of joint with a radiused jointer tool.
2. Inserts: Form contraction joints by inserting premolded plastic, hardboard, or fiberboard strips into fresh concrete until top surface of strip is flush with paving surface. Radius each joint edge with a jointer tool. Carefully remove strips or caps of two-piece assemblies after concrete has hardened. Clean groove of loose debris.

C. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than ½ hour, unless paving terminates at isolation joints.

1. Provide preformed galvanized steel or plastic keyway-section forms or bulkhead forms with keys, unless indicated otherwise. Embed keys at least 1-1/2 inches into concrete.
2. Continue reinforcement across construction joints unless indicated otherwise. Do not continue reinforcement through sides of strip paving unless indicated.
3. Provide tie bars at sides of paving strips where indicated.
4. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

3.05 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove snow, ice, or frost from subbase surface and reinforcing before placing concrete. Do not place concrete on surfaces that are frozen.

C. Moisten subbase to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.

D. Comply with requirements of the Delaware Department of Transportation for measuring, mixing, transporting, and placing concrete.

E. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

F. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

G. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete complying with ACI 309R.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcing, dowels, and joint devices.

H. Screed paved surfaces with a straightedge and strike off. Use bull floats or darbies to form a smooth surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces prior to beginning finishing operations.

I. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete.

J. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.

K. Cold-Weather Placement: Comply with provisions of ACI 306R and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

L. Hot-Weather Placement: Place concrete complying with ACI 305R and as specified when hot weather conditions exist.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.06 CONCRETE FINISHING

A. Float Finish: Begin floating when bleed water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Finish surfaces to true planes within a tolerance of 1/4 inch in 10 feet as determined by a 10-foot-long straightedge placed anywhere on the surface in any direction. Cut down high spots and fill low spots. Refloat surface immediately to a uniform granular texture.

1. Broom Finish: Brush across concrete, perpendicular to line of traffic, to provide a uniform finish.

B. Final Tooling: Tool edges of paving, gutters, curbs, and joints formed in fresh concrete with a jointing tool to radii as shown on the plans. Repeat tooling of edges and joints after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.07 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with the recommendations of ACI 306R for cold weather protection and ACI 305R for hot weather protection during curing.

B. Evaporation Control: In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before floating.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than 7 days with the following materials:

   a. Water.
   b. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with a 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3.08 TRAFFIC PAINT

A. Traffic Paint: Apply traffic paint for striping and other markings with mechanical equipment to produce uniform straight edges. Apply at manufacturer's recommended rates to provide a 15-

mil minimum wet film thickness. All traffic striping is to conform, at a minimum, to the design drawings.

3.09 FIELD QUALITY CONTROL TESTING

A. Employ a qualified independent testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement as follows:

1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

    a. Slump: ASTM C 143; one test at point of placement for each compressive-strength test but no less than one test for each day's pour of each type of concrete. Additional tests will be required when concrete consistency changes.
    b. Air Content: ASTM C 231, pressure method; one test for each compressive-strength test but no less than one test for each day's pour of each type of air-entrained concrete.
    c. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.
    d. Compression Test Specimens: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless directed otherwise. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
    e. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class exceeding 5 cu. yd. but less than 25 cu. yd., plus one set for each additional 50 cu. yd. Test one specimen at 7 days, test two specimens at 28 days, and retain one specimen in reserve for later testing if required.

2. When total quantity of a given class of concrete is less than 50 cu. yd., Architect may waive strength testing if adequate evidence of satisfactory strength is provided.
3. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
4. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.

B. Test results will be reported in writing to Architect, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in paving, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day and 28-day tests.

3.10 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective, or does not meet the requirements of this Section.

B. Drill test cores where directed by Architect when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep concrete paving not more than two days prior to date scheduled for Substantial Completion inspections.

END OF SECTION 32 13 13

SECTION 32 22 10 - EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 and 2 Specification sections apply to work of this section.

B. State of Delaware Sediment and Stormwater Regulations, latest edition.

C. State of Delaware Erosion and Sediment Control Handbook, February 2019, or latest edition.

1.2 SUMMARY

A. This Section includes the following:

1. Temporary erosion control devices required during construction.

B. Related Sections include the following:

1. Division 31 Section *Site Clearing* for site stripping, grubbing, stripping, and stockpiling topsoil and removal of above and below ground improvements.
2. Division 31 Section *Earthwork* for excavation, grading, fill placement, and backfill of excavations with specified materials.

1.3 DEFINITIONS (NOT USED)

1.4 SUBMITTALS

A. Comply with Division 1 Section *Submittal Procedures*

B. For Approval:

1. Product Data: For the following:

a. Filter cloth and pre-fabricated silt fence.
b. Geotextile fabrics.
c. Compost Filter Logs 18”
d. Super Silt Fence

C. For Information:

1. Materials test report: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

a. Classification according to ASTM of all stone and aggregate for use in erosion control devices such as stabilized construction entrances, rock check dams, temporary sediment traps.

1.5 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.

B. General Intent: In accordance with State of Delaware, Section 1, Title 7, Delaware Code Chapter 40 "Erosion and Sediment Control Act," erosion and sediment control will be minimized during construction of the project by temporary and/or permanent stabilization by seeding and other controls to limit erosion. All erosion and sediment controls shall be constructed and installed as detailed on drawings and as per DNREC's Delaware Erosion & Sediment Control Handbook, February 2019, or latest edition. As part of the base bid contract scope of work Contractor is responsible for installing additional Erosion & Sediment Control (ESC) measures as directed by Certified Construction Reviewer CCR and/or Engineer as construction progresses. The actual ESC measures shown on the plan are the minimum required to start work and install the proposed site improvements. As construction progresses additional ESC items may be required (i.e. dewatering bag, stone check dams, silt tubes, etc.) to comply with the State Sediment and Stormwater Regulations; these ESC items must be installed as directed by CCR and/or Engineer at no additional cost to owner. Contractor is also responsible for maintaining all ESC measures throughout duration of construction including re-seeding disturbed areas and repairing ESC items as directed by CCR and Engineer.

1.6 PROJECT CONDITIONS (NOT USED)

PART 2 - PRODUCTS

2.1 COMPOST FILTER LOGS 18" (must conform to DNREC ESC Handbook Standards, February 2019, or latest edition).

2.2 SUPER SILT FENCE (must conform to DNREC ESC Handbook Standards, February 2019, or latest edition).

2.3 STABILIZED CONSTRUCTION ENTRANCE (must conform to DNREC ESC Handbook Standards, February 2019, or latest edition)

A. Stone: Use 2" stone or recycled concrete equivalent

B. Filter Fabric: Woven or non-woven fabric consisting only of continuous chain polymeric filaments or yarns of polyester. The fabric shall be inert to commonly encountered chemicals and hydrocarbons, and be mildew and rot resistant. Fabric shall be Trevira Spun-bond 1135, Mirafi 600X or approved equivalent.

PART 3 - EXECUTION

3.1 INSTALL EROSION CONTROL MEASURES in accordance with the latest issue of Delaware Erosion Control Handbook (effective February 2019, or latest edition) and as shown on drawings. ESC Measures include, but are not limited to the following: stabilized construction entrance, compost filter logs, silt fence, super silt fence, stone check dams, pumping/dewatering pits, dirt bags, sediment basin, temporary diversion swales, erosion control matting, inlet protection, and temporary stabilization measures.

3.2 SILT FENCE & SUPER SILT FENCE: Install in accordance with the latest issue of Delaware Erosion Control Handbook (effective February 2019, or latest edition)) and as shown on drawings. Maximum allowable slope length shall be per Delaware Erosion Control Handbook Standards and specifications for silt fence.

A. Filter cloth to be fastened securely to fence posts with wire ties or staples.

1. Stake size, installation, spacing, and fabric overlap shall conform to the DNREC ESC Handbook details and specifications.

B. Maintenance shall be performed as needed and material removed when “bulges” develop in the silt fence.

3.3 STABILIZED CONSTRUCTION ENTRANCE:

A. Length: As required, but not less than 50 feet.

B. Thickness: Not less than 6 inches.

C. Width: 10 foot minimum, but not less than the full width at points where ingress or egress occurs.

D. Surface Water: All surface water flowing or diverted towards construction entrances shall be pipes across the entrance. If piping is impractical, a mountable berm with 5:1 slopes will be permitted.

E. Maintenance: The entrance shall be maintained in a condition, which will prevent tracking or flowing of sediment onto public rights-of-way. This may require periodic top dressing with additional stone as conditions demand and repair and/or cleanout of any measures used to trap sediment. All sediment spilled, dropped, washed or tracked onto public rights-of-way must be removed immediately.

F. Washing: Vehicle wheels shall be cleaned to remove sediment prior to entrance onto public rights-of-way. When washing is required, it shall be done on an area stabilized with stone and which drains into an approved sediment-trapping device. See plan for designated tire washing area.

END OF SECTION 32 22 10

SECTION 33 25 10 - WATER DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes water-distribution piping and specialties outside the building for the following:

1. Combined water service and fire-service mains.

1.3 DEFINITIONS

A. Combined Water Service and Fire-Service Main: Exterior water piping for both domestic-water and fire-suppression piping.

B. Fire-Service Main: Exterior fire-suppression-water piping.

C. Fire-Suppression-Water Piping: Interior fire-suppression-water piping.

D. Water-Distribution Piping: Interior domestic-water piping.

E. Water Service: Exterior domestic-water piping.

F. The following are industry abbreviations for plastic materials:

1. PE: Polyethylene plastic.
2. DIP: Ductile Iron Pipe.

1.4 SUBMITTALS

A. For approval:

1. Pipe and Fittings.
2. Gate Valves and accessories.
3. Tapping Sleeves and Valves.
4. Fire Hydrants.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of piping and specialties and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. Regulatory Requirements:

1. Comply with requirements of utility company supplying water Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection
3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing**.**

C. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use 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.

D. 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.

E. Protect stored piping from moisture and dirt. Elevate above grade.

F. Protect flanges, fittings, and specialties from moisture and dirt.

1.7 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect/Engineer and Water Supplier not less than seven days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect and the Water Supplier's written permission.

1.8 COORDINATION

A. Coordinate connection to water main with utility company.

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. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials. Refer to plans and specs for pipe materials.

2.3 DUCTILE-IRON PIPE AND FITTINGS

A. Domestic Piping: Type K Copper.

B. Mechanical-Joint, Ductile-Iron Pipe: C-900, with mechanical-joint, bell- and plain-spigot end.

1. Mechanical-Joint, Ductile-Iron Fittings: C-900, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

a. Glands, Gaskets, and Bolts: C-900, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Push-on-Joint, Ductile-Iron Pipe: Class 52, with push-on-joint, bell- and plain-spigot end unless grooved or flanged ends are indicated.

1. Push-on-Joint, Ductile-Iron Fittings: Class 52, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

a. Gaskets: Class 52, rubber.

2.4 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

1. Manufacturers:

a. American Cast Iron Pipe Co.; American Flow Control Div.
b. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
c. Mueller Co.; Water Products Div.
d. McWane, Inc.; Clow Valve Co. Div.
e. McWane, Inc.; Kennedy Valve Div.
f. McWane, Inc.; Tyler Pipe; Utilities Div.
g. NIBCO INC.
h. United States Pipe and Foundry Company.

2. Non-rising Stem Gate Valves 3 Inches (80 mm) and Larger: AWWA C509, resilient seated; bronze stem, iron body and bonnet with epoxy coated interior surfaces, iron disc with epoxy coating and replaceable steel reinforced rubber seat, double O-Ring seal stuffing box, 2" operating nut, open left, 200-psig (1380 kPa) working pressure, mechanical joint ends. Mueller A-2370-20, open left or approved equal.
3. Valve Boxes: Cast-iron box having top section and cover with lettering "WATER," bottom section with base of size to fit over valve and barrel approximately 5 inches (124 mm) in diameter, and adjustable cast-iron extension of length required for depth of bury of valve. Mueller Type H10360, or approved equal.
4. Provide one steel tee-handle operating wrench. Wrench shall have tee handle with one pointed end, stem of length to operate deepest valve, and socket-fitting valve-operating nut.

2.5 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies: Comply with MSS SP-60. Include sleeve and valve compatible with drilling machine.

1. Manufacturers:

a. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.

b. Mueller Co.; Water Products Div.
c. International Piping Services Company.
d. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
e. McWane, Inc.; Kennedy Valve Div.
f. McWane, Inc.; M & H Valve Company Div.
g. United States Pipe and Foundry Company.

2. Tapping Sleeve: Tapping sleeves shall be a Mueller mechanical joint tapping sleeve model H-615, or approved equal. The sleeve shall be a 2 piece bolted sleeve with flanged outlet for new branch connection. The outlet flange dimensions and drilling shall comply with ANSI B16.1, class 125. Sleeve shall be iron body with 3/4" NPT test plug and shall have a maximum working pressure of 200 psig.

3. Tapping Valve: Tapping valves shall be a Mueller Double Disc tapping valve model H-667, or approved equal. The valve shall meet or exceed all applicable requirements of ANSI/AWWA C500 standards. The inlet flange shall comply with ANSI B16.1, class 125 drilling, the mechanical joint outlet shall comply with ANSI/AWWA C111 Standards. The valve shall have a bronze mounted iron body, be non-rising stem and have an O-ring sealed stuffing box. The disk assembly shall be a double disc parallel seat with four point wedging mechanism. A 2" square wrench nut shall be provided. The valve shall open left.

2.6 FREESTANDING FIRE HYDRANTS

A. Dry-Barrel Fire Hydrants: Shall comply with ANSI/AWWA C502, shall be dry top design with O-ring sealed oil reservoir. Hydrant shall have a compression type main valve that closes with pressure, shall have a 5-1/4” main valve opening three way (two hose nozzles and one pumper nozzle), shall have a 200 psig maximum working pressure and a 400 psig maximum test pressure, the hydrant shall be Mueller Super Centurion A-423 or approved equal **(must comply with Water Supplier standards)**.

1. Manufacturers:

a. American AVK Co.; Valves & Fittings Div.
b. American Cast Iron Pipe Co.; American Flow Control Div.
c. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
d. American Foundry Group, Inc.
e. Mueller Co.; Water Products Div.
f. McWane, Inc.; Clow Valve Co. Div.
g. McWane, Inc.; Kennedy Valve Div.
h. United States Pipe and Foundry Company.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below, unless otherwise indicated.

C. Do not use flanges, unions, or keyed couplings for underground piping.

D. Flanges, unions, keyed couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

E. Underground Water-Service Piping: Use the following piping materials for each size range:

3.3 JOINT CONSTRUCTION

A. See Division 2 Section "Utility Materials" for basic piping joint construction.

B. Make pipe joints according to the following:

1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.

3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

A. See Division 2 Section "Utility Materials" for piping-system common requirements.

3.5 PIPING INSTALLATION

A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.

B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

C. Make connections to Water Supplier’s water mains with tapping machine according to the following:

1. Install tapping sleeve and tapping valve according to MSS SP-60.
2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

D. Install ductile-iron piping according to AWWA C600 and AWWA M41.

1. Bury piping with depth of cover over top at least 30 inches.

E. Install piping by tunneling, jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

3.6 ANCHORAGE INSTALLATION

A. 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.

B. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.7 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

3.8 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.

B. AWWA-Type Fire Hydrants: Comply with AWWA M17.

3.9 CONNECTIONS

A. Piping installation requirements are specified in other Division 2 Sections. Drawings indicate general arrangement of piping and specialties.

B. See Division 2 Section "Utility Materials" for piping connections to valves and equipment.

C. Connect water-distribution piping to Water Supplier’s water main. Use tapping sleeve and tapping valve.

3.10 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than 1-1/2 times working pressure for 2 hours.

1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.11 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or as described below:

a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

C. After completing drinking fountain installation, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

D. Clean drinking fountains, on completion of installation, according to manufacturer's written instructions.

END OF SECTION 33 25 10

SECTION 32 31 19 - DECORATIVE METAL FENCES AND GATES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Decorative aluminum fences.

1.2 REFERENCE STANDARDS

A. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

C. ASTM F2408 - Standard Specification for Ornamental Fences Employing Galvanized Steel Tubular Pickets.

1.3 SUBMITTALS

A. Product Data: Submit 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.

B. Shop Drawings:

1. Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.

C. Samples: Submit two samples of fence panels, 4 inch by 4 inch in size illustrating construction and colored finish.

D. Manufacturer's Installation Instructions: Indicate installation requirements, post foundation anchor bolt templates, and gate hardware.

E. Manufacturer's Warranty.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:

1. Extra Stock Materials: Three of each kind of rail, post and spacer.

2. Tools: One each of every special tool required for maintenance of fence and gates.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

B. Installer Qualifications: Experienced with type of construction involved and materials and techniques specified and approved by fence manufacturer.

1.5 WARRANTY

A. Provide 15 year manufacturer warranty for fences and gates.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Decorative Metal Fences and Gates:

1. Basis of Design: Knotwood, a brand of OmniMax International: Geofix: www.knotwood.com/#sle.

2. or approved equal.

B. Specialty Hardware:

1. DAC Industries, Inc; Detex Exit Bar: www.dacindustries.com/#sle.

2. D&D Technologies USA, Inc; www.ddtech.com/#sle.

2.2 FENCES

A. Fences: Complete factory-fabricated system of posts and panels, accessories, fittings, and fasteners; finished with electrodeposition coating, and having the following performance characteristics:

B. AAMA 2604/05 Metal Finishing surface Coating.

C. Electro-Deposition Coating: Multistage pretreatment/wash with zinc phosphate, followed by epoxy primer and acrylic topcoat.

1. Total Coating Thickness: 2 mils, minimum.

D. Aluminum: ASTM B221.

1. Tubular Pickets, Rails and Posts: 6063 T6 Temper Extruded Aluminum Alloy.
2. Extrusions for Posts and Rails (Outer Channel): 6063 T6 Temper Extruded Aluminum Alloy.
3. Extrusions for Pickets and Rail (Inner Slide Channels): 6063 T6 Temper Extruded Aluminum Alloy.

E. Fasteners: ASTM A276/A276M, Type 302 stainless steel; finished to match fence components.

2.3 ALUMINUM FENCE

A. Decorative Aluminum Fence System: Provide fence meeting the Test Load and Coating Performance requirements of ASTM F2408 for Industrial class.

1. Fence Panels: As indicated on drawings.
    a. Posts: Aluminum extrusions; 2-1/2 inches square.
    b. Rails: Manufacturer's standard, Extruded aluminum channels.
    c. Pickets: Manufacturer's standard; Extruded aluminum slats.
        1) Geometric Slat 4"x 5/8"; 2" spacing between pickets
    d. Fasteners: Manufacturer's standard stainless steel bolts, screws, and washers; factory finish fasteners to match fence.
    e. Accessories: Aluminum castings, extrusions, and cold-formed strips; factory finished to match fence.
    f. Swing Gate: Aluminum to match posts and pickets.
        1) Width: as shown in the drawings.
        2) Geometric Slat 4"x 5/8"; 2" spacing between pickets
    g. Finish: Powder coat finish, color to be selected by architect.

2.4 SPECIALTY HARDWARE

A. Hinges: Finished to match fence components.

1. Closing: Manual.

2. Material: Aluminum.

B. Latches: Finished to match fence components.

1. Mechanism: Gravity.

2. Locking: Mechanical.

3. Material: Aluminum.

C. Drop-bolt

1. Provide base plate.

2. Materials: Stainless steel.

3. Color: Black

4. Products: D&D Technologies USA, Inc; Lokkbolt premium drop bolt: www.ddtech.com or approved equal.

D. Ground Wheel:

1. Wheel to be used with bottom rail

2. Load Rating: 5,000 lb per gate

3. Adjustable Plates

4. Material: Steel

5. Products: D&D Technologies USA, Inc; Shut It 6" Harcore V-Groove Wheel with Carraige:www.ddtech.com

E. Rollers: Finished to match fence components.

1. Load Rating: 500 pounds (227 kg).

2. Groove: Flat.

3. Material: Steel.

4. Products:

a. D&D Technologies USA, Inc: www.ddtech.com/#sle.

F. Surface Mounted Exit device

1. Anodized Aluminum Bar
2. Stainless steel latch mechanism
3. Grade 1
4. ANSI/BHMA 156.3
5. UL Listed

2.5 ACCESSORIES

A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.

B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; steel.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Set fence posts in accordance with the manufacturer recommended spacing.

C. Space gate posts according to manufacturer's drawings, dependent on standard out-to-gate leaf dimensions and gate hardware selected.

1. Base type and quantity of gate hinges on the application; weight, height, and number of gate circles
2. Provide gate hardware by the manufacturer of the gate and install in compliance with manufacturer's recommendations.

3.2 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch.

B. Maximum Offset From Indicated Position: 1 inch.

C. Minimum Distance from Property Line: 6 inches.

3.3 FIELD QUALITY CONTROL

A. Layout: Verify that fence installation markings are accurate to design, paying attention to gate locations, underground utilities, and property lines.

B. Gates: Inspect for level, plumb, and alignment.

3.4 CLEANING

A. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.

B. Clean fence with mild household detergent and clean water rinse well.

3.5 PROTECTION

A. Protect installed products until completion of project.

END OF SECTION 32 31 19

SECTION 32 91 15 – AMENDED PLANTING SOIL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Amending of existing soil to prepare for installation of planting beds, turf, and specimen trees.

Related Sections:

1. Section 329119 – Topsoiling
2. Section 329200 – Turf and Grasses
3. Section 329300 – Planting

1.3 STANDARDS

A. The quality of materials and performance of work specified in this section shall be in accordance with the Delaware Department of Transportation Standard Specifications for Road and Bridge Construction, January, 1998.

1. Section 733: Topsoiling

1.4 SUBMITTALS

A. Legal Documents

2. Submit a complete materials list of items to be provided under this section for approval by the Owner's Representative before the purchase of any material.
3. Submit a list of proposed methods of execution of work under this section for approval by the Owner's Representative when proposed methods are different from or supplementary to those specified herein.
4. Submit copies of soil test recommendations called for in this section.

B. Delivery Slips

1. Submit delivery slip for all shipments showing the product volume and name of supplier.

1.5 PRODUCT DELIVERY AND STORAGE

A. Obtain all legal rights or easements necessary from private owners on whose lands topsoil may be stored. Furnish rights or easements in written form and signed by both CONTRACTOR and property OWNER involved, or their duly authorized representatives.

1.6 JOB CONDITIONS

A. Existing Conditions

1. Perform work in this scope only after preceding work affecting ground surface is completed.
2. Verify locations of all underground utilities prior to start of work.

B. Environmental Requirements

1. Topsoil shall not be moved or spread in frozen or muddy condition.

C. Protection

1. Protect trees and shrubs to remain as part of final landscaping against damage.

PART 2 - PRODUCTS

2.1 COMPOST

A. Compost shall be certified by US Composting Council as STA Organic Compost. Laboratory results of submittal sample shall satisfy the following:

Soluble Salts no greater than 10 mmhos/cm

% solids content 50-60% (50-40% moisture)

Organic matter 30-60%

Nitrogen 0.5-2.5 %(dry weight basis)

pH 5.0 to 8.0

Total Carbon up to 55% by weight

C:N Ration less than 20% dry weight basis

Pass select pathogens and Trace Metals

Bio Assay >95%

2.2 SOIL AMENDMENTS TO ALTER pH AS PER SOIL TEST RECOMMENDATIONS

A. Dolomite Lime: Shall be agricultural grade mineral soil conditioner containing 35% minimum magnesium carbonate and 49% minimum calcium carbonate, 100% passing No. 65 sieve, Kaiser Dolomite 65 AG or approved equal.

2.3 TOPSOIL

If, after completion of soil amendments, soil volume is insufficient to meet finish grades then topsoil

may be imported to job site. See Section 329119.13 - TOPSOILING.

PART 3 - EXECUTION

3.1 PREPARATION

A. Do not amend or place any soil or soil amendments until conditions are satisfactory. No work shall be performed when existing conditions are porous, wet, frozen or spongy.

B. Verify that clearing, earthwork, grading and other preceding work affecting ground surface have been completed and approved by Landscape Architect or Owner's Representative.

3.2 SOIL TESTING

A. Complete soil test through approved soil testing laboratory from a representative sample of all existing soil to remain on project site in planting beds or turf areas. The soil test should determine mechanical analysis, soluble salt level, N,P,K, levels, pH, organic matter content, cation exchange, micro- nutrient levels, and bulk density. Submit soil test results for approval by Landscape Architect.

B. Submit lab test results from an approved soil testing laboratory from a representative sample of the proposed imported compost to Landscape Architect for approval a minimum of 30 days in advance of plans to transport it to the site.

C. Submit source of compost (name and location) to Landscape Architect for approval.

D. Submit a physical sample of 1 gal. compost to be provided. This is in addition to submittals to analytical labs made by contractor.

3.3 COORDINATION

A. Coordinate work to maintain optimum moisture content of materials and existing soil to attain required compaction density.

1. Employ a placement method that does not disturb or damage other work, existing conditions, or surrounding soils.

2. Do not move or set heavy objects over proposed planting areas at any time during project sequence.

3.4 INSTALLATION FOR PLANTING BEDS ONLY (NOT PLANTERS)

A. Plan sequence of work to minimize compaction of soil and ensure that no heavy equipment will run across finished surfaces. Sequence of work must ensure a uniform profile and prevent localized compaction. (For example, work performed to back machines out of areas where work occurs.) Soil media shall be spread on these areas to a depth sufficiently greater than that specified on the plans. After natural settlement has taken place, the work must be in close conformity to acceptable

compaction tolerances and finish grade or meet surrounding edge conditions.

B. Final soil grades in flat areas will result in slight crowning of the soil, while grades on other areas will be with the intent of guiding runoff to drainage

C. Remove stones, lumps, roots and other objects larger than one inch in any dimension from graded surface.

3.5 DEWATERING

A. See Section “Earth Moving” for dewatering measures

3.6 STORAGE OF MATERIALS

A. Stockpile materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust or importation of weed seed.

1. Stockpile materials away from edge of excavations. Do not store within drip line of remaining trees.

3.7 AMENDING SOIL FOR PLANTING BED AREAS

A. Loosen existing soil in planting beds to a minimum depth of 12 inches. Loosen existing soil in turf areas to a depth of 6 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

B. All planting beds shall be amended by spreading horticultural compost over loosened surface to uniform depth of 3”. Incorporate compost with existing soil by tilling to a depth of 6 to 8 inches. If required to meet finish grades, place imported topsoil over amended planting soil. If required as per soil test results, apply soil amendments to alter pH and thoroughly blend into planting bed.

C. Grade planting beds to a smooth, uniform surface with loose, uniformly fine texture. Rake, remove ridges, and fill depressions to meet finish grades.

D. Restore planting beds if eroded or otherwise disturbed after finish grading and before planting.

3.8 MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

1. Do not place compost on surfaces that are muddy, frozen, or contain frost or ice.

2. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.9 COMPACTION

A. See Section Earth Moving for specifications regarding backfill and fill.

B. Compact planting areas to 90 percent (90%) maximum dry density for soils which exhibit a well-defined moisture density relationship determined in accordance with ASTM D-1557.

3.10 FINE GRADING

A. General: Uniformly grade planting areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
3. Slope grades to direct water away from buildings and to prevent ponding.

3.11 PROTECTION

A. When required, erect temporary signs and barriers to protect work area.

3.12 MAINTENANCE

A. Immediately before establishment of planting material, regrade areas which become eroded, settled or otherwise disturbed.

B. Perform all maintenance work in accordance with the Specifications without additional compensation.

C. Maintenance period to extend until installation of planting material.

3.13 CLEANING

A. Immediately clean spills, soil, and conditioners on paved and finished areas.

B. Haul and dispose of materials in excess of the quantity required for the project off site.

C. Dispose of protective barricades and warning signs at termination of maintenance period.

END OF SECTION 32 91 15

(THIS PAGE INTENTIONALLY LEFT BLANK)

SECTION 32 91 19 – TOPSOILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Prepare subsoil.
2. Furnish topsoil required from approved sources located outside the project limits, and place as shown on drawings.

B. Related Sections:

1. Section 329200- Turf and Grasses
2. Section 329300 – Planting

1.3 STANDARDS

A. The quality of materials and performance of work specified in this section shall be in accordance with the Delaware Department of Transportation Standard Specifications for Road and Bridge Construction, January, 1998.

1. Section 733: Topsoiling

1.4 SUBMITTALS

A. Legal Documents

1. Submit a complete materials list of items proposed to be provided under this section for approval by the Owner's Representative before the purchase of any material.
2. Submit a list of proposed methods of execution of work under this section for approval by the Owner's Representative when proposed methods are different from or supplementary to those specified herein.
3. Submit copies of soil test recommendations called for in this section.

B. Delivery Slips

1. Accompany all shipments of topsoil with delivery slip showing the product weight and name of supplier.

1.5 PRODUCT DELIVERY AND STORAGE

A. Obtain all legal rights or easements necessary from private owners on whose lands topsoil may be stored. Furnish rights or easements in written form and signed by both CONTRACTOR and property OWNER involved, or their duly authorized representatives.

B. Fertilizer and lime shall be delivered and stored in original unopened packages, kept dry, and not opened until needed for use. Damaged or faulty packages shall not be used.

1.6 JOB CONDITIONS

A. Existing Conditions

1. Perform topsoiling only after preceding work affecting ground surface is completed.

B. Environmental Requirements

1. Topsoil shall not be moved or spread in frozen or muddy condition.

C. Protection

1. Protect trees and shrubs to remain as part of final landscaping against damage.

PART 2 - PRODUCTS

2.1 TOPSOIL

A. Topsoil furnished from within or outside the project limits.

Contractor shall provide required quantity of topsoil to create a uniform depth of 8” after settlement on areas to be seeded or planted beds. If additional topsoil is required from off-site sources, it shall meet the following requirements:

1. Topsoil shall consist of natural loam topsoil free from subsoil, obtained from an area that has never been stripped. It shall be of uniform quality, free from hard clods, stiff clay, sods, stone, lime, cement, ashes, slag, or other undesirable material.

2. Topsoil shall contain a minimum of 5% organic matter, determined by loss of ignition of moisture-free samples dried in accordance with the current method of the Association of Official Agricultural Chemists. The acidity range shall be pH 5.0 to 7.0 inclusive. Maximum soluble salts: 500 ppm. The mechanical analysis of the soil shall be as follows:

Passing	Retained	Percentage
1” screen	--	100
1” screen	¼” screen (gravel)	3 (maximum)

¼" screen	No. 100 U.S.S. mesh sieve (sand)	40 – 60
No. 100 U.S.S. mesh sieve sand	Very fine sand, silt, or clay	40 – 60

3. The Contractor shall furnish certified report(s) of the testing laboratory showing the analysis of a representative sample of the topsoil for Lawn and Garden use he proposes to use. A separate report shall be furnished for each source of topsoil. The Contractor shall furnish the reports to the Owner's Representative before any topsoil is delivered to the site.
4. The Owner's Representative reserves the right to reject topsoil in which more than 60 percent of the material passing the No. 100 U.S.S. Mesh Sieve consists of clay as determine by the Bouyoucous hydrometer or by the Decantation method. All percentages are to be based on dry weight of sample. If the Owner's Representative directs, topsoil which varies only slightly from the Specifications may be acceptable by such corrections, as the Owner's Representative deems necessary.
5. If necessary, add peat, or approved composted leaf mold, at rate necessary to attain minimum organic content.

2.2 SOIL AMENDMENTS PER SOIL TEST RECOMMENDATIONS

A. Peat:

1. Shall be peat obtained from fresh water sites of sedge peat, reed peat, and sphagnum deposits consisting of organic matter of incompletely decomposed plant residues containing a negligible amount of woody matter, shredded to resemble texture of cultivated peats. Peat material, not cultivated or aged, shall meet the following requirements: minimum of 85% pure organic matter, maximum of 60% moisture by weight as received, minimum of 100% water absorption for each 24 hours submersion in water by weight, minimum of 350% water absorption from a dry basis by weight, maximum weight as received 30 pounds per cubic foot, equivalent to 2.47 cubic yards/ton.

   Material shall pass a 1-inch sieve and not less than 50% be retained on a 1/2-inch sieve.
2. At the discretion of the Owner's Representative, obtain analysis from an accredited soils lab at the Contractor's cost.
3. If required, add peat to topsoil obtained from sources project limits, at rate necessary to attain minimum organic content of 5 percent.

B. Mulch: Shall be shredded hardwood bark, 3/4" to 1 1/2" diameter as provided by the Contractor. It should be spread at 3" thick. There is to be no mulch at the crown of the plants. Note on color – not dyed mulch.

C. Dolomite Lime: Shall be agricultural grade mineral soil conditioner containing 35% minimum magnesium carbonate and 49% minimum calcium carbonate, 100% passing No. 65 sieve, Kaiser Dolomite 65 AG or approved equal.

2.3 PLANTING SOIL MIX

A. Planting Soil Mix: Mix topsoil with the following soil amendments and fertilizers in the following quantities:

Ratio of Loose Compost to Topsoil by Volume: 1:4

Weight of Slow-Release Fertilizer per 1000 Sq. Ft.: 1 to 2 pounds of water-insoluble nitrogen with a NPK ratio of either 3-1-2 or 3-1-1, unless otherwise indicated by soil tests.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that clearing, earthwork, grading and other preceding work affecting ground surface have been completed.

B. Final subgrade elevation and contours shall be smooth and uniform. All variations, lumps, ridges, and depressions in subgrade shall be corrected before topsoil work is started. Do not move heavy objects over the proposed subgrade planting areas.

C. The subsoil shall be loosened to a depth of no less than 6", or as directed by the Owner's Representative.

D. Do not proceed with topsoiling until conditions are satisfactory.

E. Preparation of Subsoil

1. Shape and dress area to be topsoiled. This work includes grading to required lines and elevations; removal of all stones, clods, lumps two inches or larger in any dimension; removal of all wires, cables, pieces of concrete, tree roots, and debris or other unsuitable material.

2. Do not proceed with installation of topsoil until this work has been approved.

3.2 INSTALLATION

A. Place an even layer that will produce required thickness.

Planting Areas – as shown on drawings.

Lawn Areas – 4" topsoil + 2" organic matter, mixed thoroughly;

B. Adjust quantities of lime and fertilizer to correspond with soil test results.

C. Remove stones, lumps, roots and other objects larger than one inch in any dimension from graded topsoil surface.

3.3 DEWATERING

A. See Division 31 Section "Earth Moving" for dewatering measures.

3.4 STORAGE OF SOIL MATERIALS

A. Stockpile satisfactory salvaged surface soil materials as well as imported topsoil, compost, soil amendments, etc. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.5 UTILITY TRENCH BACKFILL

A. After utility trench has been backfilled satisfactorily to subgrade, amend subsoil as specified below and fill trench to finished grade with topsoil. To the following depths:

1. Under proposed lawn areas: min. 6 inches of topsoil
2. Under proposed plant beds: min. 6 inches of topsoil.

3.6 FILL

A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.

B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

C. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under footings and foundations, use satisfactory soil material.

3.7 MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.8 COMPACTION OF BACKFILLS AND FILLS

A. See Division 02 Section Earth Moving for specifications regarding backfill and fill.

B. For the upper level of subgrades under lawn and plant bed areas, compact soil to the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under lawn areas, compact the upper 12 inches below subgrade at 85 percent.
2. Under plant bed areas, compact the upper 24 inches below subgrade at 85 percent.

3.9 GRADING

A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.

2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 1 inch.

2. Walks: Plus or minus 1 inch.

3. Pavements: Plus or minus 1/2 inch.

3.10 SOIL PREPARATION FOR LAWN AREAS

A. Limit lawn subgrade preparation to areas to be planted.

B. Disturbed areas and areas stripped of topsoil:

Loosen subgrade to a minimum depth of 4 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Apply compost and fertilizer directly to subgrade before loosening.

2. Thoroughly blend planting soil mix off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix.

a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.

b. Mix lime with dry soil before mixing fertilizer.

3. Spread planting soil mix to a depth of 6 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

a. Spread approximately one-half the thickness of planting soil mix over loosened subgrade. Mix thoroughly into 4 inches of subgrade. Spread remainder of planting soil mix.

b. Reduce elevation of planting soil to allow for soil thickness of sod.

C. Undisturbed area: If lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare surface soil as follows:

1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.

2. Loosen surface soil to a depth of at least of 4 inches. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 6 inches of soil. Till soil to a homogeneous mixture of fine texture.

a. Apply fertilizer directly to surface soil before loosening.

3. Remove stones larger than 1 inch in any dimension and sticks, roots, trash, and other extraneous matter.
4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.

D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future.

E. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

F. Restore areas if eroded or otherwise disturbed after finish grading and before planting.

3.11 SOIL PREPARATION AT PLANTING BEDS

A. Loosen subgrade of planting beds to a minimum depth of 12 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix.
    a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
    b. Mix lime with dry soil before mixing fertilizer if necessary from soil test recommendation.
2. Spread planting soil mix to a depth of 6 inches but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
    a. Spread approximately one-half the thickness of planting soil mix over loosened subgrade. Mix thoroughly into to 4 inches of subgrade. Spread remainder of planting soil mix.

B. Finish Grading: Grade planting beds to a smooth, uniform surface plane with loose, uniformly fine texture. Rake, remove ridges, and fill depressions to meet finish grades.

C. Restore planting beds if eroded or otherwise disturbed after finish grading and before planting.

3.12 PROTECTION

A. When required, erect temporary signs and barriers to protect topsoiled area.

3.13 MAINTENANCE

A. Immediately before establishment of planting material, re-topsoil and re-grade areas which become eroded, settled or otherwise disturbed.

B. Perform all maintenance work in accordance with the Specifications without additional compensation.

C. Maintenance period to extend until installation of planting material.

3.14 CLEANING

A. Immediately clean spills, soil, and conditioners on paved and finished areas.

B. Haul and dispose of topsoil in excess of the quantity required for the project off site.

C. Dispose of protective barricades and warning signs at termination of maintenance period.

END OF SECTION 32 91 19

SECTION 32 92 00 – SEEDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Seeding of areas as shown on drawings.

B. Related Sections:

1. Division 32 – Topsoiling
2. Division 32 – Amended Planting Soils

1.2 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Manufactured Soil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

C. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Certificates: For soil amendments and fertilizers, signed by product manufacturer.

C. Qualification Data: For landscape Installer.

D. Planting Schedule: Indicating anticipated planting dates for each type of planting.

E. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of seeded areas until acceptance of substantial completion.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful seeded areas establishment.

1. Installer's Field Supervision: Require Installer to maintain an experienced English speaking full-time supervisor on Project site when planting is in progress.

B. Topsoil Analysis: See Division 32 Section “Topsoiling” for requirements regarding topsoil testing and analysis. Additionally, for topsoil intended for seeded areas:

1. Report suitability of topsoil for seeded area growth. State recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory topsoil.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Seed: Per industry standards for delivery and storage.

1.6 SCHEDULING

A. Planting Restrictions: Permanent seeded area plantings must occur during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion. For temporary seeding outside of the permanent planting periods, see Division 32 on Earthwork about Erosion Control.

Seeding:

1. Spring planting: up to May 15

2. Fall planting: up to September 30

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

1.7 SEEDED AREA MAINTENANCE

A. Begin maintenance immediately after each area is planted and continue until acceptable seeded areas are established, but for not less than the following periods:

1. Seeded Areas: 60 days from date of Final Acceptance.

B. Maintain and establish seeded areas by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth seeded areas.

1. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch. Anchor as required to prevent displacement.

C. Watering: Provide and maintain temporary piping, hoses, and watering equipment to convey water from sources and to keep seeded areas uniformly moist to a depth of 4 inches (100 mm).

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.

2. Water seeded areas at a minimum rate of 1 inch (25 mm) per week.

PART 2 - PRODUCTS

2.1 SEEDING MIXES

A. No Mow Seed Mix – No Mow Lawn Mix supplied by Prairie Nursery (800)-476-9453 or approved equal. See information on Drawing L552.

B. Pollinator Habitat Seed Mix - – Vegetative Stabilization Mix No. 12 with Mix No. 8 from Delaware ESC Handbook or approved equal. See information Drawing on L552.

C. Basin Side Slope Seed Mix – Vegetative Stabilization Mix No. 3 from Delaware ESC Handbook or approved equal. See information on Drawing L552.

D. Deduct Alternate #2: Basin Floor Seed Mix - – Rain Garden Mix ERNMX-180 supplied by Ernst Seeds (800)- 873-3321 or approved equal.

2.2 TOPSOIL, SOIL AMENDMENTS, SOIL MEDIA

A. Refer to Division 32 Section “Topsoiling”.

2.3 PLANTING ACCESSORIES

A. Selective Herbicides: EPA registered and approved, of type recommended by manufacturer for application.

2.4 MULCHES

A. Straw Hay: Provide air-dry, clean, mildew- and seed-free, threshed straw of wheat, rye, oats, or barley.

B. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic; free of plant-growth or germination inhibitors; with maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

C. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

2.5 EROSION-CONTROL MATERIALS (for all seeding areas) – ***Also see info on civil drawings.***

A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.

B. Erosion-Control Fiber Mesh: Biodegradable twisted jute or spun-coir mesh, a minimum of 0.92 lb./sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be seeded for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect adjacent and adjoining areas from hydroseeding overspray.

B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Subsoil Preparation

1. Prepare sub-soil to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual and blend slopes into level areas. Remove foreign materials, stones, weeds and undesirable plants and their roots.

2. Remove contaminated sub-soil and rocks and debris larger than 2”.

3. Scarify subsoil with a subsoiler to a depth of 6 inches where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted sub-soil prior to placement of topsoil.

D. Final Grade Preparation

1. Topsoil Addition. Spread topsoil to a minimum depth of 8 inches over area to be seeded.

a. Place topsoil during dry weather and on dry unfrozen sub-grade.

b. Power rake area to remove vegetative matter, stones, and foreign, non-organic material over ½” inch diameter.

c. Fine grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage. Maintain profiles and contour of sub-grade.

d. Manually spread topsoil close to plant materials and buildings to prevent damage.

e. Tolerances: Top of topsoil plus or minus ½” inch.

3.3 SEEDING

A. Seed Application.

1. Apply seed at a rate specified by the specific seed mix evenly in two intersecting directions.

2. Seed application can be applied using one of the following methods after final soil preparation has been completed and accepted. Seed may be applied in one of two methods:

a. Hydroseeding by spraying an aqueous mixture on a prepared seedbed.

1) Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

2) Mix slurry with nonasphaltic tackifier.

3) Do not use wet seeds or seeds that is moldy or otherwise damaged.

4) Apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry application at a minimum rate of 500-lb/acre dry weight but not less than the rate required to obtain specified seed-sowing rate. Apply slurry cover coat of fiber mulch at a rate of 1000 lb./acre.

5) Protect seeded areas with slopes exceeding 1:6 with erosion-control fiber mesh and 1:4 with erosion-control blankets installed and stapled according to manufacturer's written instructions.

b. Dry Application

1) Seed installation either with culti-packer seeder or drop-type/ broadcast spreader.
2) Apply in two directions into the top ¼" of soil.
3) Rake in lightly.
4) Roll seeded area with roller not exceeding 50 lbs.
5) Immediately following seeding and compacting, apply mulch.

3.5. SATISFACTORY SEEDED AREAS

A. Satisfactory Seeded Areas: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.

B. Reestablish seeded areas that do not comply with requirements and continue maintenance until seeded areas are satisfactory.

3.4 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by seeding work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades throughout maintenance period and remove after seeded area is established.

C. Remove erosion-control measures and barricades after grass establishment period.

END OF SECTION 32 92 00

(THIS PAGE INTENTIONALLY LEFT BLANK)

SECTION 32 93 00 – PLANTING

PART 1 – GENERAL

1.1 SUMMARY

A. This section defines standards for plant selection, handling, installation and care from the project's start through substantial completion, guarantee period and final acceptance at end of the guarantee period.

B. Section Includes:

1. Furnish all labor, materials, equipment, and supplies and perform all operations required to complete landscaping work as shown on the drawings and hereinafter specified.
2. Excavation of tree pits and planting beds to the required depth. Backfill & disposal of all excavated materials as required.
3. Furnishing and planting of all plants, including woody and herbaceous plants.
4. Installing, watering, staking, guying, and pruning (if directed) all plants until acceptance by Owner.
5. Furnishing and placing of mulch.
6. Maintaining all installed plantings, including watering, until acceptance of the completed work under this Section.
7. Guaranteeing and replacing of sickly, dying and dead plants through a period of Two (2) year following acceptance of the completed work under this Section.
8. Protecting all existing site features from damage during the work of this Section.
9. Maintaining a clean work site throughout duration of planting operations. Clean up of site and removal of any debris at completion of work of this Section.

C. Related Sections:

1. Section 32 91 13 - Topsoiling
2. Section 32 91 15 - Amended Planting Soil
3. Section 32 92 00 – Lawn Turf and Grasses

1.2 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Balled and Burlapped Stock: Exterior plants dug with firm, natural balls of earth in which they are grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of tree or shrub required; wrapped, tied, rigidly supported, and drum-laced as recommended by ANSI Z60.1.

C. Bare-Root Stock: Exterior plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI Z60.1 for kind and size of exterior plant required.

D. Container-Grown Stock: Healthy, vigorous, well-rooted exterior plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for kind, type, and size of exterior plant required.

E. Finish Grade: Elevation of finished surface of planting soil.

F. Planting Soil: See Section 32 91 15 – Amended Planting Soil

G. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

H. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

I. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.

2. Plant Photographs: Submit color photographs in digital format of each required species and size of plant material as it will be furnished to Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 20 plants are required, include a minimum of three photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.

B. Samples for Verification: For each of the following:

1. Trees and Shrubs: Three Samples of each variety and size delivered to site for review. Maintain approved Samples on-site as a standard for comparison. Where not feasible, Landscape Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality.

2. Mulch: 1-quart volume of each organic mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.

3. Staking and components.

1.4 INFORMATIONAL SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Materials Lists: Within 45 days after award of the Contract, submit a complete list of all materials proposed to be furnished and installed (including sources) under this Section, demonstrating

conformance with the requirements specified.

C. Product certificates signed by manufacturers certifying that their products comply with specified requirements.

1. Manufacturer's certified analysis for standard products.

2. Analysis for other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

3. Label data substantiating that plants, trees, and planting materials comply with specified requirements.

D. Qualification data for firms and persons to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Owner's representatives and owners, and other information specified.

E. Submit project schedule for approval by Owner's representative at least five days prior to planned start of work. Schedule must include milestone dates that are coordinated with other site trades and locations of work.

1.5 QUALITY ASSURANCE

A. Codes and Standards: Perform all work in compliance with applicable requirements of governing authorities having jurisdiction.

B. Installer Qualifications: Engage an experienced Installer who has completed landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful landscape establishment.

C. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on the Project site during all times. Provide at least one English speaking person present at all times during execution of this portion of the work, who is thoroughly familiar with the type of plants being installed and the proper materials and methods for their installation, to direct all work performed under this Section. This person shall have a minimum of 5 years experience in handling the specified plants, and should have a set of prints of the project on site.

D. Provide quality, size, genus, species, and variety of plants indicated on the Plans, in accordance with the applicable requirements of ANSI Z60.1 American Standard for Nursery Stock, revised 2014. The highest horticultural standards shall be practiced from the time of plant purchase though delivery and installation on site to ensure health, vigor and establishment of all plants.

E. Measurements: Measure trees according to ANSI Z60.1, revised 2014. Do not prune to obtain required sizes.

1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container-grown stock. Take caliper measurements 6 inches (150 mm) above ground for trees up to 4-inch (100-mm) caliper size, and 12 inches (300 mm) above ground for larger sizes. Measure main body of tree for height and spread; do not measure branches or roots tip-to-tip.

2. Other Plants: Measure with stems and foliage in their normal position.

F. All plants are subject to approval by Owners Representative (OR) who may inspect plants either

at place of growth or at site before planting, for compliance with requirements for genus, species, variety, size, and quality. Owners Representative retains the right to further inspect plants for size and condition of balls and root systems, insects, injuries and latent defects, and to reject unsatisfactory or defective material at any time during progress of work and during contract period. Contractor shall remove rejected plants from project immediately and replace with approved replacement, at appropriate planting time, at no cost to Owner..

1. Notify Landscape Architect of sources of planting materials seven days in advance of delivery to site. For woody plants and trees: Label at least one (1) plant of each variety and size with a securely attached, waterproof tag bearing legible designation of botanical and common name..

G. All plants are to be provided as specified. Requests to use plant substitutes, whether for size or species/cultivar, shall be submitted in writing to the Owner's representative for client review and approval, prior to delivery to the job site.

H. Nomenclature and interpretation of plant names shall reference the following. Where the names of plant descriptions disagree, the most current information will prevail:

1. The Royal Horticultural Society Horticultural Database (http://www.rhs.org.uk/).
2. USDA – The Germplasm Resources Information Network :
3. http://www.ars-grin.gov/
6. Manual of Woody Landscape Plants; Michael Dirr; Stipes Publishing, Champaign, Illinois; Most Current Edition.

I. Plants of a larger size may be used if acceptable to Owner's Representative with a proportionate increase in size of roots or balls, and at no additions to the Contract Price

J. All plants shall comply with State and Federal laws, including quarantines with respect to inspection, plant diseases and insect infestation

K. Collected plants may be used only when approved by the Owner's Representative.

L. Equipment:

1. Provide machinery and equipment necessary for the prompt, professional completion of the work. Such machinery and equipment shall be adequate to the task required and shall be operated by a person skilled and experienced in both operation of the equipment and the implementation of the task.
2. Upon request, promptly furnish satisfactory evidence of the organization and equipment to be made available for the performance of the work.
3. Comply with all Federal and State Department of Agriculture regulations for pest control which, in general, require that contractors operating in infested areas thoroughly clean all equipment units before moving them to non-infested areas. Full information can be obtained from Federal and State Pest Control Personnel.

M. Documentation and Coordination:

1 Submit, upon request, documentation prior to the start of work under this Section that all plants and related materials have been ordered.

2 Plant delivery to site and timing of installation is to be coordinated with Owner's Representative prior to delivery of plants to site.

3 Coordination with Lawns: Plant trees and shrubs after finish grades are established and before planting lawns. If lawns are already established, protect with ¾" plywood, to be removed in manner that ensures viability of existing lawn.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.

B. Trees: Deliver freshly dug trees. Do not prune before delivery, except as approved by Owner's Representative.. Protect bark, branches, and root systems from sun scald, desiccation and drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees in such a manner as to destroy natural shape. Provide protective covering during delivery to prevent wind burn.

C. Handle balled and burlapped stock by the root ball only; do not stand on or tamp directly on root balls.

D. Container Plants: Deliver all plants to site in containers that ensure the protection of entire plant including roots and other plant parts against climatic and other injuries. Plants shall be grown or established in containers in which they will be delivered for at least 8 months but not for more than 24 months in advance of final planting. Plants shall be fully rooted into container but not root-bound. Plants with cracked or broken balls of earth when taken from the containers shall not be planted unless acceptable to the Owner's Representative. Do not lift or handle container plants by tops, stems, or trunks at any time.

E. Deliver trees and plants after preparations for planting have been completed and install immediately. If planting is delayed more than 6 hours after delivery, set planting materials in shade, protect from weather and mechanical damage, and keep roots moist. Properly protect plants with soil, moist mulch, etc.,

1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material, if not installed within six hours from delivery.

2. Root balls/plants shall not be permitted to remain un-installed or exposed during periods of freezing weather or extreme weather conditions.

3. Do not remove container-grown stock from containers before time of planting.

4. Water root systems of trees stored on site as often and thoroughly as necessary to maintain root systems in a moist condition.

1.7 PROJECT CONDITIONS

A. Utilities: Determine location of above grade and underground utilities and perform work in a manner that will avoid damage. Hand excavate, as required. Maintain grade stakes until removal is mutually agreed upon by parties concerned. The Contractor shall be responsible for the location and protection of all utilities and for repair of any utilities damaged by Contractor's work. Any damage shall be replaced/repaired to Owner's satisfaction at the Contractor's expense.

B. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Owner's representative before planting.

C. Work notification: Notify Owner's Representative at least five (5) working days prior to the start of work of this Section.

1.8 COORDINATION AND SCHEDULING

A. Planting times shall be during one of the following periods. Coordinate planting periods with maintenance periods, as applicable, to provide required maintenance through date of final acceptance.

Spring Planting: April 26 – June 15 (frost-hardy and acclimatized plant material may be planted prior to April 26 and when not restricted by inclement weather limitations).

1. Fall Planting: September 1 – October 15 (plant material may be planted after October 15 and when not restricted by inclement weather limitations).
2. Summer Planting: to be performed on a project by project basis when not restricted by extreme heat and drought conditions, and when a water source and watering equipment are provided and are easily accessible.
3. Dig trees according to the best recommended time, as per fall and/or spring dig hazards. Coordinate planting periods with maintenance periods to provide required maintenance thru date of Substantial Completion.

B. Proceed with planting only when existing and forecasted weather conditions permit. If projected or current weather will stress plants, reschedule planting/installation times and dates

1.9 PLANT MATERIAL QUANTITIES

A. In the event that quantity discrepancies or material omissions occur between the Plant List and Planting Plan, Contractor is to immediately notify Owner's Representative for clarification and to receive instruction about how to proceed.

1.10 MAINTENANCE

A. Maintain for the following maintenance period by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray as required to keep trees and shrubs free of insects and disease. Revise duration of maintenance period below to suit Project. Revise starting date of maintenance period to date of planting completion if preferred.

B. Maintenance Period: Until date of Final Acceptance, as confirmed in writing by the Owner.

1.11 SOIL ANALYSIS

A. Soil Analysis: Upon request, obtain analysis of soil from an accredited soil laboratory at the cost of the Landscape Contractor or Project to determine pH and necessary amendments and fertilizers.

1.12 SUBSTANTIAL COMPLETION AND START OF GUARANTEE PERIOD

A. Upon written notice from the Contractor, the Owner's Representative shall review the work and make a determination if the work is substantially complete.

B. The date of Substantial Completion of the planting shall be the date when the Owner's Representative accepts that all work in Planting is complete.

C. All plants must be in a vigorous growing condition at the time of Substantial Completion.

D. The Plant Guarantee period begins at the date of written notification of Substantial Completion from the Owner's Representative. The date of Substantial Completion for planting may be different than the date of substantial completion for the other sections of the project.

1.13 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Warrant the following living planting materials for a period of two (2) years after the date of Acceptance of Installation, against defects including death and unsatisfactory growth, except for defects resulting from neglect or abuse by Owner, abnormal weather conditions unusual for warranty period, or incidents that are beyond Contractor's control.

1. Trees and Shrubs

2. Herbaceous and groundcover plants

C. Replace at the direction of the Owner's Representative and in accordance with the Drawings and Specifications, all plants that are dead (all material that is at least 25% dead, and any tree with a main leader that has died back), plants that are in unhealthy or unsightly condition, plants that have lost their natural shape due to dead branches, or other causes due to the Contractor's negligence.

D. All replacements shall be plants of the same kind, size, and quality as originally specified.

E. Warranty shall not include damage or loss of plants caused by fires, floods, freezing rains, lightning, winds over 75 miles per hour, winter kill caused by severe winter conditions not typical of the planting area, by acts of vandalism, or by negligence on the part of the Owner.

F. Replaced plants shall be furnished, planted, mulched, and watered as part of the warranty.

PART 2 – PRODUCTS

2.1 GENERAL

A. All plants shall be the kind and size indicated on the plant list and shall be true to name. All plants shall be sound, healthy, vigorous, nursery stock with a normal habit of growth, shall be subjected to nursery root and top spraying, transplanting, etc., and shall have been inspected and approved for sale, transporting and transplanting by all governmental agencies authorized to administer such control. Plants shall be subject to inspection and approval by the Owner's Representative at place of growth and upon delivery to project site for conformity to specifications. Such approval shall not impair the right of inspection and rejection during process of the work. All trees will be tagged in the nursery by the Owner's Representative.

B. All plants shall be subject to inspection and approval by the Owner's Representative throughout

Contract period. All plants are subject to approval by Owner's Representative. The Contractor must submit to the Owner's Representative a letter of certification from the supplying nurseries that plants supplied to the contractor conform to the requirements listed below:

1. Provide trees of sizes and grades conforming to ANSI Z60.1 for type of trees required. Trees of a larger size may be used if acceptable to Owner's representative with a proportionate increase in size of roots or balls, and at no additions to the Contract Price.

C. Prior to delivery to the site, the Contractor shall arrange with the Owner's Representative a minimum of two nursery visits for the purpose of selecting and tagging plants proposed for the project. This will include all trees as specified. The Owner's Representative shall inspect proposed plants before plants will be permitted on site.

D. Label at least one (1) tree of each variety and caliper with a securely attached, waterproof tag bearing legible designation of botanical and common name.

E. Trees with multiple leaders, unless specified, will be rejected

2.2 SHADE AND FLOWERING TREES

A. Shade trees: Single-stem trees with straight trunk, well-balanced crown, and intact leader, free of branches to about 50% of their height, of height and caliper indicated, conforming to ANSI A300 Section 6 for type of trees required.

B. Provide balled and burlapped trees except where indicated.

1. Container-grown trees will be accepted in lieu of balled and burlapped trees subject to meeting ANSI A300 Section 6 limitations for container stock.

2.3 DECIDUOUS SHRUBS

A. Form and Size: Deciduous shrubs with not less than the minimum number of canes required by and measured according ANSI A300 Section 6 for type, shape, and height of shrub.

2.4 CONIFEROUS EVERGREENS

A. Form and Size: Normal-quality, well-balanced, coniferous evergreens, of type, height, spread, and shape required, complying with ANSI A300 Section 6.

B. Form and Size: Specimen-quality, exceptionally heavy, tightly knit, symmetrically shaped coniferous evergreens:

1. Provide balled and burlapped trees.

2.5 BROADLEAF EVERGREENS

A. Form and Size: Normal-quality, well-balanced, broadleaf evergreens, of type, height, spread, and shape required, complying with ANSI A300 Section 6.

1. Provide balled and burlapped or container plants as per plant schedule.

2.6 GROUNDCOVER PLANTS

A. Groundcover: Provide groundcover of species indicated, established and well rooted in pots or

similar containers, and complying with ANSI Z60.1.

2.7 HERBACEOUS PLANTS

A. Annuals: Provide healthy, disease-free plants of species and variety shown or listed. Provide only plants that are acclimated to outdoor conditions before delivery and that are in bud but not yet in bloom.

B. Perennials: Provide healthy, field-grown plants from a commercial nursery, of species and variety shown or listed.

C. Vines: Provide vines of species indicated complying with requirements in ANSI Z60.1 as follows:

1 Two-year or older plants with heavy, well-branched tops, with not less than 3 runners 18 inches or more in length, and with a vigorous well-developed root system.

2 Provide field-grown vines. Vines grown in pots or other containers of adequate size and acclimated to outside conditions will also be acceptable.

2.8 REQUIREMENTS FOR BALLED AND BURLAPPED STOCK

A. Where indicated to be balled and burlapped, provide trees dug with firm, natural ball of earth in which they are grown free of noxious weed matter.

B. Provide ball size of not less than diameter and depth recommended by ANSI Z60.1 for type and size of tree required. Increase ball size or modify ratio of depth to diameter as required to encompass fibrous and feeding root system necessary for full recovery of trees subject to unusual or non-typical conditions of growth, soil conditions or horticultural practice.

C. No balled and burlapped plant will be accepted if the ball is cracked or broken either before or during the process of planting. Root balls shall be firmly wrapped with burlap and bound with natural twine or wire mesh

D. Wrap and tie earth ball as recommended by ANSI Z60.1 for size of balls required. Drum-lace balls with a diameter of 30" or greater.

2.9 CONTAINER STOCK

A. Container stock shall be grown in its delivery container for not less than six (6) months but not more than 2 years.

B. Plants shall have well established root systems but not be root-bound.

C. Plants with cracked or broken balls of earth when taken from the containers shall not be planted.

2.10 BARE-ROOT STOCK

A. Bare-root stock should have a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI Z60.1 for kind and size typical of its species.

B. Plants should be sufficiently packaged and stored to preserve moisture in fibrous root systems

to ensure the health and vigor of the plant.

2.11 MULCHES

A. Mulch is to be 100% natural, free from deleterious materials, and suitable as a top dressing for plants.

B. Double shredded hardwood bark mulch.

C. Substitutions may be used only with prior approval from Owner's Representative.

2.12 LANDSCAPE HAND EDGING

A. Planting beds and tree rings are to be vertically edged with a hand spade or mechanical edger to a minimum depth of 4". The elevation of the planting bed starts at the low point of the cut edge and angles back towards the planting at a 45 degree angle until it reaches the finish grade of the planting bed. Work excess soil back into planting bed.

2.13 TOPSOIL

A. See Section 32 91 13 - Topsoiling

2.14 ANTI-TRANSPIRANT:

A. Shall be "Wilt-Pruf" by Nursery Specialty Products, Inc., 207 East 47th Street, New York, NY 10017, or approved equal, applied as specified by the manufacturer to species as indicated in drawings.

2.15 PLANTING SOIL

A. See Section 32 91 15 – Amended Planting Soil

2.16 EROSION-CONTROL MATERIALS

A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.

B. Erosion-Control Fiber Mesh: Biodegradable twisted jute or spun-coir mesh, a minimum of 0.92 lb/sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.

2.17 WATERING EQUIPMENT

A. Watering Equipment – to be provided on a project-by-project basis, and to remain the property of the Owner at the completion of the project:

1. Gator Bags

2. Ooze Tubes sufficient for watering multi-stem trees or shrubs.

3. Soaker Hose -should be black or dark color which could blend with mulch, and that can be used above or below soil/mulch surface, will not burst if frozen and provides even distribution of water throughout the planting bed. Installed as per manufacturer's specifications and as directed by project.

2.18 STAKES AND GUYS FOR TREES

A. Stakes, anchors, and wires shall be of sufficient strength to maintain the tree in an upright position in the conditions in which the tree will be installed.

B. Guy wires shall be galvanized, multi-strand, twisted wire.

C. At the location where guy wires are attached around the tree, the trunk shall be protected with 20-mm (3/4 in.) diameter rubber hose, black or dark green in color, and of sufficient length to extend past the trunk by more than 105 mm (6 in).

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine areas to receive landscaping for compliance with requirements and for conditions affecting performance of work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Verify that planters have been waterproofed and inspected.

C. Verify the required drainage and irrigation rough-in has been installed and is fully operational.

D. Verify that subgrades are accurately established before spreading planting soil.

E. Once bed preparation has been approved, the Landscape Contractor assumes responsibility for subgrades and finish grades in the areas affected.

3.2 PLANT PRUNING

A. Prune, thin, and shape trees according to standard horticultural practice and as directed by owner's representative. Prune trees to retain required height and spread. Unless otherwise directed by Owner's Representative, do not cut tree leaders; remove only crossing, injured or dead branches.

3.3 PLANTING BED PREPARATION

A. Loosen subgrade of planting beds, as needed, to promote adequate drainage and soil conditions promoting plant health and root establishment, but which prevents settlement below finished grade of topsoil layers or plantings. Remove all trash from subgrade along with stones and extraneous debris larger than 1" or that will prevent proper installation and establishment of plantings.

B. All stumps, weeds, vegetation not being retained are to be grubbed out and/or removed.

C. Install planting soil mix in 6” lifts, gently compacted using hand tamping, to a depth that meets finished grades after natural settlement but which ensures root and plant establishment. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet. Do not over compact planting soil; compaction is subject to review and alteration.

1. Thoroughly blend any soil amendments or fertilizer needed, as per soil test results, into planting soil either before installation of soil lifts, or as lifts are being installed and before tamping. Delay mixing fertilizer with planting soil if planting will not occur within a few days.

D. Finish Grading: Grade planting beds to a smooth, uniform surface plane with loose, uniformly fine texture, ensuring soil surface is free from debris. Rake, remove ridges, and fill depressions to meet finished grades.

E. Restore planting beds if eroded or otherwise disturbed after finish grading and before planting.

F. Minimize soil disturbance in areas under existing tree canopy or on sloped areas.

G Planting beds and tree rings are to be vertically edged with a hand spade or mechanical edger to a minimum depth of 4”. The elevation of the planting bed starts at the low point of the cut edge and angles back towards the planting at a 45 degree angle until it reaches the finish grade of the planting bed. Work excess soil back into planting bed.

3.4 PLANTING PIT PREPARATION FOR TREES

A. Verify that subgrades are accurately established before digging tree pit.

B. Dig a hole so that depth will enable tree to be installed in a manner that allows the root flare to be at or slightly above Finished Grade after normal compaction, and at the same relationship to finished grade as they were to the ground from which they were dug.

C. Planting hole should be 2 – 3x wider than the size of the root ball.

3.5 DELIVERY, STORAGE AND HANDLING

A. Plants must be sufficiently containerized, packaged, tarped, etc. to ensure viability of plants and the protection of roots and other plant parts against sun scald, drying, sweating, whipping, and other handling damage as well as climatic seasonal and other injuries.

B. Trees: Deliver freshly dug trees. Do not prune before delivery, except as approved by Owner’s Representative. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees in such a manner as to destroy natural shape. Provide protective covering during delivery to prevent wind burn. Do not drop trees during delivery.

C. Water all trees and plants as needed from time of pick up through substantial completion.

D. Do not lift or handle container plants by tops, stems or trunks at any time.

E. Handle balled and burlapped stock by the root ball only; do not stand on or tamp directly on root balls.

F. Deliver trees and plants after preparations for planting have been completed and install immediately. If planting is delayed more than 6 hours after delivery, set planting materials in shade, protect from weather and mechanical damage, and keep roots moist. Properly protect plants with soil, moist mulch, etc., in a manner acceptable to Owner’s Representative.

1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material, if not installed within six hours from delivery.
2. Root balls/plants shall not be permitted to remain un-installed or exposed during periods of freezing weather or extreme weather conditions.
3. Do not remove container-grown stock from containers before time of planting.
4. Water root systems of trees stored on site as often and thoroughly as necessary to maintain root systems in a moist condition.

3.6 LAYOUT

A. Layout specifications and area and perimeter measurements are provided as guidelines only, and are to be confirmed in the field by Contractor(s) and adjusted as necessary and collaboratively with Owner's Representative.

B. The location of new plants and new planting beds are to be staked out in collaboration with and approved by the Owner's Representative prior to installation.

3.7 PLANT INSTALLATION

A. All root balls removed from containers will be scarified and roots thoroughly separated prior to planting.

B. All plastic or no-rot burlap or twine are to be completely removed from the plant ball prior to backfilling with planting soil. Biodegradable burlap and twine and wire cage material shall be cut away from the top 1/3 of the root ball and remove from the site.

C. When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, stop work and notify Owner's Representative for additional direction.

D. Set plant plumb and in center of planting pit or trench with top of ball raised just above adjacent finish grade enough to allow for normal compaction and sufficient final planting depth, and so surface of root system will be flush with adjacent finished grades after normal settling.

E. Maintain full depth of planting soil around root system of plants.

F. Place soil around ball in layers, tamping gently to settle backfill and eliminate voids and air pockets -do not over tamp. When pit is approximately half backfilled, water thoroughly before placing remainder of backfill

3.8 MULCH INSTALLATION

A. Install mulch on top of raked and prepared planting bed to a depth of 2", see details..

B. Mulch is to be raked smooth, eliminating pockets and low points.

C. Mulch is not to be applied so that it touches the bark of woody plants or tree trunks.

D. For tree rings: At the time of planting, provide 3 inches high continuous soil saucer around perimeter of planting hole. Prior to end of guarantee period, but not sooner than 8 months after planting, contractor is required to shave off the saucer around the mulch ring area and top dress

with new mulch. Cover root ball with no more than 1” (depth) of mulch, installed so that mulch does not touch the bark/trunk.

3.9 STAKING AND GUYING – TREES:

A. Guy and stake trees more than 2.5 -3-inch (75-mm) caliper unless otherwise indicated, or in situations such as sandy or poor soils, in windy locations, or on slopes. Trees that settle out of plumb due to inadequate soil compaction either under or adjacent to the root ball shall be excavated and reset. Trees that have settled out of plumb shall never be pulled straight using guy wires.

3.10 PROTECTION, CLEAN-UP AND MAINTENANCE

A. During landscape installation, keep pavements clean and work area in an orderly condition. Place 3/4" plywood as needed to protect existing turf, paved areas, etc.

B. Install plastic safety fencing as needed to provide barrier protection for newly planted areas or areas to be preserved.

C. Protect new plantings and plants to remain from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damage to new or existing plantings at the expense of the Landscape Contractor.

D. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of it off the Owner’s property.

E. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray as required to keep trees free of insects and disease. Maintain throughout project work period until Substantial Completion. All plantings which appear to be in distress or defective shall be removed immediately and replaced or replanted according to planting times and quality as defined in this section, with specimens of the same species and size as originally specified:

F. Watering:

1. The contractor shall be fully responsible to ensure that adequate water is provided to all plants throughout the work period until the date of Substantial Completion.

2. Hand water root balls of all plants to ensure that the root balls have moisture above wilt point and below field capacity, and appropriate for the species. As needed, moisture content in each root ball and soil outside the root ball can be tested to determine water content.

G. Guy Wires and Stakes are to be maintained by Contractor until the end of the Guarantee Period (see section 3.10) to avoid girdling throughout the first growing season, and removed after the first growing season if site conditions and adequate plant establishment permit.

3.11 ACCEPTANCE AND GUARANTEE

A. Plants are to be guaranteed as per the following list, starting from the time of Substantial Completion. Defective materials shall be removed immediately and replaced according to planting times and quality as defined in this section, with specimens of the same species and size as originally specified, with new guarantee for the replacement plant starting at time of replacement. Written Final Acceptance shall be provided at the end of the guarantee period by Owner Representative once all conditions of this Section have been met. All plants must be in a vigorous growing condition at the end of the guarantee period:

1. Minimum of 2-year guarantee on all newly installed plant material.

B. When Maintenance after Substantial Completion is by others, and not awarded to the Contractor:

1. After Substantial Completion Acceptance, the Contractor shall make sufficient site visits to observe the Owner's maintenance and notify the Owner's Representative in writing if maintenance, including watering, is not sufficient to maintain plants in a healthy condition. Such notifications must be made in a timely period so that the Owner can take corrective action and/or schedule a time to review with the Contractor prior to taking corrective action. Notification must define the maintenance needs observed, include a date and request for site review.

2. In the event that the Contractor fails to visit the site and/ or notify the Owner's Representative in writing, with confirmation that Owner's Representative received the notification, lack of maintenance shall not be used as grounds for voiding or modifying the provisions of the warranty.

C. Contractor is to be responsible for contacting Owner's Representative defined at the start of this section (1) one month prior to end of guarantee period to review health and successful establishment of plantings. Guarantee remains in effect until this final review takes place.

END OF SECTION 32 93 00

(THIS PAGE INTENTIONALLY LEFT BLANK)

SECTION 33 41 00 - STORM DRAINAGE AND SANITARY SEWER PIPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes gravity-flow storm drainage and sanitary sewer outside the building, with the following components:

1. PVC storm and sanitary pipe and fittings
2. RCP storm pipe and flared end section
3. HDPE storm pipe and fittings
4. Cleanouts.
5. Area drains including trench drains.
6. Pre-cast concrete catch basins and manholes.
7. Pre-cast concrete pond outlet structure

1.3 DEFINITIONS

A. RCP: Reinforced concrete pipe

B. PVC: Polyvinyl chloride plastic

C. HDPE: High-Density Polyethylene

1.4 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, pipe joints shall be at least silt-tight, unless otherwise indicated.

1.5 SUBMITTALS

A. Product Data: For the following:

1. RCP Pipe and Fittings.
2. PVC SDR-26 Pipe and Fittings
3. HDPE Pipe and Fittings
4. Cleanouts
5. Pre-cast Outlet Structure for Bio-Retention SWM Areas
6. Reinforced Concrete Flared End Sections

7. Trench Drains for Loading Area
8. Trench Drains for Dumpster Pad Areas.
9. Storm and Sanitary Structures (manholes, manhole seals, catch basins, etc.)

B. Shop Drawings: For the following:

1. Manholes: Include plans, elevations, sections, details, and frames and covers. Include design calculations, and concrete design-mix report for cast-in-place manholes.
2. Catch Basins: Include plans, elevations, sections, details, and frames, covers, and grates.
3. Stormwater Pond Outlet Structure: Include plans, elevations, sections, details, frames and covers, design calculations, and concrete design-mix report.
4. Diversion Structure (DS-1): Include plans, elevations, sections, details, and frames, covers, and grates.
5. HDPE to Concrete Connection: Provide ADS specifications or approved equal (as per drawing detail).

C. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

D. Field quality-control test reports.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer’s written rigging instructions.

D. Handle catch basin and pond outlet structure according to manufacturer’s written rigging instructions.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage 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 Architect and Owner no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Architect’s and/or Owner’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.

2.2 PIPING MATERIALS

A. Refer to Part 3 “Piping Applications” Article for applications of pipe, fitting, and joining materials.

2.3 HDPE PIPE AND FITTINGS

A. Corrugated HDE Pipe and Fittings: AASHTO M 294M, Type S, with smooth waterway for coupling joints.

1. Silttight Couplings: HDPE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.
2. Soiltight Couplings: AASHTO M 294M, corrugated, matching pipe and fittings.

2.4 PVC PIPE AND FITTINGS

A. PVC Sewer Pipe and Fittings, 4” to 15” diameter: ASTM D 3034, SDR-26 with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

B. PVC Sewer Pipe and Fittings, 18” diameter and Larger: ASTM F 679, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

2.5 CONCRETE PIPE AND FITTINGS

A. Reinforced-Concrete Sewer Pipe (RCP) and Fittings: ASTM C 76, with bell-and-spigot ends and gasketed joints with ASTM C 443, rubber gaskets.

2.6 NONPRESSURE-TYPE PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Concrete Pipes: ASTM C 443, 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.

2.7 CLEANOUTS

A. Gray-Iron Cleanouts (paved areas): ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.

1. Manufacturers:

a. Josam Company.
b. MIFAB Manufacturing, Inc.

2. Top-Loading Classification(s): Heavy duty.
3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. PVC Cleanouts (lawn areas): Schedule-40 PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

1. Manufacturers:

a. IPS Corporation.
b. NDS Inc.

2.8 DRAINAGE STRUCTURES

A. Standard Precast Concrete Manholes, and Catch Basins: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Diameter: 48 inches minimum, unless otherwise indicated.
2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
3. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.

4. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.
5. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
6. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
7. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
8. Steps: Individual FRP steps wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 48 inches.
9. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.
10. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.
11. Protective Coating: Plant-applied, SSPC-Paint 16, coal-tar 10-mil minimum thickness applied to exterior and interior surfaces.
12. Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch-minimum width flange and 26-inch-diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to “STORM SEWER.”

2.9 CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water-cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

C. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water-cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

2.10 PIPE OUTLETS

A. Head Walls (N/A): Cast-in-place reinforced concrete, with apron and tapered sides.

B. Riprap Stilling Basins: Place as per DNREC standards and drawing detail with rip-rap size and thickness as specified on drawings.

C. Filter Stone: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. FS-2, No. 4 screen opening, average-size graded stone.

2.11 STORMWATER INLETS

A. Gutter Inlets: Made with horizontal gutter openings as per DelDOT standards. Include heavy-duty frames and Type 3 Bicycle Safe grates.

B. Combination Inlets: Made with vertical curb and horizontal gutter openings as per DelDOT standards. Include heavy-duty frames and Type 3 Bicycle Safe grates.

C. Frames and Grates: Heavy duty frames and Type 3 Bicycle Safe grates.

2.12 STORMWATER DETENTION OUTLET STRUCTURE

A. Pre-Cast Concrete, Stormwater Detention Structures: Submit shop drawings for concrete structure, reinforcing design, slab, trash rack, orifice restrictor plate, and orifice protector

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 2 Section “Earthwork.”

3.2 PIPING APPLICATIONS

A. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.

    a. Flexible or rigid couplings for same or minor difference OD pipes.
    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-type pipe couplings for force-main joints.

B. Special Pipe Fittings: Use for pipe expansion and deflection. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

C. Gravity-Flow, Nonpressure Sewer Piping: Use the following pipe materials for each size range:

1. Reinforced-concrete sewer pipe and fittings, gaskets, and gasketed joints.
2. PVC sewer pipe and fittings, gaskets, and gasketed joints (NPS 4 and NPS 6).
3. PVC sewer pipe and fittings, gaskets, and gasketed joints (NPS 8 to NPS 12).

3.3 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.

F. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope of 0.005 ft/ft, unless otherwise indicated on plans.
2. Install PE corrugated sewer piping according to CPPA's "Recommended Installation Practices for Corrugated Polyethylene Pipe and Fittings."
3. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
4. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.4 PIPE JOINT CONSTRUCTION

A. Basic pipe joint construction is specified in Division 2 Section "Piped Utilities - Basic Materials and Methods." Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. Join gravity-flow, nonpressure drainage piping according to the following:

1. Join corrugated PE piping according to CPPA 100 and the following:

   a. Use silttight couplings for Type 1, silttight joints.
   b. Use soiltight couplings for Type 2, soiltight joints.

2. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric gasket joints.
3. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
4. Join dissimilar pipe materials with nonpressure-type flexible or rigid couplings.

C. Join dissimilar pipe materials with pressure-type couplings.

3.5 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Medium-Duty, top-loading classification cleanouts in **earth or unpaved/paved foot-traffic** areas.
2. Use Heavy-Duty, top-loading classification cleanouts in loading/**vehicle-traffic service** areas.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 inches deep (or as per drawing detail). Set with tops 1 inch above surrounding earth grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.6 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections according to ASTM C 891.

C. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere, unless otherwise indicated.

3.7 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.8 DRAIN INSTALLATION

A. Install type of drains in locations indicated.

1. Use Light-Duty, top-loading classification drains in[earth or unpaved foot-traffic areas.
2. Use Medium-Duty, top-loading classification drains in paved foot-traffic areas.
3. Use Heavy-Duty, top-loading classification drains in loading/vehicle-traffic service areas.
4. Use Extra-Heavy-Duty, top-loading classification drains in [roads]

B. Embed drains in 6-inch minimum concrete around bottom and sides (see drawing detail).

C. Fasten grates to drains if indicated.

D. Set drain frames and covers with tops flush with pavement surface.

E. Assemble trench sections with flanged joints.

F. Embed trench sections in 6-inch minimum concrete around bottom and sides (see drawing detail).

3.9 STORM PIPE OUTLET INSTALLATION

A. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.

3.10 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318/318R.

3.11 STORMWATER INLET AND OUTLET INSTALLATION

A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.

B. Construct riprap of broken stone, as indicated.

C. Install outlets that spill onto grade, anchored with concrete, where indicated.

D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.

E. Construct energy dissipaters at outlets, as indicated.

3.12 DRAINAGE SYSTEM INSTALLATION

A. Assemble and install components according to manufacturer’s written instructions.

B. Install with top surfaces of components, except piping, flush with finished surface.

C. Assemble channel sections to form slope down toward drain outlets. Use sealants, adhesives, fasteners, and other materials recommended by system manufacturer.

3.13 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Division 22 Section "Facility Storm Drainage Piping."

B. Connect force-main piping to building's storm drainage force mains specified in Division 22 Section "Facility Storm Drainage Piping." Terminate piping where indicated.

C. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches 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, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

    a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
    b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

D. Connect to sediment interceptors specified in Division 22 Section "Sanitary Waste Interceptors."

E. 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 nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.

    a. Flexible couplings for same or minor difference OD pipes.

b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

2. Use pressure-type pipe couplings for force-main joints.

3.14 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

A. Abandoned Piping: 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. Use either procedure below:

1. Close open ends of piping with at least 8-inch thick, brick masonry bulkheads.
2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:

1. Remove manhole or structure and close open ends of remaining piping.
2. Remove top of manhole or structure down to at least 36 inches below final grade. Fill to within 12 inch**es** of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

C. Backfill to grade according to Division 31 Section "Earth Moving."

3.15 IDENTIFICATION

A. Materials and their installation are specified in division 2 Section “Earthwork.” Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.16 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:

a. Alignment: Less than full diameter of inside of pipe is visible between structures.

b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
c. Crushed, broken, cracked, or otherwise damaged piping.
d. Infiltration: Water leakage into piping.
e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

3.17 CLEANING

A. Clean interior of piping, flared end sections, and structures of dirt and superfluous materials as directed by CCR and Engineer.

END OF SECTION 33 41 00